The Challenge of Reducing the Global Incidence of Civil War

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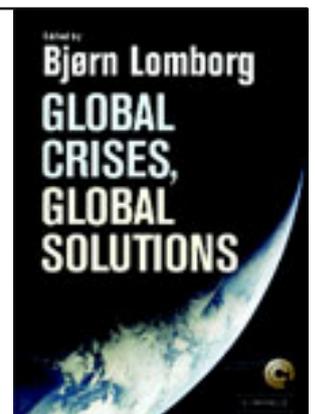Department of Economics,
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1. Introduction and Overview

Definition of the Challenge:

Large-scale violent conflict takes several forms. However, over time international conflict has tended to become less common, whereas civil war has tended to become more common. The two phenomena are radically different and cannot sensibly be analyzed within the same study. Here we focus exclusively upon the challenge of reducing the global incidence of civil war. Much of what we will do is previewed in our recent book *Breaking the Conflict Trap: Civil War and Development Policy*, (OUP 2003). We should add that the main models we use to calculate the costs and benefits are our own. It would clearly strengthen the robustness of the analysis were a range of models to be used, but unfortunately the quantitative analysis of civil war risk is still at an early stage and so there is not yet a substantial literature.

Benefits

The benefits of a reduction in the global incidence of civil war are common to all successful deployments of instruments for conflict reduction. Section 2 attempts to establish credible lower-bound estimates of these benefits. They accrue at three levels: national, regional and global. The benefits at the national level are partly economic and partly social. The economic benefits of avoiding war in a country can be estimated from estimates of the effect of civil war on growth. The social benefits are more difficult, but some estimate in terms of DALYs has been attempted. The regional benefits of avoiding war have also been estimated, at least in terms of economic growth; the social spillovers, though large, are more difficult to quantify. The global benefits of conflict reduction are the most difficult to estimate. Three big global scourges – AIDS, drugs, and safe havens for terrorism, have been attributed to civil war environments. We leave these unquantified, but include them as separate speculative benefits.

Opportunities

Within the challenge of reducing the global incidence of civil war, we focus on three opportunities. These are the prevention of civil war in currently peaceful environments; the shortening of conflicts in currently war-torn environments; and the reduction in the risk of the resumption of conflict in post-conflict situations. These opportunities are very different, both in terms of instruments and pay-offs. Probably the highest pay-off is from improved interventions in post-conflict situations. Post-conflict relapses into renewed violence account for around half of all global civil wars, and so they provide an opportunity for highly focused interventions. By contrast, prevention is a highly diffuse approach.

1. Conflict prevention

In Section 3 we investigate the costs and benefits of two instruments of conflict prevention. While all large-scale violent conflicts have elements of internal politics, it is striking that the risk of conflict is much higher in countries with particular economic characteristics – low per capita income, negative growth, and dependence upon natural resource exports. By contrast, social and political characteristics – such as ethnic and religious composition, and a lack of political rights, do not seem to have much if any predictive power as to conflict risk. This suggests that interventions that improve the economic characteristics can reduce proneness to conflict even if they do not directly address the political issues that are the ostensible triggers of violence. We look at two international interventions that have some potential to improve economic performance – enhanced aid to the poorest countries, and improved transparency of natural resource payments to governments. Of these, it is much easier to place the former into the context of costs and benefits.

1.A : Aid as an instrument of conflict prevention:

The costs of aid are straightforward, and the benefits depend upon the effects upon economic development, and then upon the effects of economic development upon conflict risk. There is a massive literature on the effect of aid on development. We use the methodology of Collier and Dollar (2002), partly because this is the most straightforward to link to the conflict reduction benefits. It is also currently probably the dominant model in policy circles.[1] The model can be used to forecast how incremental aid would raise growth, country by country.

For assessing the risks of conflict, and the contribution of growth to conflict reduction, we use the model of conflict risk of Collier and Hoeffler (2004a). In combination these two models generate estimates of the benefits of aid for conflict prevention in a way that can be compared with their costs.

1.B: Transparency in Natural Resources as an instrument of conflict prevention

There is a useful literature (e.g. Sachs and Warner, 2000, Ross 2000 and 2002, Klare 2001, Bannon and Collier, 2003), on the adverse effects of natural resource dependence on development. There are also practical proposals – discussed at the Evian meeting of the G8 in 2003 – for greater transparency in the management of natural resource rents. Greater transparency is an important and cheap practical instrument.

2. Shortening conflicts

In Section 4 we investigate the opportunity of shortening conflicts and focus on one particular instrument. To date there do not seem to have been systematic effects of either economic or military interventions to shorten conflict. The most promising intervention is to improve the tracking of natural resources, and this is the intervention on which we will focus.

Tracking the natural resource trade

Many conflicts are sustained because rebel forces get substantial finance from plundering natural resources and selling the proceeds on the international market. Recent developments are trying to certify the origin of natural resources so as to curtail this trade. The best example is the Kimberley process in diamonds, but there is also a new initiative for timber. Using a new model of the duration of conflict (Collier, Hoeffler and Söderbom, 2004) we show, at least tentatively, that reductions in the price of natural resource exports increase the chances that a conflict will end. In effect, schemes such as Kimberley are trying to create a price discount for rebel sales of natural resources (('conflict diamonds') by making them illicit, and this can be interpreted within the model as significantly shortening conflict. The benefits of shortening conflicts can be handled within the same framework as the benefits of conflict prevention.

3. Post-Conflict Policies

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[1] See, for example, Benyon (2003).

In Section 5 we investigate the opportunity of reducing the risk of a reversion to conflict in post-conflict situations. Improving post-conflict policies provides the biggest opportunities for reducing the global incidence of civil war. We focus on two interventions, aid and military expenditures.

3 A: Aid in post-conflict situations

Aid in post-conflict situations has distinctive effects – different from aid in the more normal situations that will be discussed under 1A. Here we rely upon our application of the Collier-Dollar model of aid in post-conflict situations (Collier and Hoeffler, 2004). The growth effects are then fed into the previously mentioned model of conflict risk, to show how aid in post conflict situations could reduce the risk of repeat conflict.

3 B Military intervention post-conflict

We compare and contrast the effect on conflict risk of military spending by the post-conflict domestic government with a post-conflict external military presence –e.g. the British military presence in Sierra Leone. According to a new model of the effect of military intervention on risk (Collier and Hoeffler, 2002, 2003), military spending by post-conflict governments is highly dysfunctional. This intervention is all costs and no benefits. By contrast, external military peace-keeping interventions appear to be highly cost-effective.

Conclusion

To summarize, we look at the challenge of reducing the global incidence of civil war. We take three opportunities, one of which is much bigger than the others, namely reducing the risk that conflicts restart once they have ended. We take five interventions:

1A – aid as conflict prevention

1B – transparency in natural resource rents as conflict prevention

2. – natural resource tracking as conflict shortening

3A – aid post-conflict to reduce the risk of repeat conflict

3B – military spending post-conflict to reduce the risk of repeat conflict

In Section 6 we pull the analysis together and attempt to rank the cost-effectiveness of these five interventions.

2. The Benefits of Reducing the Incidence of Civil War

The benefits of reducing the incidence of civil war accrue at three distinct levels – national, regional and global. We consider them in turn.

The most straightforward benefits to estimate are the economic costs of civil war at the national level. Collier (1999) estimated the costs of civil war in terms of the reduction in the rate of economic growth. For this he adapts the standard approach of empirical growth econometrics, taking as the dependent variable the growth rate during a decade, and introducing the number of months during which the country is at civil war as an explanatory variable. Unsurprisingly, during civil war the growth rate is significantly reduced. The estimate from this regression is that each year of civil war reduces the growth rate by around 2.2%. The counterfactual takes into account the country's initial level of income but does not allow for the fact that countries prone to civil war might in any case tend to have worse economic policies even in the absence of war. Other estimates have been made from aggregations of case studies, and these tend to propose rather higher growth costs of war. However, the case studies were not selected randomly and there may have been a tendency to select particularly costly wars. In what follows we will, however, take 2.2% as the best estimate of the opportunity cost of war for the economy during the conflict. It does not seem inherently unreasonable, and there are plenty of cases of civil war where the costs were clearly higher. The average civil war lasts for around seven years (Collier and Hoeffler data set). Thus, by the end of a civil war the economy is approximately 15% below its counterfactual level.

The next issue is to determine how long this persists. Collier and Hoeffler (2004) study the growth pattern during the first post-conflict decade. We find that the typical pattern is that by the end of the decade the economy has more or less recovered its pre-conflict growth path. The growth rate during the decade is 1.13 percentage points above normal, and this is statistically significant. Hence, a reasonable approximation is that the typical conflict involves a cumulative decline of 2.2% per year (relative to counterfactual income) for the seven years of the conflict, followed by a cumulative recovery over the following decade. If we extrapolate this recovery to the 21st year after the conflict started, GDP is back to its counterfactual level. Discounted at 5% back to the year in which the conflict starts, this implies a NPV of 105% of initial GDP. We will take this as the first cost of civil war.

We are able to get some sense of the robustness of this figure from the 90% confidence intervals around the two growth rates from which it is generated. The confidence intervals define the bounds within which there is a 90% chance of finding the 'true' growth rate. We will estimate the lower bound for the cost of a civil war as that generated by the *lower* bound on the loss of growth during the conflict and the *upper* bound on the additional growth after the conflict.[2] Conversely, the upper bound for the cost is generated by the upper bound on the loss of growth during the conflict and the lower bound on the additional growth after conflict. Applying precisely the same procedure as previously, the range generated by these bounds is 41% to 305% of initial GDP. Evidently, while our cost estimate of 105% used the central estimate of the growth rates, it is close to the bottom of the implied range of costs. Hence, there is reason to think that our cost estimate is conservative. Where it is feasible to do so, we will include analogous estimates of confidence intervals in our subsequent calculations.

The income loss from civil war is compounded by a change in the composition of expenditure. Specifically, the share of GDP spent on the military increases and this can reasonably be seen as a waste – not in the sense that it is necessarily foolish given the context of conflict, but in the sense that benchmarked against peace it constitutes a further lowering of welfare. It is a deterioration in the conversion of GDP into well-being. Our estimate of how civil war affects military spending is taken from Collier and Hoeffler (2002). There we explain the share of GDP spent on the military in terms of various characteristics, including whether the country is engaged in civil war. We find, unsurprisingly,

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[2] Although the bounds on the growth rates define the 90% confidence interval for each growth rate, the bounds on the costs of conflict are likely to represent a wider confidence interval. At one extreme, the two growth rate effects are independent of each other, so that the chance of being 'lucky' both in terms of low growth losses during conflict and fast recovery post-conflict is the product of two one-in-ten events, i.e. one in a hundred. At the other extreme, the same circumstances which make growth losses low during conflict make recovery rapid, so that there is only one chance event, the odds being one-in-ten. Hence, our bounds for the cost of conflict represent at least the 90% confidence interval and may represent the 99% interval.

that during civil war military spending rises significantly, by around 1.8% of GDP. In a further paper (Collier and Hoeffler 2003) we investigate what happens to military spending post-conflict, and find that during the first decade governments tend to maintain it at much higher levels that prior to conflict – approximately, governments reduce spending only by around 0.5%. Beyond the first decade there is no evidence and it seems best to make the conservative assumption that spending levels revert to normal, if only to avoid large but very speculative numbers. Hence, the additional waste on military expenditure as a result of civil war is 1.8% of GDP for the seven years of the conflict, followed by 1.3% of GDP for the next decade. Again discounting at 5% to the first year of the conflict, this produces an NPV of 18% of initial GDP.[3]

These economic benefits omit major effects that may well be more important. After all, civil war is not socially equivalent merely to a prolonged economic recession. Civil war causes a severe deterioration in health states. Most of this does not arise from the direct casualties of combat, but from forced population movements and the collapse of basic preventative health services. There have been some estimates of this in terms of DALYs and others in terms of mortality rates, especially among infants. Ghobarah, Huth and Russett (2003) use data on 23 major diseases and find significant adverse effects of civil war. Using WHO data they estimate that during 1999 then-current wars were causing the loss of 8.44 million DALYs, and that a further 8.01 million DALYs were lost as a legacy effect of the civil wars that had ended during the period 1991-97. On the basis of the first of these figures, the typical civil war incurs around 0.5 million DALYs a year of loss during the conflict.[4] These losses persist for some time after the conflict. There is some evidence that the health effects are more persistent than the economic effects, but to err on the side of caution we will taper the health costs out at the same rate as the economic costs – that is we assume that they decline to zero by the 21st year after the onset of the conflict. We taper the loss of DALYs out linearly from the end of the war after seven years of conflict to zero by the 21st year. The resulting estimate of DALYs lost post-conflict is a little less than that of Ghobarah et al., and so is probably an underestimate. We then discount the loss of DALYs at 5% and reach an NPV in terms of discounted DALYs of 5 million. To convert DALYs into an economic metric of income-equivalent is not straightforward. Recent work by Becker, Philipson and Soares (2003) and Soares (2003) provides some basis for valuing a DALY, country-by-country, but unfortunately their evidence is fragmentary for precisely the low-income countries with which we are primarily concerned. Rather than leave DALYs hanging as an additional cost to bear in mind, we will assign the obviously arbitrary value of $1,000 to a DALY. This is approximately the 'purchasing power parity' level of per capita annual income in many of the countries at risk of conflict, and is also within the ballpark implied by the analyses of Becker et al. and Soares. This yields a health cost of the typical civil war of around $5bn.

There are other important costs of civil war that accrue to the nation directly affected. For example, forced migration is a bad in itself, over and above its adverse consequences for health and income. However, rather than aggregate a range of effects that are difficult to quantify, we will include only these two effects of civil war – health and economic costs. These are clearly under-estimates of the full costs of civil war, but hopefully not such wild underestimates that they are worthless.

We now turn to the second layer of costs of civil war, namely those that accrue to neighbouring countries. There is no clear quantitative evidence that conflict in one country directly spills over into an increased risk of conflict in neighbouring countries. However, there are various estimates of the effect of conflict in one country on the economies of neighbouring countries. The first credible estimate was by Murdoch and Sandler (2001), who established rigorously that there were significant effects not just on neighbours, but on a much larger geographic area over a region. Chauvet (2003) also finds significant effects. Our own estimate is that a civil war in one country reduces the growth rate of neighbouring countries by around 0.9 percentage points.[5] There is as yet to our knowledge no research

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[3] Again we can assess the robustness of this figure from the 90% confidence intervals on the additional military expenditure. As before, there are two apparently independent effects – the increases in spending during conflict and after conflict, which are nevertheless likely to be correlated. The estimated bounds – 12% and 25% - thus represent at least the 90% confidence interval for the extra costs of military spending.

[4] There are typically around 17 civil wars at any one time (Collier *et al.*, 2003, Chapter 4). Hence, the loss per war is 8.44/17.

[5] Our estimate, made for the purposes of the present study, regressed the annual growth rate over a five-year period, on the initial level of income, education, dummy variables for whether the country

on the effects on neighbours post-conflict. We will assume that the recovery of the neighbourhood follows the same trajectory as that of the country directly affected. Again taking a discounted NPV of these losses, the cost to the typical neighbour is 43% of initial GDP. The average country has 2.7 neighbours (Collier and Hoeffler, 2002). Hence, the adverse growth effects of a conflict during the conflict are equivalent to a loss of 115% of initial GDP of one country (ignoring any systematic differences in the size of war-effected countries and their neighbours). The growth loss to neighbours thus exceeds the loss to the country itself. The 90% confidence interval on this estimate comes from that around the coefficient on neighbouring civil war in our growth regression.[6] The lower bound is 49% and the upper bound 182%%.

A further cost to the neighborhood is through neighborhood arms races. Recall that during and after a civil war the government of the affected country substantially raises its military spending. Collier and Hoeffler (2002) show that the military spending of neighbours is a powerful influence upon the level of spending that a country choses. That is, there are neighborhood arms races. An increase in military spending by a country affected by civil war triggers such an arms race, with the neighborhood also significantly increasing its spending. The extent of this arms race effect – termed the 'arms race multiplier of neighbour's expenditure' – depends upon the number of neighbours. As the number of neighbours increases the multiplier declines sharply. We estimate that for the typical country, - with 2.7 neighbours – an exogenous one percentage point increase in military spending by one country – due to civil war – would increase the average spending of neighbours by around 0.23%.[7] Recall that during conflict spending by the conflict-affected country rises by 1.8% of GDP and that for the decade after conflict spending is 1.3% of GDP higher. Thus, the typical neighbour would raise its spending during its neighbour's conflict by around 0.4% of GDP and during the post-conflict period by around 0.3%.[8] The NPV of these extra expenditures is 4.3% of initial GDP.[9] Since this occurs in each of the 2.7 neighbours, the total extra expenditure is equivalent to around 12% of the GDP of one country (again ignoring size differences between countries).[10]

There are also indirect non-growth costs of civil war on neighbours. Perhaps the most important is that during forced migration out of the civil war country migrants pick up diseases to which they lack immunity, and then transmits these diseases to neighbouring populations. An estimate of the incidence of malaria by Reynol-Querol finds that each thousand civil war immigrants to a neighbouring country raise the number of cases of malaria in the recipient country by 1,400. It is not possible at present to quantify these effects into DALYs or some other equivalent. Hence, we will make no attempt to incorporate these costs.

Before continuing it is useful to sum the various costs that we have so far considered. The cost of the loss of GDP to the country directly affected is 105% of initial GDP. Onto this is added the loss of GDP to neighbours, being equivalent to 115% of initial GDP, the diversion of spending into the military in the country directly affected, costing the equivalent of 18% of GDP, and finally the same diversion in neighbours, costing the equivalent of 12% of GDP. Hence, the total cost is the equivalent of 250% of initial GDP. To express this in dollars we need the GDP for pertinent countries. Our discussion of

was landlocked, for time period, and for region, and the number of months during which the country itself, and any of its neighbours were experiencing civil war. If a neighbour was at civil war for the full five years the reduction in the annual growth rate was 0.89 percentage points. This is larger than the effect found by Murdoch and Sandler, but their growth regression includes investment as an explanatory variable so that any effects of neighbourhood civil war on growth via the investment rate are omitted. Results are available from the authors.

[6] We maintain the assumption that post-war the neighbour gradually recovers over the same period as the country that experienced the civil war.

[7] We estimate this using the results of Collier and Hoeffler (2002), equation (6).

[8] That is, 0.23*1.8 = 0.4, and 0.23*1.3 = 0.3.

[9] As usual, we assume that the conflict lasts for seven years. We assume that the post-conflict increase in military spending persists for a decade. We discount at 5%.

[10] We again estimate the confidence interval. Potentially there are now three components in the estimate, each with a confidence interval: the civil war country's increased military spending during and after conflict, and the degree of gearing in the response of the neighbours. However, the degree of gearing in the neighbours' response can reasonably be treated as independent of the other events and so our 90% confidence interval on this component of cost incorporates only the confidence interval around the degree of gearing, namely 8% and 16%.

policy instruments will be designed to reduce risks in low-income countries. Hence, the benefits will be proportionate to the GDP of conflict-affected low-income countries. In estimating the GDP of such countries we exclude India and China, even though they have both had relatively minor internal conflicts. The exclusion of these countries is because they are too large and *sui generis* to be pertinent to our policy instruments. Being so large, their inclusion would swamp the results. Thus defined, the average GDP of conflict-affected low-income countries just prior to conflict was $19.7 billion.[11] Thus, had a representative conflict been averted the benefit would have been around $49 billion.[12] To this must be added the health benefits, which we have already estimated directly in dollars to be around $5bn. The total benefit of averting the typical civil war in a low-income country would thus be around $54bn.

Having established a figure for the cost of a single civil war we must now introduce a further cost generated by the 'conflict trap'. That is, once a country has had a civil war it becomes much more likely to have a further war. Evidently, in econometric terms such a proposition is problematic unless due allowance is made for 'fixed effects': that is, it is easy to confuse an inherent proneness in a particular country to civil war for the legacy effects of war. However, it is possible to an extent to distinguish the two since the legacy effects fade over the course of around two decades. It is thus possible to exclude any highly persistent effects that make a country atypically prone to conflict. We may be mis-attributing to the legacy effects of civil war risk factors which actually cause both the first war and a subsequent relapse, but are not highly persistent. All that can be said here is that civil war is itself such a profound experience for a society that it is likely to dwarf other non-persistent events that precede it. With these caveats, we use the Collier-Hoeffler (2004a) model of the risk of civil war to estimate the additional risks faced by societies that have recently had a civil war, period by period. Here we take the 21 civil wars for which both began and ended during the period 1965-99 and for which we have complete data both just prior to the commencement of the war and after its ending. We then consider a hypothetical country with characteristics that are the mean of this group and estimate the risk of conflict both just prior to the war and once it had ended. Even prior to war, the modelled five-year risk of war for this group of countries was high, at 22.3%.[13] However, just after the end of the war the predicted risk had risen to 38.6%. This increase in risk of 16.3 percentage points was thus a further legacy effect of the war. If the peace is maintained, the risk gradually fades: it takes around 15 years for the risk to revert to its pre-conflict level. The cost of this legacy is then the enhanced risk of conflict, times the cost of a single war, discounted back to the beginning of the first conflict. Taking this approach yields a conflict trap effect of around $10.2bn.[14] This has to be added to the $54bn, yielding a cost of $64.2bn. In effect, in a probabilistic sense, the typical civil war persists for more than seven years. Again we estimate confidence intervals. The lower bound of the 90% confidence interval is 10% of GDP, and the upper bound is 26%, the central estimate being 19%.[15]

The final layer of effects is global. These effects are too important to ignore but too speculative to quantify. Over the past thirty years three massive world scourges have been linked to civil war. As will be obvious, at the most civil war has been a contributing factor to these scourges rather than their sole cause. The best-documented is the link to the production of hard drugs that are consumed predominantly in the OECD societies. Around 95% of hard drugs production takes place in civil war

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[11] We use here our comprehensive data set for global conflicts, 1965-99. We take the average GDP of all conflict-affected low-income countries (excluding India and China) just prior to the conflict. Our data set uses 1985 constant price dollars from the Penn World Tables 5.6. We convert this into current dollars using the US CPI.

[12] That is, $2.50*19.7 = 49$.

[13] The risk for the typical low-income country other than post-conflict countries is much lower at 13.8%.

[14] We assume that the conflict occurs in the middle of the five-year period of prediction. Thus, during the first five year period the NPV of the additional risk of conflict is $(0.386-0.223)(54)/(1.05)^3$. During the second five-year period the risk falls to 31.9%, and so the additional legacy cost is $(1-0.386)(0.319-0.223)(54)/(1.05)^8$. During the third five-year period the risk falls to 25.8% so the additional legacy cost is $(1-0.386)(1-0.319)(0.258-0.223)(54)/(1.05)^{13}$. The post-conflict risk gradually falls due to three effects: the increased duration of peace, the higher rate of growth, and the cumulative effect of growth upon income.

[15] The confidence interval is established from the coefficient on the duration of peace in the logit regression. We replace the central estimate for this coefficient with the lower and upper bounds in turn, and then repeat our estimates as set out above.

areas. The reason for this is straightforward: production basically needs territory outside the control of a recognized government, and this is inadvertently – and in some cases consciously – provided by rebel organizations (Brito and Intrilligator, 1992). The second scourge is AIDS. A reasonable, but not definitive medical case has been made that the origin of the present pandemic is a civil war. Civil war can vastly increase the spread of a new sexually transmitted disease because it combines mass rape with mass movements of populations. Hence, what might normally have been localized outbreaks that quickly died out, might have been scaled up to the point of sustainability. The third scourge is international terrorism. As with drugs, it is highly convenient for such terrorists to have access to territory outside the control of any recognized government. Al Quaida located in Afghanistan, not because its members were Afghani, but because it was outside the control of a recognized government.

The global costs of these three scourges have been astronomic and huge resources are being deployed to contain them. International military interventions were eventually felt to be necessary in six civil wars where the interventions have been costed: Bosnia, Cambodia, El Salvador, Haiti, Rwanda and Somalia. The combined cost of external intervention was $85bn.[16] For the moment, however, we will leave these benefits as a large but unknown residual. In effect, we will try to determine how large this residual would have to be before our various interventions started to look attractive in a cost-benefit sense.

So far, we have considered what a typical civil war might cost, and also what civil wars in aggregate do to global society. However, when we turn to opportunities for reducing civil war, to the extent that they work they reduce the global incidence of civil war – the number of countries at war at any one time. We thus need to convert our measures of the cost of a typical war into something that is commensurate with
the effects of the opportunities. At present, on average two civil wars start each year. Thus, for opportunities which reduce the risk of war starts but leave the duration of war unaffected, the benefits are double the NPV of the cost of a civil war, - i.e. $128.4bn - multiplied by the reduction in the risk of war initiation. This then becomes the annual benefit from the opportunity. For example, an initiative which reduced the risk of war by a tenth would generate benefits of around $12.8bn per year.

The opportunities which we discuss in the following sections do not, however, reduce the risks of all civil wars but rather focus on the two most salient sources. Here we rely on a simulation model of the global sources of civil war set out in Collier *et al*. (2003). This model simulates the steady state flows into and out of civil war with countries divided into five groups: high income countries at peace; middle-income countries at peace; low-income countries at peace; post-conflict countries; and countries at civil war. According to this model, the most salient source of civil war starts is post-conflict relapses. Typically, half of all civil wars are relapses into conflict during the first decade of peace following a previous conflict. We will be considering specific instruments to reduce this risk. The other salient source of civil war is from low-income countries (excluding post-conflict situations). Typically, 0.7 civil wars per year start in such countries.

For opportunities which shorten wars, the benefits need to be calculated differently. We simply repeat all the above calculations replacing the actual seven year duration of civil war with an imagined six year duration. Such a shortening has quite a large effect on the total cost of a war, reducing it from $64.2bn to $53.5bn.[17] This would be a gain to the two civil wars which on average start annually, representing an annual gain of $21.4bn. However, in addition to this continuing gain, were existing civil wars to be shortened by one year there would be a once-and-for-all gain from this stock of ongoing wars. Typically, there are around 17 significant civil wars going on at any one time. Were their average cost to be reduced by $10.7bn this would constitute a gain of $181.9bn. To get this one-off stock gain into a flow gain in order to make it comparable with our other figures we again apply a

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[16] See Brown and Rosecrance (1999).

[17] Excluding the legacy effects, the cost of a civil war of six years duration is $36.8bn compared with $45bn for a seven year war. Again we estimate the 90% confidence interval. In the low-cost scenario (a smaller growth loss during the war and a faster recovery), shortening the war by one year reduces total costs by 27%. In the high-cost scenario (a larger growth loss during the war and a slower recovery), shortening the war by one year reduces total costs by 13%. In our central estimate, shortening the war by one year reduces costs by 18%.

5% interest rate. The flow gain is thus $9.1bn. Hence, an initiative which shortened civil wars by one year would generate an annual benefit of around $30.5bn.[18]

At present these benefits are entirely hypothetical because we have yet to discuss instruments for achieving a reduction in the risk of war initiation and a reduction in war duration. These are the tasks of the next two sections. This will determine whether the potentially large numbers involved in the benefits of greater peace can actually be accessed.

3. Opportunities for Conflict Prevention

We now consider the first opportunity for reducing the incidence of civil war. This is to reduce the risk that conflicts will start. Here we exclude the circumstances in which a recently ended conflict restarts because we consider this separately in Section 5.

To investigate the opportunities for conflict prevention we need a quantitative model of the risks of conflict. The Collier-Hoeffler model was, we believe, the first such model, and we will use its latest version (see Appendix A1). There are now several other such models and we will discuss the extent to which our model agrees with the findings of other models.

The CH model finds that political and social characteristics of a country prior to conflict are surprisingly unimportant in determining the level of risk. Whether a country is democratic or not seems to have no significant effect. This result is broadly echoed by the political science literature. Some scholars find a non-monotonic effect, such that partial democracies are actually more dangerous that dictatorships. Some authors also find a disturbing interaction with per capita income, such that in lower income countries democracy is significantly more dangerous than dictatorship. Such results do not, of course, lead to the conclusion that dictatorship is preferable, but they do suggest that solutions purely in terms of the design of the political system may be less promising than one would have hoped. Similarly, but more hopefully, ethnic and religious diversity does not appear to be a very significant risk factor with the possible exception of 'ethnic dominance', in which the largest ethnic group constitutes a modest majority of the population. Fortunately, most low-income countries are too diverse to be characterized by such dominance.

By contrast, the CH model finds that three economic characteristics have significant and substantial effects on the risk of conflict. These are the level of income, its rate of growth, and the degree of dependence upon primary commodity exports. The effect of the level of income is well-supported – it is evident that civil war is concentrated in the poorest countries. While potentially this could be due to reverse causality, during colonialism there was in effect an imposed peace. Countries came out of colonialism at very different levels of income, and on top of this had very different economic performance, before some of them succumbed to their first conflict. The relationship to the level of income is robust to the exclusion of cases of repeat conflict. The effect of the rate of growth of income is questioned by some scholars. However, unless the post-conflict phase is properly treated, analyses are liable to obtain spurious results: during the post-conflict phase there is both a high rate of growth – due to recovery – and a very high risk of further conflict, so that the two can appear to be positively associated. We will use the CH results because they seem to be both intuitively reasonable and to be predicted by simple theory. When an economy is growing rapidly the returns to expanding the cake are higher relative to fighting over how to divide the cake and so one would expect a reduction in the risk of conflict.

We are going to focus here on low-income countries. These are the ones that according to the CH model are most at risk, and they are also the ones for which aid as an instrument is pertinent. Specifically, we will consider low-income countries excluding post-war situations (these will be considered in Section 5). We will also exclude both India and China from our data because they are too large for international interventions to make a credible difference. Our focus is therefore on relatively small, poor countries with a recent history of peace. Such countries are, according to our analysis, nevertheless living dangerously. During a five-year period, we estimate that the typical such country faces a risk of civil war of 13.8%. This is based on average experience 1965-99, but over that period

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[18] That is, the $21.4bn from shortening the two wars that start each year, plus the $9.1bn which is the annual income from the one-off windfall from shortening the 17 current civil wars.

there were no major trends in the risk of civil war, so it is a reasonable estimate to apply to present circumstances.

Raising the growth rate of such an economy thus has two beneficial effects on the risk of conflict – it reduces the risk directly through the growth rate effect, and it reduces it cumulatively through the income levels effect. We are going to take as an experiment an increase in the growth rate of one percentage point sustained for a period of ten years. According to the CH model, which analyses risk in five-year periods, this would have an impact effect during the first five year period, through its effect on the growth rate. Specifically, the risk would decline from 13.8% to 12.7%. In the second five-year period there would be both a growth effect and an income level effect since growth would cumulatively have raised income. Their combined effect on conflict risk would be to reduce it to 12.2%. In the third and subsequent five-year periods the growth rate reverts to its previous level and the only effect is therefore due to the permanently higher level of income. This permanent effect is for the risk to be 12.7% rather than the 13.8% that it would have been.

The benefits of the reduced risk of conflict can then be valued using our previous estimate of the cost of a conflict and the contribution of low-income countries to this risk. Recall that the cost of a civil war is $64.2bn, and that 0.7 such wars occur in the typical year in low-income countries (excluding post-conflict situations). The 'impact' effect of faster growth, that is during the first five year period, is to reduce the rate of conflict initiation by 8%.[19] Hence, for each year of this five-year period, there is a gain of $3.6bn.[20] Analogously, in the second five year period the rate of conflict initiation falls by 12%, and so the annual gain rises to $5.4bn. Finally, in the third five-year period and all subsequent years there is a gain of $3.6bn. The NPV of this income stream, discounted at 5%, is around $79.2bn. We should, of course, note that this is simply the gain due to *conflict* reduction in these societies. The main benefit of growth in these societies is likely to be poverty-reduction. We are only focusing on the value of the additional benefits of enhanced security, which are normally omitted from the analysis of the effects of growth. This particular estimate has a wide confidence interval, the 90% bounds being $29bn and $127bn.[21]

Having got some valuation of the effect of enhanced growth in low-income countries with a history of peace, we now consider instruments for achieving faster growth. The first such instrument that we will consider is an increase in aid.

3.1 The Instrument of Aid

The effect of aid on growth is controversial although most scholars find it to be significantly positive. The main controversy is the extent to which the effect of aid on growth is contingent upon the policy, governance and institutional context. We will use the estimates of Collier and Dollar (2002), and combine them with the Collier-Hoeffler model of conflict. This was the approach taken in Collier and Hoeffler (2002a).

Collier and Dollar find that aid raises the growth rate but that it is subject to diminishing returns. Hence, at some point a country can become saturated with aid and no additional growth is achieved by further aid. They find that the capacity to absorb aid (as a percentage of GDP) is dependent upon the quality of economic policies, governance and institutions. They measure these using a detailed ordinal index compiled annually by World Bank staff for each country, the 'Country Policy and Institutional Assessment', So measured, they find that the CPIA itself powerfully influences the growth rate, and that it also influences the capacity to absorb aid.

Recall that for conflict prevention we are focusing on low-income countries that are not in post-conflict situations, and we are excluding India and China. Thus defined, we consider incremental aid as a means of raising growth rates. We abstract from issues of aid allocation by adding additional aid worth two percentage points of GDP
(valued at purchasing power parity prices) to all such countries. We simplify by considering the effect on the 'representative' such country, with characteristics at the mean of the group. The extra two percentage points of aid raise the growth rate by 0.2 percentage points. This is a relatively modest gain

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[19] That is, $1 - (12.7)/(13.8) = 0.08$.
[20] That is, $0.08*0.7*\$64.2bn$.
[21] The bounds come from the confidence interval on the growth coefficient in our logit of conflict risk.

– much smaller than the impact of existing aid flows – because of the problem of diminishing returns. We should also note that it abstracts from issues of improved aid delivery. With better delivery mechanisms and more selective allocation, the contribution of aid to growth could be considerably higher. However, our figure is a simple benchmark.

The benefits of such growth in terms of conflict prevention are approximately one fifth of the benefits of those achieved by a one percent faster growth rate, which we have just estimated. Hence, the benefits are approximately $16bn.

The costs are simply the additional aid flows. There are 32 countries in the category of low-income, at peace, and not in their first decade post-conflict (excluding China and India). Their combined GDP is $1,200bn (again valued at purchasing power parity prices but expressed in current dollars), so that the extra aid programme would cost $24bn annually.[22] Over the decade this would amount to an NPV of $195bn.

Evidently, the conclusion of this estimate is that conflict prevention achieved purely by unselective aid programmes to low-income countries is not very cost-effective. The benefits amount to less than ten percent of the costs. The uncounted global costs of conflict would therefore have to be over ten times the included costs for this strategy to justify itself purely on security grounds. Recall that this is decidedly not a comment on the efficacy of additional aid, since the main purpose of such aid is poverty reduction rather than security. However, it does suggest that the addition of security considerations may not be central to the argument over additional aid for low-income countries.

3.2 The instrument of improved governance of natural resource rents

Natural resource rents are usually not successfully converted into growth. Indeed, they appear often to be detrimental (Sachs and Warner, 2000, Lane and Tornell, 1999). In addition to these adverse effects for growth, we find that revenue from primary commodities is a risk factor in civil war. While this specific econometric result has been challenged, at least for natural resource rents the result is supported by a considerable body of case study evidence. Such evidence is particularly useful because it can suggest the likely mechanisms by which natural resource rents increase the risk of conflict, and hence what policies might be appropriate.

There seem to be five routes by which natural resource rents increase the risk of conflict. The first is that such resources are prone to price booms and busts and these episodes tend to destabilize the economy, producing both overall slower growth and phases of rapid economic decline. Both of these economic consequences would raise the risk of conflict. The second route is that because the government gets income from natural resources it does not need to tax the population so heavily, and some political scientists suggest that this tends to distance the government from the population. In effect, the population is less concerned to hold the government to account and so spending becomes corrupt. This is compounded by a third effect, namely that natural resource rents tend to be associated with increased levels of 'grand' corruption. Large contracts have to be negotiated, and there are enormous incentives for companies and politicians to enter into deals that are beneficial for each party at the expense of the country. This in turn tends to play into a fourth route, namely regional secessions. Natural resources tend to be located in the periphery of a country, where there will usually already be some romantic ethnic separatist movement even prior to the resource discovery. However, once valuable resources have been discovered this romantic secessionism can batten on to the robust cause of economic self-interest. If national level politicians can plausibly be depicted as corruptly looting the resource rents then the secessionist party will of course do so. Finally, natural resource rents provide opportunities for extortion rackets on the part of rebel movements and these finance and sustain conflict even if they do not initially motivate it.

Where in this is there an opportunity for the international community? We suggest that there is an opportunity for collective action around the principles of how natural resource rents are managed. Specifically, international action could improve the domestic governance of primary commodities by establishing a 'template' for their proper use. Such a template could lay down two core principles. The

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[22] Thinking the same costing through using prevailing exchange rates instead of PPP, the amount of aid needed would be around 6% of GDP rather than 2%, but there would be an offsetting reduction in the value of GDP itself.

first would relate to transparency of revenues. At present in many countries the rents from natural resources are not reported in the budget and so expenditures cannot be scrutinized effectively. A major campaign is currently being mounted, backed by a range of NGOs, G8 governments and the International Financial Institutions, known as the Extractive Industries Transparency Initiative. It aims to establish guidelines for both corporate and government disclosure of natural resource rents. The second would relate to inter-temporal revenue management. While there is little rationale for low-income countries establishing funds for future generations, along the lines of Norway and Kuwait, there is a much stronger case for medium-term revenue smoothing. Poor management of revenue booms has been an important cause of slow growth in many resource-rich countries. International guidelines could encourage the adoption of either hedging or savings rules to cope with such shocks. For both transparency and smoothing mechanisms the advantage of international guidelines is that it makes it much easier for a reforming government to achieve change. For example, the President of Nigeria has publicly announced his intention of adopting the EITI transparency guidelines. Similarly, a government newly facing a resource discovery has a ready-made policy to adopt or reject. Again the EITI has already proved potent in the context of such a discovery in Sao Tome and Principe. Finally, it makes it more costly for a government to persist with bad policies. Citizens can challenge their government as to why it is choosing to flout international guidelines, and the decision not to adopt them would constitute a negative signal to international markets. An analogy would be the widespread adoption of Basel guidelines in banking. An effective precursor to the EITI was the Chad-Cameroon pipeline initiative, which has substantially increased the ability of citizens of Chad to scrutinize how revenues are being used.

The cost of producing such guidelines is not financial. Rather its cost is the opportunity cost of achieving collective international action in some other sphere. Such action is difficult, and only a very few initiatives can be achieved. If, for example, a summit can reasonably discuss only three issues, the cost of the EITI is the gain from whichever issue it crowds out.

To estimate the gains from a successful initiative we proceed as follows. We first establish that there is indeed an adverse effect of natural resource rents upon policies, governance and institutions. For comparability we again rely upon the Country Policy and Institutional Assessment of the World Bank. We regress the CPIA on per capita GDP and upon the share of natural resource exports in GDP:[23]

$$CPIA_t = 0.463 + 0.320 \ln GDP_{t-5} - 0.513 SXP_{t-5}$$
$$(1)$$
$$(1.44) \quad (7.16)*** \quad (-2.53)***$$

n=465, R^2=0.12

The effect of natural resource rents, as proxied by SXP, is indeed both highly significant and adverse: controlling for the level of income, the more dependent upon natural resources is a country, the worse is its policy, governance and institutions.

We have no way of telling how effective global guidelines on natural resource management would be. A fully successful effort to improve the management of natural resource rents would eliminate the adverse effect on the CPIA. We suppose that such an improvement would be beyond the bounds of the feasible, but imagine that by giving the issue sufficient prominence and promoting sound guidelines the adverse effects of natural resource rents could be halved. In terms of the above regression this would imply that the negative coefficient on SXP of –0.513 would be reduced to –0.257. This we take to be the feasible aspiration of an international effort. Some of the mismanagement of natural resource rents has indeed been so egregious that major improvements should be possible with little effort.

Our next task is to estimate the benefits for conflict prevention of such an improvement. We find that the CPIA has no direct effect on conflict risk (Collier and Hoeffler, 2002a). However, following Collier and Dollar (2002), an improvement in the CPIA would raise growth. At the mean characteristics of the

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[23] OLS regression results, t-statistics in parentheses, robust standard errors used, time dummies not reported. To reduce the problem of endogeneity GDP and SXP are lagged by five years. To reduce the problem of auto-correlation we use only five-year 'snapshots': 1975, 1980…1995.

low-income countries at peace that we are considering in this section, halving the adverse effect of natural resources on policy would raise growth rates by 0.067 percentage points. In the case of aid we considered a ten year programme. However, there is no reason to suppose that once international guidelines became effective their benefits would only be temporary. The goal is to produce a one-off permanent change in practices. The NPV of the gain in reduced risk from this permanent higher rate is $12.1bn.[24]

Recall that we find that in addition to the adverse effect on growth, there is a substantial direct effect of primary commodity dependence increasing the risk of civil war. This effect is controlling for the growth and level of income. Case study evidence suggests that one of the important routes by which this happens is that secessionist movements gain strength by being able credibly to suggest that resource rents generated in their region are being wasted or embezzled. Hence, transparency and scrutiny of revenue use can be expected to weaken the risks generated by a given level of natural resource rents. More generally, if natural resource rents flow transparently into the budget and out again for reasonable public expenditures, then there is less incentive for rebels to try to capture them, and less reason for them to expect to be successful in doing so. We have no way of knowing how large such an effect might be. For illustrative purposes, we assume that the EITI could reduce the direct contribution of natural resources to conflict risk by one tenth of the overall risk that they generate. According to our model, natural resources are a major source of risk, although we cannot disaggregate among the various channels. A reduction in the risk from natural resources of one tenth would reduce the overall risk for the typical low-income country from 13.8% to 12.7%. From this, we calculate the gains as above. That is, we take the proportionate reduction in risk, and multiply it by the annual cost of conflict generated by poor countries falling into conflict. The annual gain is around $3.9bn. Since this is a permanent gain, the NPV would be around $77bn.

Thus, the overall security gain from an effective implementation of the EITI would be the $12.1bn from permanently faster growth, and $73bn from a reduction in the direct risks of conflict. That is a total gain of $89.1bn. These are, of course, highly speculative numbers. However, they are not necessarily over-estimates. They assume that effective international action would halve the damage currently being done by natural resources to growth, and reduce by one tenth their direct contribution to conflict risk. While the benefits of these improvements are considerable, the improvements themselves are not wildly ambitious.

4. Opportunities for Shortening Conflicts

Civil wars last far longer than international wars. The typical civil war lasts around seven years whereas the typical international war lasts around six months. The difference was dramatically illustrated in the case of the Eritrea-Ethiopia conflict. When this was a civil war it lasted for around thirty years and was only ended by a military victory on the part of the rebels. When it resumed after Eritrean independence, and hence as an international war, it lasted less than a month. Evidently, if civil wars could be shortened more to resemble the duration of international wars, their global incidence would be dramatically reduced. Worse, the duration of civil wars appears to be increasing. The average duration of wars in the period 1980-1999 was around double that in the period 1960-79. Average duration in the 1990s was fortunately a little shorter than in the 1980s, but this probably reflected the one-off effect of the end of the Cold War, with a number of conflicts that had been funded by one or other of the superpowers coming to an end.

The long duration of civil wars reflects the much greater ability of the international community to put pressure on states to end international wars, to act even-handedly between the parties, and to guarantee the terms of a settlement. With a civil war the terms of a settlement often lack credibility: rebel forces

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[24] We estimate the effect of the increase in the growth rate on the risk of conflict for low-income countries at peace, period by period. Thus, in the first period there is only a growth rate effect, whereas in subsequent periods there is both a growth rate effect and an income level effect. From this we calculate the proportionate reduction in risk, per period. This reduction is then multiplied by the cost of civil war generated annually by poor countries at peace falling into conflict. That is, 0.7 countries per year, multiplied by the cost of a civil war ($64.2bn). The NPV of this stream of future gains is then calculated, discounting at 5%.

are unable to guarantee that rival rebel groups will not emerge to continue the war, and governments have no way of binding themselves to their offers.

Collier, Hoeffler and Söderbom (2004) analyze the duration of civil wars econometrically. Using a data set on international interventions collected by Regan (2002) we test to see whether there has been any systematic effect of either economic or military interventions – whether on the side of the government or on the side of the rebels. We find that none of these types of intervention has had a significant effect on the duration of conflict. This has to be qualified. It was not possible to 'instrument' for international interventions. Hence, it may be that the interventions occurred in the most difficult environments where wars would otherwise have lasted longer than average. Further, even taken at face value, the result does not show that all interventions were ineffective, simply that no type of intervention was *systematically* effective. However, with these qualifications, the result is discouraging. It suggests that although the shortening of civil wars superficially looks to be an important opportunity for reducing the incidence of civil war, in practice the international community lacks effective instruments.

The fact that civil wars have been getting longer may give us some guidance as to how to shorten them. One of the important developments in civil war has been the emergence of commercial markets both for natural resources that can be extorted by rebel organizations, and for military equipment. Whereas in the 1960s a viable rebel movement generally needed some supportive government for funding and armaments, by the 1990s rebel movements could be entirely viable as private enterprises. This suggests that the greater control of these two international markets, with a view to curtailing access by rebel movements, might be effective instruments in shortening conflicts. Here we consider only the markets in natural resources, while noting that control of the trade in armaments is also worth serious effort.

The Instrument of Curtailing Rebel Access to Commodity Markets

Concern over rebel access to international commodity markets initially arose among NGOs – most notably by Global Witness - and was then taken up by the United Nations. The first market which attracted attention was that for diamonds. There was overwhelming evidence that two large rebel organizations – the RUF in Sierra Leone, and UNITA in Angola – were generating much of their income from the sale of diamonds extorted from the territories under their control. A campaign of public awareness that introduced the concept of 'conflict diamonds' led to dramatic changes in industry practice. First De Beers withdrew from making purchases of diamonds on the open market, and then the industry in collaboration with NGOs and diamond-producing governments established the Kimberley process whereby diamonds were certified by governments as to having a legitimate source. The Kimberley Process is new and as such it is too early to determine its effectiveness. However, the change in the practice of De Beers preceded Kimberley, and given the dominance of that company in the market, this itself must have substantially impaired rebel access. Subsequent to the change in De Beers policy, and to the radically greater scrutiny placed on diamond transactions, both of the diamond-financed rebel movements – RUF and UNITA – collapsed. The squeeze on their finances was most certainly not the only reason for this reversal in their fortunes. However, by the account of their own senior leadership, international actions had made their operations substantially more difficult. It is also worth noting that by the standards of rebel movements both the RUF and UNITA had been very large and successful.

The idea of certification of source has now been taken up in respect of timber, where there is also compelling evidence that rebel movements both in Asia and Africa have been using timber felling as a revenue-generating activity. There may also be a need for it in oil. For example, criminal/rebel groups in the Delta region of Nigeria are looting around $3 million per day of oil by tapping into pipelines and selling the product on the international market. With such revenues they are well-equipped militarily. Similar concerns are likely with the network of pipelines planned in Central Asia.

The basic idea behind certification is to create a two-tier market in which illegitimate supplies can only be sold at a deep discount. The analogy is with counterfeit goods where essentially the same physical product - such as watches or videos - is sold at radically different prices depending upon its provenance. The price discount indeed provides a good measure of the effectiveness of the certification process.

Other than the example of diamonds and the ending of the civil wars in Sierra Leone and Angola, is there any evidence that creating a price discount for rebel-supplied natural resources would shorten

conflicts? Collier, Hoeffler and Söderbom (2004) investigate whether the prevailing world price of a country's export commodities has any bearing on the chance that a conflict will end. They utilize a price series for commodity exports constructed by Dehn (2000). They find that for those countries with large natural resource exports, the world price of their exports has a significant effect upon the chance of peace – and hence upon the expected duration of conflict. Specifically, as the world price falls the chances of peace significantly rise. For countries with large primary commodity earnings (30% of GDP) a 10% decline in the world price is associated with a shortening of the duration of conflict by 12%. This is open to multiple interpretations. One interpretation is that the result is picking up effects analogous to those of a price discount for rebel-controlled resources. If so, this would be encouraging evidence supporting efforts such as the Kimberley Process. A different interpretation would be that lower commodity prices squeeze the finances of both the rebels and the government, and so encourage them to find a settlement. On that interpretation generating a price discount for rebel-controlled commodities would not necessarily be effective, since it would not encourage the government to reach a settlement.

Perhaps the most that can reasonably be said is that the case study evidence and the econometric evidence do not contradict each other, and both give some reason to hope that creating a price discount would tend to shorten some civil wars. Given that other initiatives for shortening wars appear not to have been systematically effective, and that the duration of wars is already long and appears to be lengthening, this new initiative may be worthwhile.

All certification procedures can be evaded at a cost. The purpose of certification is not literally to shut rebel supplies out of the market, but rather to create a deep discount in the price that rebels receive. The cost of certification procedures is negligible. The basic principle is the 'presumption of guilt'. That is, supplies are presumed to be illegitimate, and national-level certification procedures themselves are presumed to be ineffective, unless it can be demonstrated to internationally agreed and monitored standards that they are not. Policing the supply chain is already standard practice in products where there is a risk of counterfeiting, and the problems of 'conflict commodities' are not intrinsically different.

We have already discussed the case for such measures in diamonds, timber and oil. There is one further commodity strongly linked to conflict and that is illegal drugs. For example, all the main rebel groups in Colombia generate their major revenues from extortion rackets on the cultivation of hard drugs. Approximately 95% of the world's supplies of hard drugs come from civil war environments. As discussed in Section 2, a key reason for this is that the cultivation of an illegal commodity essentially needs the connivance of the controlling authority. Thus, only territory outside the control of recognized governments is suitable for sustained cultivation.

While superficially curtailing rebel revenues from hard drugs may appear to be a very different problem from curtailing rebel revenues from diamonds, there are in fact important similarities. The certification approach seeks to create a two-tier market between a legitimate source and an illegitimate source. In the case of diamonds, until recently no source was treated as illegitimate; in the case of hard drugs, at present no source is treated as legitimate. As a result, illegitimate producers of hard drugs do not have to compete with legitimate supplies. It may seem fanciful to imagine a two-tier market in hard drugs, but this was, in fact, the policy in the UK during the 1960s. Once an individual because addicted to heroin they could become registered as an addict through the health services, and thereafter supplied with drugs paid for by the government. In turn, the government obviously purchased its supplies on the legitimate market. This approach –which yielded very low rates of addiction – had various advantages, for example, drug addicts did not resort to crime in order to finance their addiction. However, for our present focus, its big advantage was that during this period hard drug addiction in the UK provided no significant opportunity for rebel groups to acquire finance. The situation in the USA and Europe today is in dramatic contrast to the UK in the 1960s. Western drug addiction creates a massive demand for territory outside the control of recognized governments, and hence finances civil war.

Hence, the proposed instrument of international certification of the supply chain is meant to come into effect wherever rebel groups are getting significant finance from extortion rackets on commodity exports. The intention is always to create a two-tier market, with a legitimate source of supply competing with an illegitimate source of supply. The direct effectiveness of the instrument can be monitored by measuring the extent of this price discount. Obviously, the price of the illicit product is not quite as observable as that of the licit product. However, informed industry participants are aware

of the illicit price. For example, in the case of diamonds, it is reported within the industry that as of 2002 the discount on the price of illicit diamonds was around 10%. Since diamonds are a very difficult product to monitor, and since at the time of this discount the Kimberley Process lacked any monitoring procedure and so was not yet operating on a 'presumption of guilt' basis, this scale of discount probably represents the minimum that could reasonably be expected from a certification process.

As with the EITI, the costs are primarily in terms of the opportunity cost of international collective action in some other sphere.

We now attempt to quantify the benefits. Suppose, for illustrative purposes, that certification processes in the relevant commodities achieved a 10% price discount for illicit commodities similar to that already achieved for diamonds. What might this achieve by way of benefits of reduced conflict?

The closest we have to a reasonable quantitative estimate, at present, is the contribution of a lower world price of exported commodities on the duration of conflict. Recall that a 10% reduction in this price shortened conflict by around 12%. A price discount might have larger or smaller effects than an overall lowering in the world price. It is different in that it tilts the balance more clearly against rebel forces, but this might enhance or weaken pressures for an end to a conflict depending on each situation. Assuming, however, that conflicts were on average shortened by 12%, what

would this imply for the incidence of conflict? Recall from Section 2 that an across-the-board shortening of conflict by one year would have an NPV of around $30.5bn. For a country with primary commodity earnings at 30% of GDP a ten percent reduction in export prices achieves a shortening of not far off this, namely 0.84 years. However, only a minority of countries at civil war are as dependent upon primary commodities as this. Specifically, when we allow for the proportion of civil war countries that are significantly effected, according to the analysis of Collier, Hoeffler and Soderbom, the NPV of a successful price discrimination strategy would be around $5.9bn.

5. Reducing the Risks Post-Conflict

During the first decade post-conflict there are very high risks of repeat conflict. According to the Collier-Hoeffler model, approximately half of these risks are inherited from the characteristics that already made a county prone to conflict and have not improved during it. The other half of the risk arises from changes brought about by the conflict. On the nature of these changes the econometric evidence is more or less non-existent. The case study evidence points to the build-up of armaments and military skills, the desensitization of part of the population to violence, the creation of a rebel organization with a financial interest and capabilities, and the legacy of hatred and distrust.

Because of the high risk of conflict repeat, around half of all civil wars are due to a breakdown of peace during the first post-conflict decade. Yet at any one time relatively few post-conflict countries, (in the sense of countries at peace but still in their first post-conflict decade). Typically, there are around 12 countries in this category at any one time, and so it is possible to focus resources with relatively little waste.[25] Compared with conflict prevention in countries with a long record of peace, discussed in Section 3, interventions are much more precisely targeted. Obviously, compared to strategies for shortening conflicts by direct intervention at the country level, resources are less well-targeted since even without intervention some post-conflict countries will succeed in establishing a durable peace. However, as we have seen, there appears to be relatively little scope for shortening conflicts. By contrast, there is considerable scope for the international community to do a better job at reducing post-conflict risks.

Here we will focus on two instruments already widely used: aid and military spending. We will suggest that aid is particularly effective in post-conflict circumstances, but that to date both its scale and its timing has been flawed. Because of the high risk of repeat conflict, post-conflict governments naturally tend to spend a lot on the military. While this is natural, we will show that it is counter-productive. We accept that there is an important role for a stabilizing military force in post-conflict situations – even with ideal economic assistance and government policies the risk of repeat conflict is irreducibly high. We will argue that foreign military intervention is likely to be far more effective than domestic military

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[25] The 'typical' number of conflicts, and other figures on the flow into and out of conflict are taken from Chapter 4 of Collier *et al*. (2003) which estimates a steady-state global model of the incidence of civil war.

forces. We will suggest that a condition for such intervention should be the swift reduction in domestic military spending.

5.1 The Instrument of Post-Conflict Aid

As discussed in Section 3, aid reduces the risk of conflict by raising the growth rate. A higher growth rate directly reduces the risk of conflict, and cumulatively, by raising the level of income, further reduces the risk. These effects also appear to apply in post-conflict situations. Using the CH model, Bigombe et al. (2002) find that growth is slightly but significantly more effective in reducing the risk of conflict during the first post-conflict decade than it is in less focused situations of conflict prevention. The issue to which we now turn is the effect of aid on the post-conflict growth rate. For this we rely upon the results of Collier and Hoeffler (2004), summarized as appropriate in Appendix A3.

During the first post-conflict decade growth is typically faster than normal. That is, there is some economic recovery. This is not surprising given the loss of growth during conflict. Recall that by the end of a typical seven-year civil war GDP is around 15% lower than it would have been. By the end of the first decade this is more or less fully recovered.

However, the growth recovery is neither evenly spread through the decade, nor inevitable. In terms of timing, supra-normal growth is concentrated in the middle years of the decade – approximately the fourth through the seventh post-conflict years. In analyzing this growth we apply the model of Collier and Dollar (2002), which partitions growth into an exogenous component, a component determined by the quality of policies, institutions and governance, and a component determined by the amount of aid received (partly a direct effect, and partly interacted with the quality of policies, institutions and governance). We find that growth during the post-conflict decade is distinctive within this framework. Specifically, supra-normal growth is entirely determined by the volume of aid (and its interaction with policy). That is, aid is atypically effective in raising growth rates during the middle years of post-conflict recovery. To understand why this should be we have to rely upon case study experience. Evidently, in post-conflict conditions there are atypically high needs for aid. This was, indeed, the original rationale for establishing the World Bank – it was originally named the International Bank for *Reconstruction* and Development. However, there is reasonable evidence that in the first few years after a civil war the quality of institutions is so low that, while needs are great, the capacity to use resources effectively is very limited, so that the returns to aid are no higher than normal. By the middle of the decade the ability to manage resources has usually increased, while needs remain great. Hence, purely from the perspective of maximizing the impact on growth, donors should allocate atypically large amounts of aid to the middle years of the first decade of post-conflict societies. Clearly, growth has two types of pay-off. For aid donors the normal interest is that growth tends to reduce poverty, which for many donors is their prime objective. However, for our present purposes we are interested in the peace-building effects of growth. Hence, over-and-above its enhanced poverty-reducing effects, aid targeted in this way significantly reduces the risk of civil war in the category of countries most prone to lapse into conflict.

Are donors already taking this opportunity? At the end of the Second World War the USA mounted a major aid program that was, in effect, targeted to the recovery of societies in the middle of their first post-conflict decade. But more recently, donor allocation of aid has not followed this pattern. Over the entire course of the first post-conflict decade aid is no higher than were the society not post-conflict, while during the first couple of years of peace there is a flood of aid. Hence, aid typically tapers out just as it should be tapering in.

What would be the pay-off to increasing aid to post-conflict societies in the middle of the post-conflict decade? We take the average characteristics of post-conflict societies during the 1990s, and consider what would have been the costs and returns to increasing aid for five years in the middle of the first post-conflict decade by two percentage points of GDP (at purchasing power parity prices).

Typically there are around 12 such countries at any one time and as previously we evaluate the policy sustained for a decade. Given that the typical post-conflict country would receive additional aid for only half of the decade, at any one time only six countries would be receiving it. The combined GDP of all twelve post-conflict countries is around $163bn, so that the cost of the additional aid to the six would be around $1.6bn a year. The NPV of this aid, discounted over the decade, would be $13bn.

Following the same procedure as previously, we estimate that the gain in the growth rate during these years would be 1.1 percentage points – that is, around five times the effect of incremental aid in normal low-income situations.[26]

We now estimate the effect of faster growth on risk in post-conflict situations. For comparability with our previous estimates we first consider the effect of a sustained one percentage point addition to the growth rate. We evaluate the risk for the typical low-income country. Although the absolute level of risk is much higher for post-conflict countries, the proportionate effect of faster growth is very similar to that for other low-income countries. The only important difference in the calculation of the benefits is that the base for conflict prevention in low-income countries at peace is only 0.7 new conflicts a year, whereas the base for post-conflict countries is one new conflict a year. Hence, the benefits of an extra percentage point of growth in post-conflict countries are greater at around $5bn per year during the decade.[27] In the third and subsequent periods countries that have not reverted to conflict cease to be 'post-conflict' and so become part of the group of low-income countries at peace. The gains here are therefore those of that category of country, proportionate to the number of countries being funded. That is, whereas our previous calculation of the benefits of aiding low-income countries at peace involved aiding 32 countries, now it involves aiding only twelve.[28] Hence, from the eleventh year on, the gains are equal to 12/32 of the gains from the conflict prevention aid programme.[29] The NPV of these gains is $56.9bn.[30]

The gain from post-conflict aid targeted to the middle of the decade would be less than the gain from one percent additional growth sustained throughout the decade since the extra growth of 1.1% would only be sustained for five years. The benefits are around $31.5bn. The bounds of the 90% confidence interval around this figure are $20bn and $40bn.[31]

At our central estimate of the benefits, the returns on post-conflict aid are more than double their costs. Further, even at the lower bound of our estimate of the security benefits, they still comfortably exceed the costs, generating a gain or around $7bn. We should stress that there are global security benefits that we have entirely omitted from quantification, and that we have omitted all the usual benefits of aid, namely poverty reduction. The security considerations are now large enough to be dominant in the case for aid, whereas in the case of more generalized conflict prevention they appeared to be only a marginal consideration.

5.2 The Instrument of Military Expenditure

In early post-conflict situations the risk of reversion to conflict is typically very high although it gradually declines if peace is maintained. Economic remedies eventually work to lower risk, but inevitably they take time. However rapid is growth, it cannot reduce risks to acceptable levels during the first few post-conflict years. Nor, it seems, can political design. There is some evidence that in cases where democracy has been introduced into post-conflict situations, the second election is actually a time of enhanced risk. This is not to say that democracy is inappropriate in post-conflict settings, but

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[26] We use the growth regression reported in Table A3, column 2, and the means for post-conflict countries.

[27] Specifically, the risks of conflict decline as a result of faster growth from 38.6% to 36.3% in the first five-year period, and from 31.9% to 28.8% in the second five-year period (when both growth and accumulated income effects are working). We approximate by taking the average proportionate reduction in risk during the decade, namely, 7.8%. Since the category of post-conflict countries generates around one civil war per year, costing $64.2bn, the gain from such a proportionate reduction in risk would be 0.078*$64.2bn=$5.0bn.

[28] Because the extra post-conflict aid is concentrated during only half the post-conflict decade, only six such countries would be receiving aid at any one time. However, since the effect of aid on growth is double its normal effects, the twelve five-year aid programmes achieve the same as twelve ten-year aid programmes in normal situations.

[29] Recall that the annual gains for the conflict prevention category of country were $3.0bn, so that the gains from the smaller group of post-conflict countries would be (12/32)*$3.0bn=$1.1bn.

[30] That is, $5bn for a decade, and $1.4bn subsequently.

[31] The confidence intervals are generated from the coefficient on the post-conflict interaction term in Table A3, column 2.

rather that in the short term it should not be expected in itself to solve the problems of violent conflict. Most governments in post-conflict settings appear to conclude that high military expenditure is needed to maintain the peace. During civil wars the typical level of military spending is around double peacetime levels, and during the first post-conflict decade it only declines modestly. Post-conflict military spending is much closer to wartime spending than to peacetime spending. Given the high risks of repeat conflict, it indeed seems likely that there is a need for some military force to keep the peace. However, such expenditures should be judged by their effectiveness.

Collier and Hoeffler (2003) analyze whether military spending in post-conflict situations is effective in reducing risks. Naturally, there is a potential endogeneity problem here since spending is likely to be highest where risks are highest. They therefore 'instrument' for military spending using the military spending of neighbours and the past history of international warfare, both of which are good predictors of spending. So instrumented, in normal conditions (i.e. other than in post-conflict settings) military spending has no significant effect on the risk of rebellion – it appears to be an ineffective deterrent. However, in post-conflict settings it is significantly counter-productive, increasing the risk of repeat rebellion. This result is broadly consistent with the case study literature which emphasizes the low credibility of peace settlements. Rebels try to read signals of government behavior to form a judgment as to whether the government intends to maintain its agreement or renege upon it. High military spending might well be read by rebels as a signal of an intention to renege.

The combination of a high risk of repeat conflict in post-conflict settings, and an understandably high, but counter-productive level of government military spending, creates an opportunity for international military intervention designed to keep the peace. A condition of such an external military presence could be that the government itself makes deep cuts in its military budget, thereby reaping a peace dividend. Knight *et al*, (1996) estimate the costs to growth of military spending, conditional upon the maintenance of peace. Based on their figures, the reduction of post-conflict military spending to peacetime levels, maintained for a decade, would raise GDP by the end of the period by 2%.

We will take as a concrete example the current British military presence in Sierra Leone. The intervention started in 2000 and is continuing. It is sanctioned under Article VII of the United Nations Charter and was a response to a request by the government of the country. It replaced a large but spectacularly ineffective UN military presence under Chapter VI rules of engagement, during which a large UN military force was held hostage by rebel forces. During the period of British military engagement peace has been secured throughout the country and elections held. The future risks once external forces withdraw can only be estimated. We will assume that the risk reverts to the normal level of a post-conflict country that has maintained peace for however many years the British presence has been maintained, subject to one qualification. We will assume that during the external military presence, domestic military spending is reduced to normal peacetime levels. In turn, this lower level of military spending relative to most post-conflict situations delivers additional growth, which we estimate following the results of Knight *et al*. The actual conflict risk post-withdrawal could be higher or lower than this, but there is no evidence on which to choose between these possibilities.

The pay-off to the temporary external military presence can thus be estimated as the elimination of risk during the period of external military presence, which we will take to be ten years, plus the reduction in risk thereafter as a result of faster economic growth during the decade. In the first five-year period of post-conflict, the risk of reversion to war is typically around 38.6%, and in the second five-year period it is typically around 31.9%. Recalling that the cost of a civil war is around $64.2bn, the NPV of the gains from eliminating these risks during the military presence is around $29.9bn.[32] Onto this should be added the gain after military withdrawal from the reduced risk consequent upon the 2% higher level of income due to the reduced level of domestic military spending during the post-conflict decade. The NPV of this is $3.2bn.[33] Hence, the overall gain is $33.1bn.

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[32] Thus, in the first five-year period there is a 38.6% risk of a $64.2bn loss, which we assume accrues in year 3. In the second five-year period, conditional upon there being no war in the first period, there is a 31.9% risk, again of a $64.2bn loss, which we again assume accrues in the middle of the period. The NPV of these losses is thus $(0.386*\$64.2bn)/(1.05^3) + ((1-0.386)*0.319*\$64.2bn)/(1.05^8) = \$29.9bn$.

[33] The 2% higher level of income reduces the risk of the typical poor country at peace from 13.8% to 13.6%, a proportionate reduction of 1.6%. Recalling that there are 0.7 civil wars per year generated from the poor-at-peace category of countries, and that there are only 12 countries in the post-conflict category, rather than the 32 in the poor-at-peace category, the annual gain is therefore

The costs of an external military presence evidently depend upon its scale. An advantage of taking the concrete situation of Sierra Leone is that here the external military presence can be precisely costed, and it was of a scale that proved to be effective not only in maintaining peace, but in establishing it in the first place. Further, Sierra Leone is a pretty typical civil war situation – a low-income country, with a large rebel movement well-resourced by natural resource income. The costs per year of the British military presence in Sierra Leone for the four years of the present occupation were around $49m, were the presence to be maintained for a decade at this rate of expenditure, the NPV of the cost would therefore be $397m.

The pay-off to such external military intervention is clearly massive relative to its cost. An outlay of less than half a billion dollars secures benefits in excess of $30bn. Further, the benefits have been estimated on very pessimistic assumptions about risks after the withdrawal of external forces.

Typically, there are around 12 post-conflict situations and hence 12 opportunities for this sort of pay-off. Historically, these opportunities have not been taken – Sierra Leone marked the launch of a new, and at the time highly experimental strategy. Were the strategy applied in all 12 post-conflict situations the approximate costs and benefits would be $4.8bn costs, and $397bn benefits, yielding a net gain of $392bn. Again, this benefit omits all the global-level gains from reduced conflict.

6. Conclusion and Comparison of Instruments

All the estimates in this study are gross approximations. At best they provide guidance as to orders of magnitude. Nevertheless, this can be useful. Our estimates suggest that some instruments are radically uneconomic, whereas others offer remarkably large returns. This ranking of instruments is probably more robust than the assessments of individual instruments.

We started by estimating the costs of civil war. We have taken lower-bound estimates, and these figures are, we believe, reasonably well-founded when interpreted as a lower-bound. That is to say, civil war may be much more damaging than implied by our estimate, but it is unlikely to be less costly. Even these lower-bound estimates suggest that the economic and social costs of civil war are enormous. As such the issue clearly deserves international attention. The question is not whether the problem is important, but rather whether there are instruments that can be used effectively to tackle the problem through international action. We have explored five of them.

The most disappointing instrument is, in a sense, the most obvious and the most readily available. This is aid for conflict prevention. We should at once make it clear that our estimates have been quite ungenerous to such a strategy. We have simply increased aid to all low-income countries (excluding India and China). No attempt has been made to target aid to countries at particularly high risk, and aid agencies may be able to do much better than our unselective simulation experiment. Nevertheless, if our numbers are within the right ballpark, selectivity would need to be pretty good before aid could be justified simply in terms of conflict prevention. Of course, additional aid can be justified on other grounds, notably poverty reduction. But our analysis suggests that the addition of security considerations is marginal rather than central to the benefits of aid in normal, peacetime situations. Even if our estimates are grossly and systematically wrong – notably by massively underestimating the cost of conflict, - this would not significantly affect our ranking of interventions.

Aid does become an effective instrument in post-conflict situations. This is mainly because it is more effective in the growth process, but also because it is more precisely targeted on high risk countries. The pure security gain is now sufficient by itself to warrant additional aid even at the lower bound of the 90% confidence interval. Further, we have completely omitted the gains at the global level from reducing the incidence of civil war, some of the gains at the regional level, notably health effects, and all the poverty-reduction benefits of aid. These considerations make higher aid for post-conflict situations look to be a good use of international public resources as long as it is properly timed.

0.016*(12/32)*0.7*$64.2bn. This sets in from the eleventh year after conflict. The NPV of this income stream is $3.2bn.

Our third instrument was to extend the initiative which began with diamonds and is now known as the Kimberley process. The objective is to partition the market in pertinent commodities that might provide revenue for rebel forces into a legitimate market and an illegal market on which produce can only be sold at a discount. We found that a ten percent discount for illegal produce, which seems a feasible international objective, might yield global benefits of around $6bn. The costs of this initiative were almost entirely the opportunity cost of international collective action. There is only a capacity for a few international initiatives at any one time, and so only those initiatives should be undertaken which offer high pay-offs. An advantage of the proposed instrument is that, being virtually costless, the sign of the pay-off is robust. International action here is highly unlikely to be counter-productive, and there is a reasonable basis for expending a large, though not massive, return.

Our fourth instrument was to extend the current Extractive Industries Transparency Initiative. By improving the governance of natural resource rents, albeit not eliminating the problems associated with them, there are reasonable grounds to expect two security benefits: a direct one that reduces the risk of conflict initiation, and an indirect one through faster growth. We estimated the combined pay-off to this instrument as being very substantial at around $89bn. Again, the cost of this instrument is the opportunity cost of international collective action, the direct costs being trivial. An advantage of this instrument is that because its benefits come through two distinct routes the prospect of some substantial returns are reasonably robust. The actual numbers we have suggested are speculative, but not biased. They are based on the idea that effective international action could reduce by half, but not eliminate, the adverse effects on growth that currently come from natural resource rents, and that it can reduce by one tenth the adverse effects that directly increase the risk of conflict. By analogy with other international economic guidelines, such as in the sphere of banking, this does not seem to be an unreasonable goal.

Our fifth, and most effective instrument is also the most problematic politically. This is external military intervention under Chapter VII of the United Nations Charter to enforce peace in an immediate post-conflict situation and to maintain it throughout the prolonged period – a decade – during which the risks of reversion to conflict are very high. The pay-off to this instrument we estimated using the example of Sierra Leone. This choice was not, however, a matter of picking a rare success, but rather a matter of investigating a new strategy. This was the first substantial Chapter VII intervention by a major power (as distinct from using UN forces under Chapter VI) for many years. It has recently been followed by similar French intervention in Cote d'Ivoire, and most recently (February, 2004) by the creation of a Franco-British 'rapid reaction force' of 1,500 men. The pay-off to such a strategy adopted universally in post-conflict situations is massive, at around $392bn, even on the rather pessimistic assumption that after withdraw risks revert to what they would have been without the military presence. The pay-off is all the more remarkable given the relatively unpromising returns to some of the other interventions.

Appendix A1: The CH model of conflict risk

Table A1: Determinants of the Outbreak of Civil War

	(1)
Primary commodity exports/GDP	16.773
	(5.206)***
(Primary commodity exports/GDP)^2	-23.800
	(10.040)**
Ln GDP per capita	-0.950
	(0.245)***
(GDP growth)t-1	-0.098
	(0.042)**
Peace duration	-0.004
(months)	(0.001)***
Geographic concentration	-0.992
(index 0-1)	(0.909)
Ln population	0.510
	(0.128)***
Social fractionalization	-0.0002
(index 0-10000)	(0.0001)***
Ethnic dominance (45-90%)	0.480
(Dummy variable)	(0.328) p=0.14
N	750
No of wars	52
Pseudo R^2	0.22
Log likelihood	-146.84

Notes: Logit Regressions, dependent variable is 'war start'. The regression includes time dummies. Standard errors in parentheses. ***, ** and * indicate significance at the 1,5 and 10 percent level, respecively. Source: Collier and Hoeffler (2004).

Appendix A2: The relationship between the international prices of natural resources and the duration of conflict

Table A2: Duration Analysis of Civil War: Econometric Estimates of Hazard Function Parameters

	(1)
Income inequality	-0.1258
	(0.0283)***
Missing inequality	-5.8717
	(1.2689)***
Per capita income	0.4043
	(0.1370)***
Ethnic fractionalization	-0.0695
	(0.0261)***
Ethnic fractionalization^2	0.0007
	(0.0003)**
ln Population	-0.2860
	(0.1225)**
1970s	0.1298
	(0.4677)
1980s	-1.3830
	(0.5256)***
1990s	-1.1810
	(0.5405)**
3rd and 4th years of war (λ_2)	-0.8747
	(0.5790)
5th and 6th years of war (λ_3)	0.0044
	(0.5601)
7th year of war and beyond (λ_4)	0.7100
	(0.4440)
Change in commodity price index (cpi)	1.7669
	(1.0629)*
Primary commodity exports/GDP (sxp)	10.6114
	(5.9267)*
Cpi*sxp	-11.3237
	(5.8518)**
Democracy	
Constant	5.2044
	(3.0352)*
Log likelihood	-78.18
Number of observations	55

Notes: *z*-statistics are based on asymptotic standard errors. Significance at the 10%, 5% and 1% level is indicated by *, ** and ***, respectively. Source: Collier, Hoeffler and Söderbom (2004).

Appendix A3: Aid and Growth, Post-Conflict

Table A3: Aid, Policy and Economic Growth

	(1)	(2)
ln(per capita income)	0.629	0.712
	(0.638)	(0.617)
Governance	0.164	0.172
(ICRGE, index 1-6)	(0.160)	(0.155)
Policy	0.871	1.021
(CPIA, index 1-5)	(0.418)**	(0.392)***
ODA * Policy	-0.329	0.127
	(0.377)	(0.064)*
(ODA/GDP)^2	-0.023	-0.028
	(0.016)	(0.012)**
South Asia	0.228	2.662
(dummy variable)	(0.113)**	(0.620)***
East Asia	2.563	2.880
(dummy variable)	(0.636)***	(0.660)***
Sub-Saharan Africa	2.938	-0.366
(dummy variable)	(0.668)***	(0.809)
Middle East/ North Africa Europe	-0.535	1.606
(dummy variable)	(0.815)	(0.563)***
Central Asia	1.537	-0.365
(dummy variable)	(0.558)***	(1.053)
Post-conflict dummy*		0.186
(ODA/GDP) *Policy		(0.046)***
Observations	344	344
p.-conflict obs.	34	13
R^2	0.37	0.38

Notes: OLS regressions with robust standard errors, dependent variable is 'average annual per capita GDP growth'. All regression include a constant. Standard errors in parentheses. ***, ** and * indicate significance at the 1,5 and 10 percent level, respectively. Source: Collier and Hoeffler (2004).

Appendix A4: Estimating the risk of a civil war outbreak

The figures and probability of civil war estimates presented in this are based mainly on the logistic regression analysis reported in table A-1. The data set used is global, spans the years 1960—99, and covers 161 countries. We divide the data series into eight subperiods, 1960–64, 1965—69, ..., 1995–99.

In our regressions we estimate the probability of a war breaking out during a five-year period, and the model can be written in the following general form:

$$Y_{it} = a + bX_{it} + cM_{i,t-1} + dZ_i + u_{it},$$

(A1.1)

where t and i are time and country indicators. The dependent variable is a dummy variable indicating whether a war broke out during the five-year period, so that Y_{it} is the log odds of war. The explanatory variables are either measured at the beginning of the period (for example, income per capita, primary commodity exports/gross domestic product [GDP], population), or during the previous five-year period (for instance, per capita income growth, or are time invariant or changing slowly over time (for example, social fractionalization).

The expected probability $\hat{p}_{it}$ of a war breaking out can be calculated by using the estimated coefficients obtained from equation (A1.1):

$$\hat{a} + \hat{b}X_{it} + \hat{c}M_{i,t-1} + \hat{d}Z_i = \hat{W}_{it}$$

(A1.2)

$$\hat{p}_{it} = \frac{e^{\hat{W}_{it}}}{(1 + e^{\hat{W}_{it}})} \cdot 100. \tag{A1.3}$$

We calculate probabilities for hypothetical observations. For example, we find the average values for $\overline{X}_{it}, \overline{M}_{i,t-1}, \overline{Z}_i$ for a subgroup of countries and take this to be a typical country within the subgroup. We then calculate $\hat{p}_{it}$ by applying equation (A1.3). For the policy simulations we used the probability for the average low income developing country as a baseline.

Table A4: Estimating the risk of a civil war outbreak

	(1) Coefficients from Table A1	(2) Means for low in - come countries	(3) (1)*(2)
Primary commodity exports/GDP	16.773	0.164	2.751
(Primary commodity exports/GDP)^2	-23.800		-0.640
Ln GDP per capita	-0.950	975	-6.541
(GDP growth)t-1	-0.098	0.248	-0.024
Peace duration (months)	-0.004	340	-1.292
Geographic concentration (index 0-1)	-0.992	0..57	-0.565
Ln population	0.510	11100000	8.282
Social fractionalization (index 0-10000)	-0.0002	2964	-0.593
Ethnic dominance (45-90%) (Dummy variable)	0.480	0.48	0.230
Sum of coefficient*mean $\hat{W}_{it}$			-1.830
Estimated probability $\hat{p}_{it}$			13.819

Note: For per capita income and population we take the natural logarithm of the average per capita income and total population and multiply these numbers with the corresponding coefficients.

Table A5: Confidence Intervals

	lower confidence limit	estimates	upper confidence limit
loss of GDP due to reduced growth (%)	41	105	305
loss of GDP due to increased milex (%)	12	18	25
loss of GDP due to the arms race multiplier(%)	8	12	16
loss of GDP due to legacy effect (%)	8	19	27

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