# How Much Is Prevention Worth?

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## Background Paper

## Pathways for Peace: Inclusive Approaches to Preventing Violent Conflict

### United Nations - World Bank Joint Flagship Study

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## Abbreviations and Acronyms

| | |
|---|---|
| DAC | Development Assistance Committee |
| DPA | Department of Political Affairs |
| GDP | gross domestic product |
| IEP | Institute for Economics and Peace |
| PDA | Peace and Development Adviser |
| SPM | special political missions |
| ODA | official development assistance |
| VSL | Value of Statistical Life |

## Introduction

The goal of this report is to present the results from a unified conceptual framework so as to evaluate the cost-effectiveness and different trade-offs involved in conflict prevention. The context for the framework's development is a radical rethinking of the peacebuilding architecture put forth by several reports published in 2015. One of these reports, an expert report that formed part of the review of the United Nations' peacebuilding architecture, argued for shifting away from a narrow understanding of peacebuilding—where the aim is to avoid relapsing into violent conflict—toward an understanding that sustains peace. If this advice is heeded, the World Bank and the United Nations will need to leave behind the predominantly postconflict focus of peacebuilding and reimagine it as a more comprehensive enterprise where prevention is also included.

Such a shift in focus requires undertaking a cost-benefit analysis. In line with this, the aforementioned expert report asks: "If more global priority were consistently given to efforts at sustaining peace, might there not, over the course of time, be reduced need for crisis response?" (United Nations 2015, 42-3.)

The answer to this question is most likely yes. However, the goal of this report is to provide a much more quantitative answer—that is, the amount of resources that would be saved if global priority were consistently given to efforts to sustain peace. The answer to this question will obviously always be speculative, but there is enough data to dare a quantitative approach.

This report provides an empirical framework that aims to help decision-makers think about the different trade-offs involved in prevention. In particular, the framework will build a structure to analyze the interplay between three factors: the dynamics of conflict and peace; the costs of early and late interventions; and the suffering, damage and destruction caused by violent conflict.

At the center of the framework stands the insight that true prevention is impossible without a definition of conflict risk—that is, without prediction. Interestingly, the current discussion has often sidestepped this issue by focusing on ongoing conflicts or postconflict scenarios where the risk of conflict is inherent in the experience of the recent past or present. However, if we want to move from building peace toward sustaining peace we need to know which countries to focus on. This report will therefore rely on recent advances in the ability to predict the timing of civil war. Prevention is then defined as actions taken in high-risk but highly uncertain environments that anticipate violence. Of course, a policy based on these risk evaluations will err in the allocation of resources because prediction will indicate some situations as high-risk that would never develop conflict, and by missing some other future conflict onsets.

However, this uncertainty is compensated by the fact that conflict often persists once it has started and, even after it ends, the likelihood of relapse remains relatively high. This means that preventing entry into the conflict cycle has dynamic benefits that become stronger over

time. Put differently, prevention is not about preventing a year of civil war; rather, it is about preventing a future path of repeated episodes of conflict that can last decades. An additional benefit of prediction and prevention is that the policy response would take place in an environment without armed violence. Measures such as diplomatic efforts, mediation, and capacity building can therefore be used to address fault lines in societies that have not yet experienced large-scale armed violence and the resulting death and destruction.

The simulated benefits offered by a prevention system for high-risk countries are dramatic. Under reasonable assumptions, benefits could, on average, amount to nearly US$34 billion per year in the first fifteen years of implementing a system that intervenes in about five countries each year. More importantly, the benefits of such a system are growing over time since prevention indirectly affects economic growth. After fifteen years, the benefits could stand at close to US$150 billion per year. At this stage, the world would have to host 1.5 million fewer refugees.

But can prevention save resources for the donor community? Existing spending patterns in peacekeeping and official development assistance (ODA) suggest as much. Both are strongly focused on countries in or after conflict and, if prevention stabilizes a country, these resources could be saved. Indeed, a full dynamic analysis suggests that large cost savings could be achieved with prevention. After fifteen years, the donor community would save close to US$2.5 billion each year as a result of spending less on aid and peacekeeping. According to our main estimates, this would almost cover the costs of prevention.

However, whether cost savings for donors could be achieved this way critically hinges on a prevention action's funding requirements and effectiveness. We therefore provide alternative scenarios that illustrate the uncertainty surrounding these estimates. Strikingly, we find that there are still substantial cost savings from prevention even if preventive action only works in 25 percent of all cases and costs the donor community US$1 billion per year per intervention. If, on the other hand, prevention cost only US$100 million per intervention and worked 75 percent of the time, the cost savings would be so enormous that the system would pay for itself within a few years, as a result of reduced spending requirements.

The key is to target high-risk countries—that is, do a few interventions in situations that would otherwise likely descend into conflict. Systems that would spread the spending across a larger group of countries (i.e., without identifying concrete risks) would be much less cost-effective. However, using forecasts for prevention is no panacea. Relying on a forecast means that the large majority of prevention efforts will take place in situations that would not have escalated in any case. The forecast we use marks countries as "high risk" that have an escalation likelihood of only 11 percent. In other words, one in ten cases would not have escalated in any case—with or without prevention. This means that a lot of resources must be spent in vain. Still, under reasonable assumptions, prevention is still worth every dollar, despite this large uncertainty.

This report is structured as follows. Section 2 presents the dynamic framework used for the simulation. Section 3 then presents the results of the simulation. All technical details are discussed in the appendix.

## Constructing the Framework

This section describes the intuition of the framework and its most important findings, and offers a view of the status quo. We first discuss the different risks of escalation and conflict persistence as they currently appear in the data. We then present data on the losses caused by conflict in the conflict-affected countries. Next, we analyze the publicly available data on peacekeeping expenditures and aid flows to give an overview of the donor community's current costs from conflict. These three factors (probabilities, damages to the affected countries, and costs to the donors) together form the framework, which we will use in Section 3 to contrast the status quo with an alternative future that features more prevention.

### Risks in the Conflict Cycle

The framework builds on the idea that conflict follows a cycle of different phases that can be distinguished in and analyzed from the data. A previously latent conflict comes to the surface, erupts into violence, escalates into civil war, continues for a while, then ends and stabilizes into peace. However, all of these phases follow each other randomly. The outbreak of violent conflict, for example, is clearly hard to predict. So even if some situations are deemed high risk, the outbreak is far from certain. In addition, it can be that conflict starts but does not escalate. It can be that peace after conflict is more or less stable, or that the conflict period lasts one year or decades.

The framework captures these complicated, random risks by defining seven states of conflict. It is then assumed that, ex ante, these states follow each other randomly and with fixed probabilities. One can then calculate these probabilities from the history of conflict. We use the period 1975 through 2014 to define states and calculate the probabilities by which they follow each other. The seven states described in Table 1 are:

1. Stable peace: Most countries are in this state most of the time. Their likelihood of experiencing an outbreak of civil war conflict is just 0.09 percent. The likelihood of a lower-intensity armed conflict is 2.32 percent, and only 1.55 percent of countries transition into a high-risk situation in a given year.

2. High-risk: This is a situation in which an early-warning model indicates there is a high likelihood that a civil war will break out. The appendix framework uses a risk evaluation from an actual early warning model.[2] Accordingly, the risk of civil war in this scenario is 5.5 percent—more than sixty times the baseline risk. The likelihood of an armed conflict is 5.75 percent—about twice as high as the baseline risk.

3. Armed conflict: Defined by a year with more than 25 battle-related deaths but not a civil war—i.e., no violence at a larger scale. In armed conflict, the risk of escalating

[2] This is a risk model in which only newspaper text is used to predict the timing of conflict within-sample. For a discussion of this model's out-of-sample performance, see Mueller and Rauh (2017), who show that the method yields a focus on new conflict risks. For the purpose of this report we use the overall model presented in their paper. For further discussion see the appendix.

to civil war is 4.2 percent. However, the likelihood that armed conflict persists is more than 75 percent.

4. Civil war (first year): This is a situation in which a country experiences more than 0.08 battle-related deaths per 1,000 population. The framework in this report distinguishes the first year of civil war from all other years because often there are short outbursts of conflict. In other words, the data show it is often the case that the first year of civil war is not followed by more civil war years—in about 43 percent of cases, in fact. This leaves about 57 percent of cases that escalate into longer civil wars.

5. Other civil war years: If a conflict does not stop after the first year it is likely to go on much longer. The likelihood that a civil war will end within the next year falls to about 23 percent after the first year. In other words, close to 77 percent of all civil war years are now followed by another year of civil war. This high persistence significantly contributes to the danger of civil war.

6. Recovery year (first year): This is the first year after civil war.[3] Peace is particularly unstable in this first year. The likelihood that another civil war will break out following the first year of recovery is almost 18 percent.

7. Other recovery years: These are the second to fifth years after the end of civil war. During this time, peace is more stable than in the first year but still fairly unstable. After the fifth year of recovery the country can transition back to the more stable peace defined above.

A convenient way to summarize the entire dynamics of peace, conflict, and recovery is via a matrix in which one dimension captures where the transition is from and the other dimension where the transition is to (see Table 1). The states that can follow armed conflict, for example, are in the third column titled “armed conflict.” There is a 17.26 percent chance that peace follows armed conflict, and a 75.44 percent change that armed conflict follows armed conflict. There is a 4.2 percent chance that armed conflict escalates to civil war.

**Table 1. Summary of States and Transition Likelihoods**

| | | transition from | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | peace | high-risk peace | armed conflict | first year of civil war | other year of civil war | first year of recovery | 2nd to 5th year of recovery |
| transition to | peace | 96.04% | 15.50% | 17.26% | 0% | 0% | 0% | 4.33% |
| | high-risk peace | 1.55% | 73.25% | 3.10% | 0% | 0% | 0% | 10.58% |
| | armed conflict | 2.32% | 5.75% | 75.44% | 0% | 0% | 0% | 4.81% |
| | first year of civil war | 0.09% | 5.50% | 4.20% | 0% | 0% | 17.81% | 9.13% |
| | other year of civil war | 0% | 0% | 0% | 57.33% | 77.20% | 0% | 0% |
| | first year of recovery | 0% | 0% | 0% | 42.67% | 22.80% | 0% | 0% |
| | 2nd to 5th year of recovery | 0% | 0% | 0% | 0% | 0% | 82.19% | 71.15% |

[3] In order to capture the postconflict period, we include years of armed conflict that follow civil war.

Using this matrix one can build future scenarios for each country. For example, a country that is currently in state 1 (peace) will most likely stay in that state. A country that is currently in armed conflict has a much higher likelihood of escalating the conflict, but also has a decent chance to escape the conflict cycle by transitioning back to peace.

Importantly, the definition of the conflict cycle's different states also allows a policy-maker to simulate an alternative world where policy shifts resources toward prevention. In particular, Section 3 shows the result of a policy experiment in which resources are spent on de-escalation in high-risk years (state 2). The benefit of such an intervention hinges on the costs associated with the different states, which we discuss next.

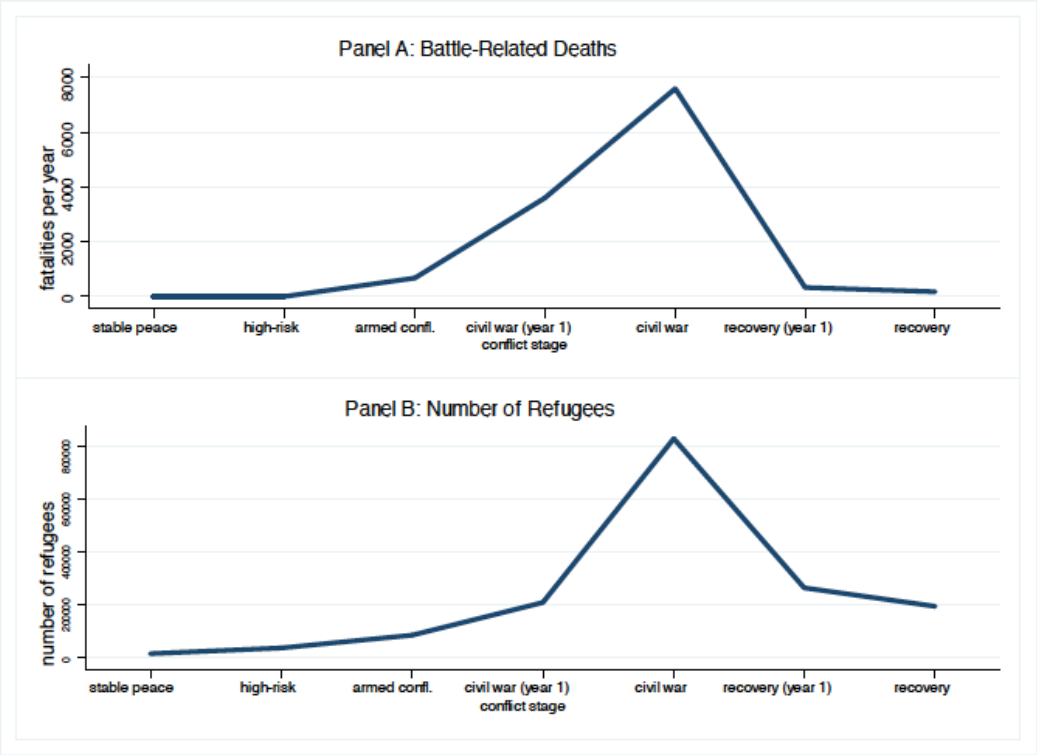
## Losses to High-Risk Countries

This section looks at the terrible reality of civil war through the lens of the framework—i.e., data on fatalities; refugees and economic growth will be analyzed separately for the seven states defined by the framework. The results of this analysis can then be used to simulate what would happen if some of the states—in particular states 3 to 7—were avoided more often.

First, consider the fatalities the civil war inflicts on the affected population. Figure 1, Panel A reports the number of battle-related deaths per year over the conflict cycle. By definition, peace (in both low-risk and high-risk states) is associated with no fatalities. During armed conflict, an average of more than 650 people lose their lives per year. The first year of civil war is associated with more than 3,500 deaths on average, while all subsequent years are associated with almost 8,000 deaths. In other words, civil war becomes more vicious and persistent after the first year. After conflict, the number of fatalities drops back to close to zero.

A similar dynamic can be seen in the number of refugees who flee a country. Figure 1, Panel B reports the average number of refugees across the conflict cycle. It shows that more than 200,000 people have fled their country after the first year of civil war. This number increases dramatically to more than 820,000 people for subsequent years. After civil war, the number of refugees adjusts downward as refugees return home.

**Figure 1. Fatalities and Refugees in the Conflict Cycle**



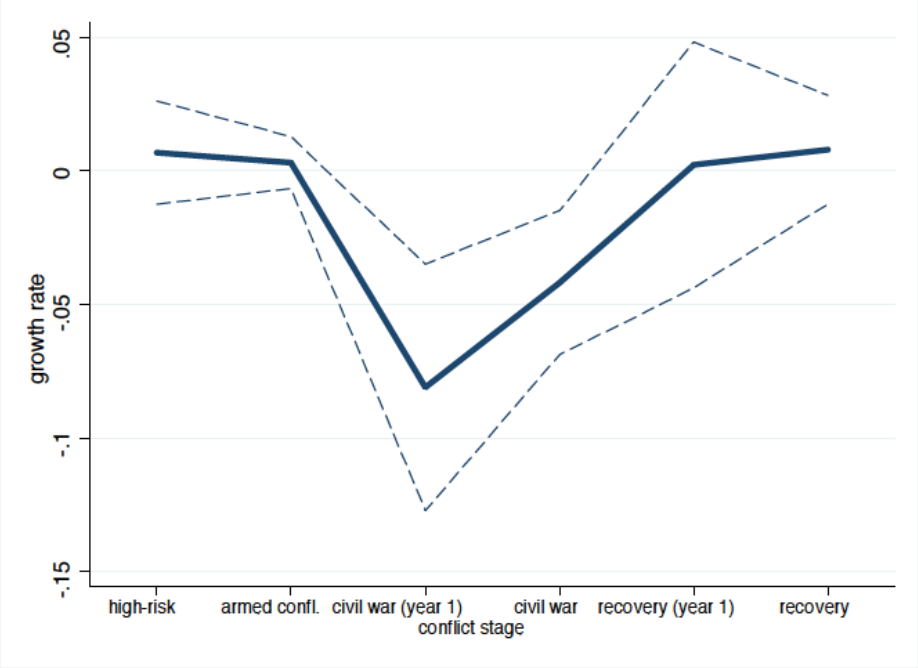

It is hard to grasp the suffering behind these numbers. This is part of the problem with prevention. Consider that humanitarian efforts often organize the resources to help by mobilizing empathy with the victims. They do this by combining numbers with images or victims' individual stories. What prevention tries to achieve is action before the violence starts—meaning that prevention cannot rely on stories or images. Prevention needs rationality; it needs to rely on the power of numbers and cost-benefit analysis. This report therefore tries to give monetary values to suffering so it can be compared to the costs of interventions like peacekeeping and aid. Obviously, this is a difficult task that is bound to be unsatisfactory.

In order to calculate the loss we will consider two factors. First, battle-related deaths are evaluated using the Value of Statistical Life (VSL) method to compute costs. To escape an income-based evaluation, this report will rely on new estimates of the VSL from León and Miguel (2017), which estimate an average VSL of US$577,000.[4] This is the lower of two numbers given by León and Miguel (2017). Also, as highlighted in Fearon and Hoeffler (2014), VSL methods do not fully take into account the pain and suffering of family members and friends, or long-term effects on children, among other factors, although it would include the pain and suffering of family members reflected to the extent that the individuals take this into account when considering their compensation for mortality risks.

[4] For example, McCollister et al. (2010) estimate the VSL in the United States, which mainly relies on victims' average lifetime earnings. León and Miguel (2017) take advantage of the situation of Sierra Leone's Lungi International Airport, which can be reached by different transportation methods. As each of these transportation means are subject to very different and known mortality risks, this can be used to estimate travelers' evaluations of their own lives.

However, as the number of refugees compared to the number of deaths already makes clear, civil war has a much broader and more worrying impact than can be captured with fatalities alone. Civil wars often cause humanitarian crises, destroy assets, upend institutions, and disrupt whole countries' economies. The humanitarian crisis linked to civil wars in particular has the potential to damage a whole generation.[5] Large parts of these effects can be captured by looking at growth outcomes across the whole conflict cycle—i.e., not only during conflict, but also in the recovery period. In particular, this report looks at how countries have grown compared to their own growth rate during peacetime across the entire conflict cycle. The results are reported in Figure 2 which, for completeness, also reports confidence intervals as dotted lines. From the estimated coefficients and confidence intervals, one can see that both high-risk and armed conflict have no discernible effect on growth—that is, the change in growth when a country moves from peace to high-risk or to armed conflict is close to none.

**Figure 2. Growth Across the Conflict Cycle**




However, Figure 2 indicates that something dramatic happens during civil war years. In the first year of civil war, growth is 8.5 percentage points lower on average than during peace years. Other civil war years are not as damaging, but growth is still 4.6 percentage points lower in a civil war year than in times of peace. Importantly, Figure 2 also shows that the recovery years after civil war do not feature extraordinarily high growth rates. In fact, the difference to other peace years is again close to zero. This implies that countries tend to stay below previous trend levels of GDP per capita after conflict ends.[6]

It is hard to overstate the significance of this result for the benefits of prevention. If a system of prevention manages to keep countries from moving from high-risk situations into

[5] See Mueller et al. (2017) for a discussion.
[6] Mueller et al. (2017) discuss related literature and various reasons for this result.

armed conflict and civil war, then this will have a growth effect that can lead to large overall level differences in the long run. A successful prevention system has the potential to change the growth path of large parts of the developing world, and as such can have huge economic benefits in the long run.

The numbers we find in Figure 2 are the basis for a substantial part of the total long-term gains from prevention. It is therefore important to discuss their validity. Cross-country studies like ours face the same standard omitted variable bias and reverse causality problems as cross-country panels. In this regard, the key question is whether the impact of civil war on growth can be understood by looking at growth in the same country but during peacetime. Several factors make us believe it can. First, we do not find significant pre-trends in growth before conflict, and, as can be seen in Figure 2, we do not find significantly higher growth in the postconflict period either. Second, the magnitude of the effects are very similar when controlling for time-fixed effects and country-specific time trends. Third, the extent of per capita violence is directly related to the extent of the growth damage; the more intense the violence, the lower the growth. Finally, Mueller (2016) shows that growth effects are also of similar magnitude within country—i.e., the findings at the country level are not driven by country effects. However, to alleviate remaining concerns we will also use the standard deviations of the estimates depicted in Figure 2 to provide alternative upper and lower bounds in terms of the damage done by conflict.

In summary, we will use the deaths caused by conflict and the relative GDP per capita collapse during conflict to capture the costs of conflict. Naturally, this does not include a lot of other factors. We ignore international spillovers, the plight of refugees, increasing mortality rates caused by thirst, hunger, and the break down of public services, and the terrors of war and their immediate and long-term psychological effects. However, if we tried to assign monetary values to this suffering, we would end up doing some double counting as all of this is, in parts, also reflected in declining GDP. This reports tries to produce a reasonable lower bound of the costs of conflict, and so we prefer to err by disregarding costs rather than by double counting. The results should be read with this in mind.

## Intervention Costs for Donors

The 2015 review of the United Nations' peacebuilding architecture suggested that the international community might not spend enough in the early phases of the conflict cycle to avoid needing to spend later. A very simple way to look at this would be to compare general spending levels on peacekeeping and humanitarian aid (around US$30 billion per year) to the budget for prevention measures. The problem is that prevention is not clearly defined in the government or international organization budgets because high-risk initiatives are not defined as a spending category. Very often the discussion instead moves toward postconflict initiatives as prevention.

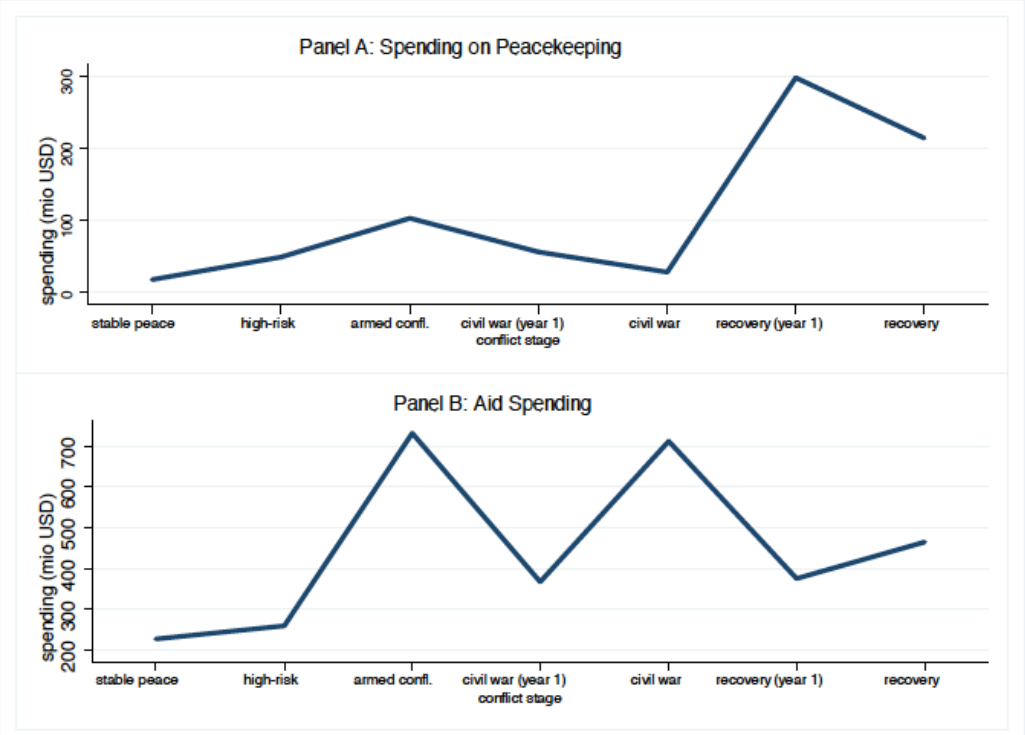
To look at this more systematically, this report matches data on spending on peacekeeping missions from the United Nations Peacekeeping Factsheet Archive and total net bilateral ODA flows from Development Assistance Committee (DAC) countries to the definition of the

seven states defined through violence and violence risk. These two spending categories provide a good overview regarding how spending is allocated across the conflict cycle.[7]

Figure 3 summarizes average spending on peacekeeping and total bilateral aid flows at each state of the cycle. Panel A reports average spending on peacekeeping. Reassuringly, the recovery period is where most spending on peacekeeping takes place. Spending increases from around US$30 million before recovery to about US$300 million on average when conflict ends. This high spending level is maintained in the years following recovery. These numbers imply that during a full recovery when a country comes out of civil war, more than US$1.1 billion would be spent on average. Of course, a country that would flip back and forth between recovery and civil war would generate higher costs.

The numbers for foreign aid are shown in Panel B of Figure 3. Note the stark difference between aid spending during peace versus during conflict. Of course, this is partly due to the fact that conflict countries tend to be poorer ones.[8] However, there is something striking about aid spending here. Spending during armed conflict is extremely high, but spending during high-risk years is actually extremely close to spending during stable peace years. Donors seem to treat "high-risk" peace similar to other peaceful years. Spending only increases dramatically once it is too late—that is, once violence has started. We will return to this pattern below.

**Figure 3. Donor Spending in the Conflict Cycle**




[7] The United Nations Peacekeeping Factsheets include monthly data reports from 2004 to 2016 on budget, personnel, and fatalities for missions running at the time the respective report is issued. Reports were downloaded from http://www.un.org/en/peacekeeping/resources/statistics/factsheet_archive.shtml on January 4, 2017.

[8] Throughout, the analysis always excludes developed countries to prevent some of this effect.

In the simulation exercise, this report treats the additional late peacekeeping and aid expenses as resources that could be saved if conflict were prevented. For peacekeeping expenditures, this is obvious, as peacekeeping expenses are directly and causally linked to conflict. For ODA, however, the causality is a lot harder to establish. Still, it is now an accepted truth that the countries that most dramatically fail development goals are so-called fragile states. Hence, in the long run at least, there is a causal link between preventing conflict and the need to spend on development. Also, large parts of aid, like spending on reconstruction, peacebuilding, and humanitarian aid, can be directly linked to conflict.

## Three Prevention Scenarios

The framework presented in the previous section can be used to simulate different versions of the future. Two futures are particularly interesting. The first is when the status quo is maintained so that high-risk situations escalate into civil war and armed conflict with a probability of about 5 to 6 percent. In this status quo future, spending on aid and peacekeeping will only increase when conflict breaks out and the affected country's population will suffer as populations typically do during civil war.

In the second simulated future, prevention measures are set in motion in high-risk years. These measures are assumed to help prevent escalation into armed conflict and civil war and increase the likelihood that the high-risk situation transitions to a low-risk one again. The idea here is that a system is put into place so it reacts to situations that have been identified by prediction models and/or experts as high risk. Such a system would need to rely on permanent resources in order to guarantee a fast response. It would not intervene in situations with open conflict or recent conflict—that is, it would differ from already existing peacekeeping and peacebuilding systems.

One problem with contrasting these two scenarios is that the prevention system is not currently in place and thus important aspects are unknown. We therefore present three prevention scenarios for the future: a pessimistic, a neutral, and an optimistic scenario. These three scenarios vary in the assumptions made regarding three key parameters: the effectiveness of an intervention, the cost per intervention, and the growth collapse that is prevented with an intervention. We discuss these three parameters in turn.

### Prevention Effectiveness

The impact of prevention on the likelihood of conflict is a major determinant of its effectiveness. The Institute for Economics and Peace (IEP 2017) calculates the benefits from peacebuilding by looking at a scenario in which conflict will certainly break out. This implies that the effectiveness of prevention is assumed to be close to 100 percentage points, from certain conflict to (almost) certain peace. Chalmers (2007) assumes a lower leverage but still proposes that in such a scenario, there is a 50 to 80 percent likelihood that conflict will be prevented. What often goes unappreciated is that these levels of effectiveness require the policy maker to be relatively sure that conflict will break out without a prevention effort.

However, when undertaking prevention, one deals in probabilities, which are often quite small, and initiatives, which have an uncertain influence on outcomes.

We have no way to causally infer the impact of prevention on the likelihood of conflict. Instead, we make three assumptions in the three scenarios. We assume that the likelihood of escalation is reduced by 25 percent, 50 percent, or 75 percent, respectively. In addition, we assume that the chance of transitioning to another year of being high risk is 12.5 percent, 25 percent, and 37.5 percent less likely, respectively. Table 2 illustrates this with the example of a 50 percent reduction in the neutral scenario. Panel A shows the original transition matrix in the status quo that was described in Section 2. The shaded region captures the transition likelihoods out of high-risk states. Note that there is only a 15.5 percent likelihood that a high-risk situation will de-escalate.

**Table 2. Transition Likelihoods With and Without Prevention**

*Panel A: Without prevention (status quo)*

| | | transition from | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | peace | high-risk peace | armed conflict | first year of civil war | other year of civil war | first year of recovery | 2nd to 5th year of recovery |
| transition to | peace | 96.04% | 15.50% | 17.26% | 0% | 0% | 0% | 4.33% |
| | high-risk peace | 1.55% | 73.25% | 3.10% | 0% | 0% | 0% | 10.58% |
| | armed conflict | 2.32% | 5.75% | 75.44% | 0% | 0% | 0% | 4.81% |
| | first year of civil war | 0.09% | 5.50% | 4.20% | 0% | 0% | 17.81% | 9.13% |
| | other year of civil war | 0% | 0% | 0% | 57.33% | 77.20% | 0% | 0% |
| | first year of recovery | 0% | 0% | 0% | 42.67% | 22.80% | 0% | 0% |
| | 2nd to 5th year of recovery | 0% | 0% | 0% | 0% | 0% | 82.19% | 71.15% |

*Panel B: With prevention (50% reduction of escalation probability)*

| | | transition from | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | peace | high-risk peace | armed conflict | first year of civil war | other year of civil war | first year of recovery | 2nd to 5th year of recovery |
| transition to | peace | 96.04% | 39.44% | 17.26% | 0% | 0% | 0% | 4.33% |
| | high-risk peace | 1.55% | 54.94% | 3.10% | 0% | 0% | 0% | 10.58% |
| | armed conflict | 2.32% | 2.88% | 75.44% | 0% | 0% | 0% | 4.81% |
| | first year of civil war | 0.09% | 2.75% | 4.20% | 0% | 0% | 17.81% | 9.13% |
| | other year of civil war | 0% | 0% | 0% | 57.33% | 77.20% | 0% | 0% |
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| | 2nd to 5th year of recovery | 0% | 0% | 0% | 0% | 0% | 82.19% | 71.15% |

Panel B in Table 2 shows the assumed impact that prevention has on these probabilities in the neutral scenario. The probabilities of armed conflict and civil war fall by 50 percent—i.e., by around 2.8 percentage points each. The likelihood of staying in a high-risk state is reduced by 25 percent—i.e., by about 18 percentage points. All this probability mass is moved to the stable peace state and so stable peace becomes more likely by close to 24 percentage points. In other words, prevention makes escalation less likely and instead increases the likelihood of de-escalation.

It should be kept in mind how conservative these assumptions are when compared to existing studies.[9] The main reason for this is that we assume that future events cannot be foreseen with anything close to certainty. Instead, our goal here is to capture the massive degree of uncertainty in which policy makers need to operate. It is often impossible to be sure that an escalation will take place, and even more difficult to know it would have taken place, without an intervention.

## Prevention Costs

We also know little about the costs of prevention. Again, one of the few studies that looks explicitly at prevention is Chalmers (2007). He estimates the costs of hypothetical prevention packages for several case studies in which conflict was arguably imminent. Chalmers proposes relatively large expenditures at a minimum of around US$1 billion per intervention per year. For example, the prevention package proposed for the Balkans in 1989 would include diplomatic engagement, debt relief, and economic assistance made conditional on peace talks and de-escalation. According to Chalmers, such a prevention package would cost US$15.4 billion spent over 15 years. According to IEP (2017), peace could be effectively built by spending between US$16.4 and US$20.3 billion per year in 31 conflict-affected countries. This is between US$520 million and US$650 million per country per year. However, these numbers come from postconflict situations in countries like Rwanda, Afghanistan, or Iraq, where building peace should be more complicated than in countries that do not emerge from civil war.

In any case, it is clear that much less is currently spent. For the years 2016–2017, the Department of Political Affairs (DPA), the UN organization most clearly responsible for prevention, has requested a total of US$50 million to cover its priority areas of engagement.[10] With an engagement in five countries, this would leave only US$5 million per country per year. In addition, most of this spending actually flows into countries which the framework presented above would have categorized as in conflict or recovery, not high-risk. This lack of engagement in high-risk countries is also visible in the overall ODA data we used in Figure 3. From Panel B of Figure 3 we know that only about US$250 million of ODA flows into high-risk countries on average. Finally, the IEP (2017) report goes through a detailed analysis of different parts of ODA and categorizes some of it as peacebuilding. In this way the report can show that US$60.3 billion were spent on peacebuilding in 31 conflict-affected countries between 2002 and 2013. This is about US$130 million per country/year.

We take the current ODA spending in high-risk countries and the IEP numbers as a starting point. Based on these numbers, we assume a range of additional costs of prevention of US$100 million, US$500 million, and US$1 billion per year per intervention in high-risk situations. In the pessimistic scenario we assume that each intervention costs US$1 billion to stay close to the Chalmers estimates. In the neutral scenario we assume that prevention costs US$500 million per year, which is close to the IEP estimate of what should be spent. In

[9] A real comparison to our estimates is difficult as the time horizon in both IEP (2017) and Chalmers (2007) are longer.

[10] Exactly where the money is spent and for what is hard to know from the reports. However, it is clear that spending is low in many countries. For more details on the DPA budget, see the appendix.

the optimistic scenario we assume prevention costs only an extra US$100 million per year. In other words, we assume that a targeted increase of ODA resources by 40 percent, from US$250 million to US$350 million, would suffice to lower the likelihood of conflict.

### Growth Damage

Finally, we vary the damage that ongoing civil war does to the growth rate in our three scenarios. We do this because the growth damage is a major determinant of the overall cost of conflict and therefore of the benefits of prevention. In the neutral scenario we assume that the growth reduction follows the estimates in Figure 2; i.e., -3.9 percentage points during civil war. In the optimistic scenario, the conflict damage is assumed to be one standard deviation higher than in the neutral scenario.[11] The standard deviation of the coefficient is 1.3 percentage points, so that in the optimistic scenario we assume that civil wars lead to a growth decrease of -5.2 percentage points on average. In the pessimistic scenario, the conflict damage is assumed to be one standard deviation lower than in the neutral scenario.

### Summary of Prevention Scenarios

We summarize all of these assumptions in the optimistic, neutral, and pessimistic scenarios. In order to get to the pessimistic scenario we combine high intervention costs with low effectiveness and a low growth damage. We assume the following:

- In the optimistic scenario, the conflict damage is assumed to be -5.2 percentage points on average. In addition, the effectiveness of interventions is assumed to be high (75 percent success rate) and the cost of an intervention is assumed to be only US$100 million per year.
- In the neutral scenario, the conflict damage is assumed to be -3.9 percent during civil war. The effectiveness of interventions is assumed to be intermediate (50 percent success rate) at an intermediate cost of US$500 million per year.
- In the pessimistic scenario, the conflict damage is assumed to be one standard deviation lower than the main estimate (-2.5 percent during civil war) and the effectiveness of interventions is assumed to be low (25 percent success rate) and to cost US$1 billion per year.

While every assumption in the optimistic and pessimistic scenarios might be realistic in its own right, we do not think that a combination of all three is. We therefore see the optimistic and pessimistic scenarios as bounds on what we think is realistic and not as likely alternatives to the neutral scenario, which we will treat as our main result.

### How Much Is Prevention Worth?

Civil wars lead to immense damage. This implies that even a narrow and limited prevention system that focuses on a few high-risk cases each year will lead to tangible benefits after a few years. Our simulations show that with prevention, the number of countries in stable

[11] A higher damage implies larger benefits from prevention.

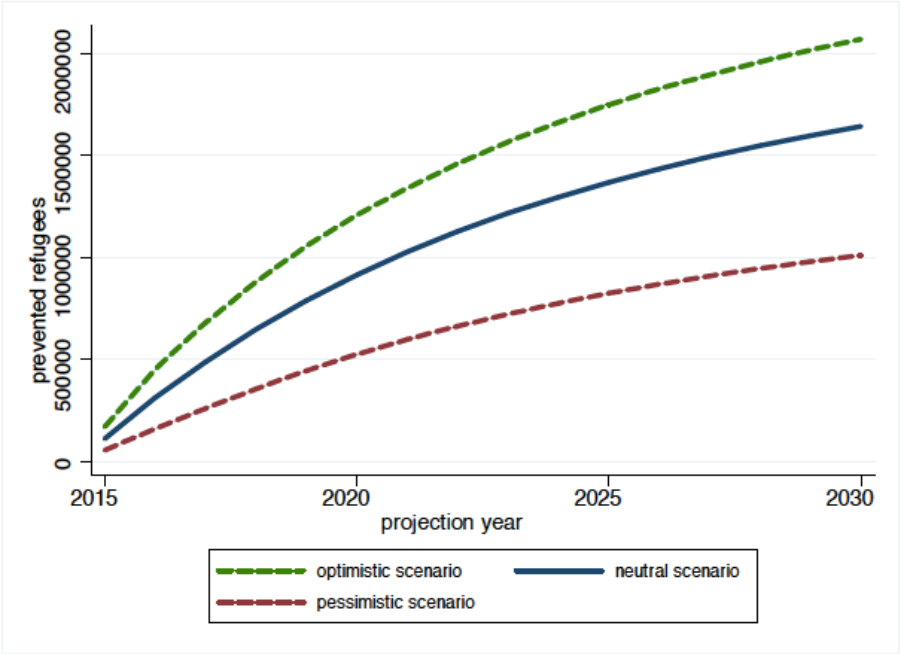
and high-risk peace increases by about four after fifteen years. In other words, despite the fact that high-risk interventions are rare events, and not always effective, they lead to a new long-run equilibrium with about four fewer countries suffering from organized violence.

This section provides a cost/benefit calculation in which the results from the simulation are used to calculate both benefits of prevention and the expected costs for the three scenarios. We first examine the benefits and then the costs, and then bring them together for our final result.

## The Benefits of Prevention

Figure 4 displays the resulting prevented number of refugees for the three scenarios to illustrate the dynamics of the model. After five years the implemented prevention system would lower the number of refugees by about 1 million in the neutral scenario. After fifteen years, this number would increase to over 1.5 million. This is, of course, a direct result of the fact that more and more countries would be at peace with a prevention system in place. Strikingly, even in the pessimistic scenario, more than 1 million refugees would be prevented after fifteen years.

**Figure 4.Prevented Refugees from High-Risk Countries**

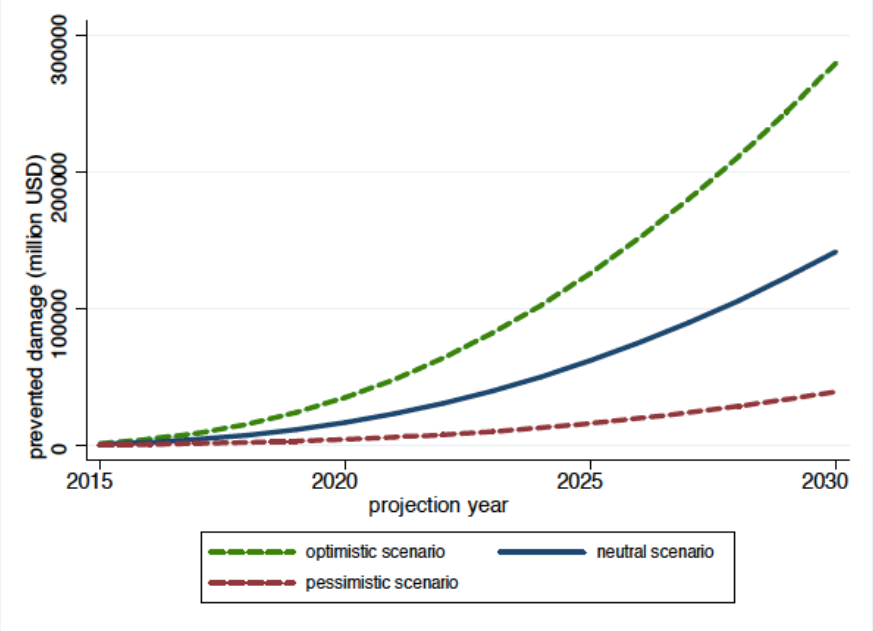



However, as discussed in the previous section, our estimates will focus on the growth effect and loss of life to capture the damage caused by civil war. This is done by simulating the total worldwide GDP with and without prevention for fifteen years. The difference between the status quo GDP and GDP with prevention then establishes the benefits of prevention. To this difference the framework then adds the costs generated by fatalities.

The result for the three scenarios is displayed in Figure 5. The figure shows accelerating benefits which, in the neutral scenario, reach close to US$150 billion per year after fifteen years. The reason for this huge prevention benefit lies in the fact that prevention affects the

rate of growth in high-risk years. It does so in a very subtle way—by replacing years of conflict by years of peace in a few instances, but given the size of total output the divergence in growth paths quickly leads to sizable absolute differences in output. The divergence even accelerates as more and more countries become peaceful with prevention. Due to the accelerating nature of gains, the prevented damage in the optimistic and pessimistic scenarios diverge from the neutral scenario. Still, even in the pessimistic scenario, the prevented damage reaches US$40 billion per year in 2030.

**Figure 5. Prevented Loss in High-Risk Countries**

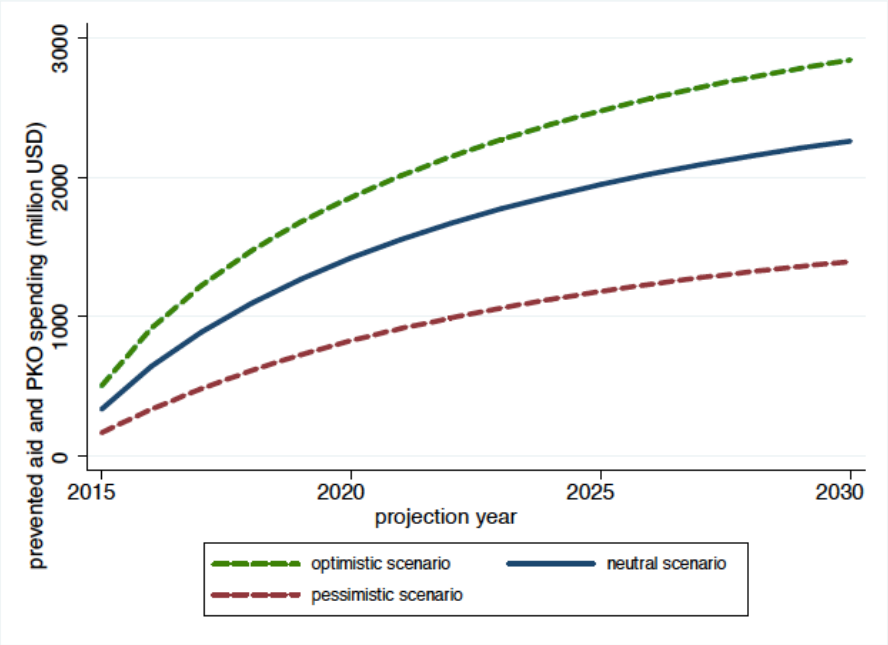



It is important to stress that the estimates in Figure 5 are conservative for several reasons. First, the simulation assumes only minimal baseline growth so that the differences in growth rates do not lead to larger accumulated benefits. We show in the appendix that benefits reach over US$200 billion if this assumption is dropped. Second, the richest countries are excluded from the model so that only a total GDP of US$29 trillion—about a third of global output—are included in the simulation. Results are also qualitatively robust to exclude more countries from the sample. Third, the simulation assumes that countries can escape the so-called violence trap by staying stable for long enough. If one assumed that countries keep a high-risk state beyond the 5-year recovery period, this would further increase the benefits of prevention.

One can use a similar technique to simulate the amount of resources that would be saved each year in aid and peacekeeping spending with early intervention. The results of this simulation are in Figure 6. From this, it is clear that donors will need to spend much less on late interventions with prevention in place. After fifteen years, the donor community would save close to US$2.5 billion each year from spending less on aid and peacekeeping in the neutral scenario. Even in the pessimistic scenario, cost savings are well over US$1 billion after fifteen years. The key for the savings here is that early interventions prevent countries from entering the conflict cycle, which thereby prevents the much higher costs incurred

during the conflict and recovery phases depicted in Figure 3. The gains are increasing because more and more countries enter stable peace.

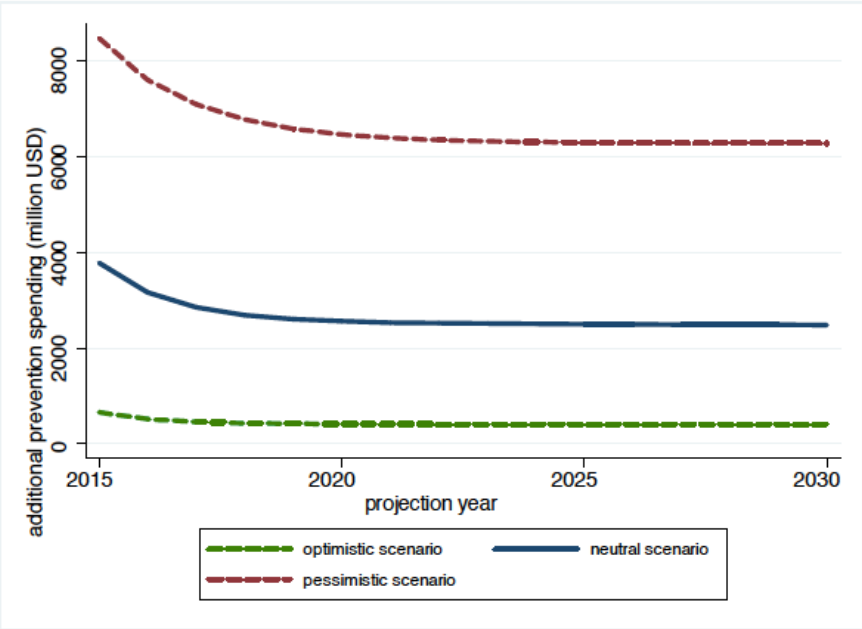
**Figure 6. Reduction in Spending with Prevention**




## The Costs of Prevention

To circumvent the problem of unknown intervention costs, we assumed that prevention costs US$100 million in the optimistic scenario, US$500 million in the neutral scenario, and US$1 billion in the pessimistic scenario. All these costs are per intervention per year—that is, if a country stays in high-risk for three years in the pessimistic scenario it will incur a cost of US$3 billion. In Figure 7 we show how overall costs evolve in the three scenarios.

**Figure 7. Total Yearly Costs of Prevention**



Costs are highest in the pessimistic scenario, with over US$8 billion after the first year and close to US$6 billion after 15 years. Costs are much lower in the neutral scenario, with less than US$4 billion after the first year and just over US$2 billion after 15 years. In the optimistic scenario, costs are very low—i.e., never more than US$1 billion. Note that two factors lead to such different levels of costs in Figure 7—the number of interventions and the cost per intervention. The number of interventions is established by the number of high-risk situations; since interventions are less effective in the pessimistic scenario, for example, more are necessary. In the long run we have over six preventive interventions per year in the pessimistic scenario, but only four in the optimistic scenario.

## The Business Case for Prevention

This section puts the different pieces of the puzzle together and compares costs with benefits. The question is whether the adoption of a prevention framework would save resources—and, if yes, how much?

An important takeaway from the dynamic view of the previous two sections is that costs start high and end up falling, whereas benefits start being low but rise steeply. When comparing costs to benefits, we therefore want to compare the overall benefit instead of making a year-by-year comparison. We do this by comparing average yearly values and discounting the future a little so that gains a year later count slightly less.[12]

The resulting, discounted numbers are in Table 3. It becomes immediately clear that, even in the lower bound pessimistic case, prevention would still provide net benefits of more than US$4.8 billion per year. In the neutral scenario, net benefits are more than US$33.3 billion per year. In the optimistic scenario, net benefits are close to US$70 billion per year.

**Table 3. The Business Case for Prevention**

Spending, damages, and costs are all in US$ millon per year

| | scenario | | |
|---|---|---|---|
| | optimistic | neutral | pessimistic |
| prevented damage | 68736 | 34251 | 9377 |
| saved costs | 1523 | 1176 | 698 |
| additional cost | -352 | -2118 | -5247 |
| **net savings per year** | **69907** | **33309** | **4828** |

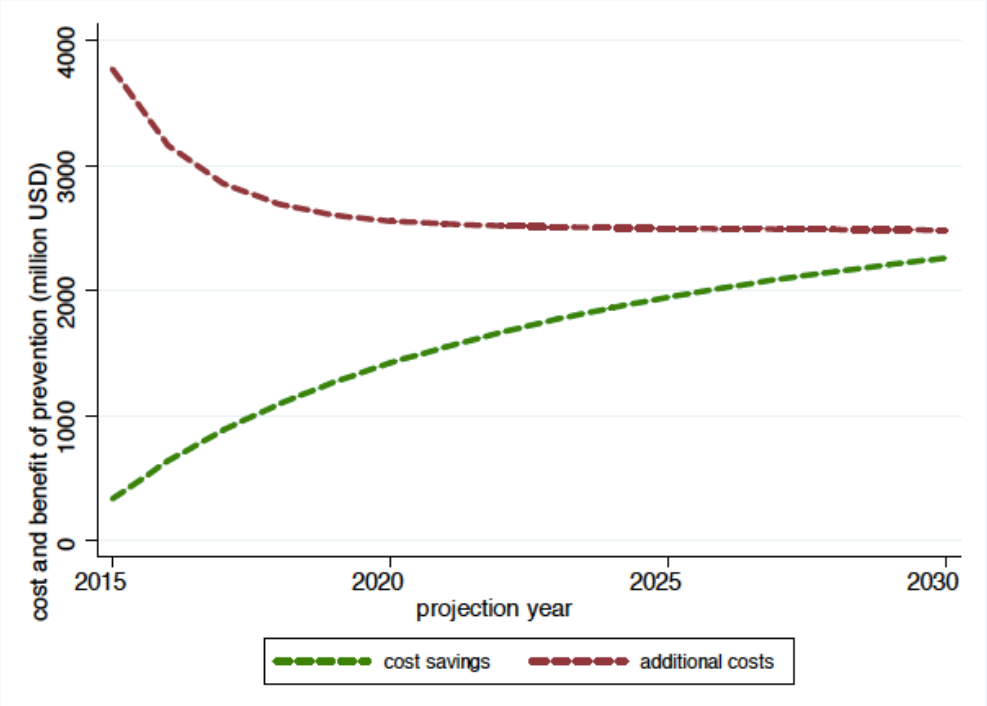
*Notes: Prevented damage is the prevented economic damage and deaths. Saved costs are the costs saved from late intervention costs that become unnecessary with prevention. Additional costs are the extra costs needed for prevention efforts. The table shows the business case under different assumptions regarding effectiveness and the growth damage caused by conflict and the cost of prevention. In the optimistic scenario, the conflict damage is assumed to be one standard deviation higher than the main estimate (-5.2% during civil war) and*

[12] As a discount rate we use 3 percent, which is fairly high for the current interest rate regime and therefore biases us slightly against prevention.

*the effectiveness of interventions is assumed to be high (75% success rate) and to cost only US$100 million per year. In the neutral scenario, the conflict damage is assumed to be as estimated (-3.9% during civil war) and the effectiveness of interventions is assumed to be intermediate (50% success rate) at a cost of US$500 million per year. In the pessimistic scenario, the conflict damage is assumed to be one standard deviation lower than the main estimate (-2.5% during civil war) and the effectiveness of interventions is assumed to be low (25% success rate) and cost US$1 billion per year. All numbers are yearly averages calculated as discounted values from a 15-year period with a 3% discount rate.*

Table 3 also provides information regarding which share of the benefit is in saved costs and which part is prevented damage. This distinction is important, as these benefits arise in different ways. The "prevented damage" item is a crude, monetized measure of the prevented deaths and destruction in conflict-affected countries and the suppression of social and economic development that violence brings. This benefit will accrue in developing countries. The "saved costs" will manifest themselves in fewer peacekeeping missions and fewer humanitarian crisis and reconstruction efforts. In other words, we would expect these savings to lighten budgetary pressures for international organizations and development agencies worldwide. It is striking to see that in the neutral scenario, these savings are more than half the additional costs incurred by the prevention system. In other words, the system would finance itself by half. In the optimistic scenario, saved costs are more than four times higher than additional costs. In other words, the donor community would save resources with more prevention.

**Figure 8. Dynamic Costs and Benefits for Donors in the Neutral Scenario**




Since the costs and benefits are dynamic, the average numbers in Table 3 hide another big advantage of engaging in prevention that only plays out over time. As the world becomes more stable, prevention costs fall and savings and prevented damage rise. Depending on the horizon of the donor community, this might change perspectives—even if very narrow

cost/benefit calculations are conducted. In Figure 8 we show the yearly cost savings and additional costs together. These have both appeared before in Figures 3 and 7, but in bringing them together we see that after fifteen years, the additional costs are almost compensated by the savings, even in the neutral scenario.[13]

**Figure 9. Increasing Benefits of Prevention**

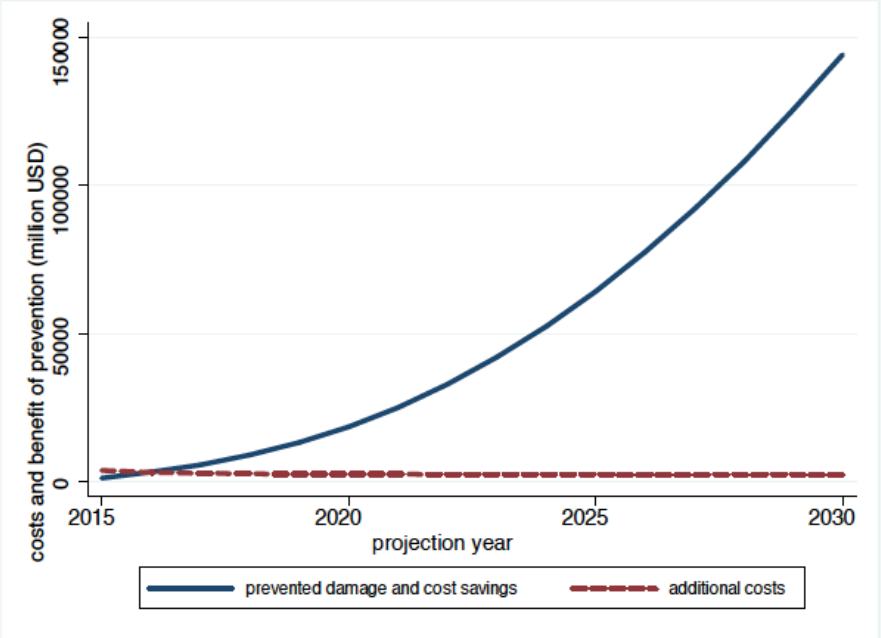



Figure 9 adds the prevented damages to the cost savings and compares the total to the additional costs across time. This clearly shows the accelerating benefits that accrue due to the growth effect of prevention. The total benefits reach close to US$150 billion in 2030—this is the yearly gain over the status quo. By this time additional costs have fallen to about US$2.5 billion. Prevention has huge long-term benefits for countries affected by conflict, which clearly outweigh its costs.

## Conclusion

The conclusion from this report is that, clearly, the benefits that flow from conflict-affected countries engaging in prevention make the costs of prevention look insignificant. Even if we assume that prevention only works half the time, only about five interventions are needed a year to increase the number of countries at peace by four in the long run. Therefore, if donors would need to spend an additional US$500 million per prevention per year, then the total spending would be US$2.5 billion. This spending would prevent losses of close to US$150 billion per year after fifteen years. Even when we discount these values to the

[13] Attentive readers will note that the additional costs are always above US$2.5 billion but average costs in Table 3 are US$2.1 billion. The reason is the discounting of 3 percent, which transforms future values into smaller, discounted values. For example, the present value of US$2.5 billion in fifteen years is $(1/1.03)^{15} * 2.5 = 1.6$.

present, we get an average of US$2.1 billion preventing US$35.4 billion in total damages per year within the first fifteen years.

A part of this benefit goes to donors who can expect lower costs from spending on aid and peacekeeping. In the first fifteen years, a discounted value of close to US$1.2 billion per year can be saved through prevention. After fifteen years the yearly savings reach close to US$2.5 billion. This implies that under the assumptions of our neutral scenario, prevention would start to pay for itself.

Needless to say, all these estimates are just that—estimates. Given the large uncertainties involved in prevention, there are no guarantees that prevention will have exactly the benefits described in the neutral scenario—that is, the actual realized benefits and costs could be higher or lower. The provided optimistic and pessimistic scenarios illustrate this uncertainty. Still, yearly discounted net benefits are US$70 billion and US$4.8 billion, respectively, in these two alternative benchmarks. This means the gains are substantial even in the most pessimistic scenario. At this point it is important to remember that this report tried to give a lower bound of the benefits of prevention. It is therefore extremely likely that prevention as a strategy would have huge payoffs for developing countries.

This report also points clearly in a direction for further research. Strikingly little is known about prevention. Donors should start by taking stock of their actions in high-risk situations so that these can be analyzed systematically. Importantly, this should be done regardless of whether these actions were aiming at conflict prevention. A particularly interesting area of research is the trade-off between forecasting precision and prevention costs. It would, for example, be possible to improve the forecast of civil war significantly by including violence of lower intensity in the forecast. However, prevention might be much more costly at this stage.

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# Appendix

## Conflict Data

The conflict data is from the Uppsala Conflict Data Program (UCDP), which collects information on a large number of aspects of armed conflicts that have occurred since 1946. The UCDP provides several datasets that allow analysts to explore different features of armed conflicts. In this report, we make large use of the UCDP Battle-Related Deaths Dataset, which provides yearly information on the country-level number of fatalities related to combat. The time period covered is 1946–2014. For our main estimates we use the forty years between 1975 and 2014, as we need estimates of high-risk years, which is only available after 1975.

The data on battle-related deaths are collected from news sources. All reports that contain information about individuals killed or injured in fighting are gathered and manually coded into an event-year level dataset. For every event, several details are recorded and translated into variables: date and location, reporting source, primary source, actors involved, what happened, and three estimates of fatalities caused by the event (low, high, and best estimate).

For the purpose of this report, we focus on three variables provided by the UCDP Battle-Related Deaths Dataset, which we describe below. These variables describe the type of violent event, its location, and an estimated number of fatalities.

The UCDP/PRIO Armed Conflict Dataset identifies four different types of conflict. For each conflict event coded in the dataset we can distinguish among the following:

1. Extra-systemic conflict, which occurs when a state government is fighting to retain control of a territory outside the state system.
2. Interstate conflict, which occurs between two or more different states.
3. Internal conflict, which occurs when a state government fights one or more internal groups. There is no intervention from other states in this type of conflict.
4. Internationalized internal conflict, which occurs when the government of a state fights one or more internal groups and external states intervene to support one or both sides.

Given that in this report we analyze civil conflicts, we only focus on two types of conflict reported in this dataset—internal conflict and internationalized internal conflict, or conflict types 3 and 4.

The UCDP Battle-Related Deaths Dataset provides three estimates of the fatalities that each violent event incurs. These variables are:

- bdlow: provides the low estimate of the battle-related deaths for each conflict event and year. It is the results of the aggregation of low estimates for all the fatalities related to battle-related incidents.
- bdhigh: results from the aggregated high estimates for all battle-related incidents in a given conflict event and year.
- bdbest: consists of the aggregated, most reliable numbers for all battle-related fatalities in a given conflict event and year. If different reports provide different estimates, the estimate from the most reliable source is provided. If no such distinction can be made, the lowest among these numbers is used.

In this report we use variable bdbest. We define armed conflict as a year with more than 25 battle-related deaths but not a civil war.

Civil war is defined as when a country experiences more than 0.08 battle-related deaths per 1,000 population. This definition is nonstandard, as civil war is typically defined through an absolute value of 1,000 battle-related deaths. Here, a relative measure is chosen in accordance with Mueller (2016), who shows that this is a better way to capture a country's situation. This alternative definition is one of the reasons why we find a larger growth impact of conflict compared to the literature.

## Refugee Data

Data on refugees comes from the UNHCR Population Statistics Database, which provides information about UNHCR's populations of concern from 1951 to 2014. This database lists seven categories: refugees, asylum-seekers, returned refugees, internally displaced persons (IDPs), returned IDPs, stateless persons, and others of concern. For each group the database provides yearly information about their composition by location of residence and origin. We exploit only the data on refugees.

According to the UNHCR definition, refugees are "individuals recognized under the 1951 Convention relating to the Status of Refugees; its 1967 Protocol; the 1969 OAU Convention Governing the Specific Aspects of Refugee Problems in Africa; those recognized in accordance with the UNHCR Statute; individuals granted complementary forms of protection; or those enjoying temporary protection; and people in a refugee-like situation."

In particular, the report uses the annual stock of refugees for each country of origin—i.e., how many people with refugee status have left their home country each year. Hence, for each country of origin we sum the stock of refugees reported in each host country.

## Aid Data

Net bilateral aid flows from DAC donors are the net disbursements of ODA or official aid from DAC members. Net disbursements are gross disbursements of grants and loans minus repayments of principal on earlier loans. ODA consists of loans made on concessional terms (with a grant element of at least 25 percent, calculated at a discount rate of 10 percent) and grants made to promote economic development and welfare in countries and territories in the DAC list of ODA recipients.

Official aid refers to aid flows from official donors to countries and territories in Part II of the DAC list of recipients: more advanced countries of Central and Eastern Europe, the countries of the former Soviet Union, and certain advanced developing countries and territories. Official aid is provided under terms and conditions similar to those for ODA. Part II of the DAC List was abolished in 2005. The collection of data on official aid and other resource flows to Part II countries ended with 2004 data.

DAC members include Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Republic of Korea, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom, United States, and European Union institutions. Data are in current U.S. dollars.

## Spending from DPA

To get an idea of the resources available for prevention it is useful to look at the budget of the DPA, the organization explicitly responsible for prevention. The DPA is funded primarily through the UN's regular budget. However, over the last few years, the DPA has become increasingly reliant on extra-budgetary resources to rapidly respond to needs on the ground. These are raised through Multi-Year Appeals, which are designed to increase the coherence of DPA fundraising efforts and secure support for the less predictable parts of the DPA's work.

However, while contributions have nearly tripled in four years (from US$7.2 million in 2010 to US$19.2 million in 2014), funds still lack predictability, and often come with significant earmarking (around 50 percent), both of which reduce the flexibility of the response. For 2016–2017, the DPA has requested a total of US$50 million to cover the priority areas of engagement.[14] With an engagement in five countries, this would leave US$5 million per year and country.

## The Framework and Simulation

At the core of the framework is the idea that conflict follows a random pattern that, despite its randomness, has some predictability. These patterns are captured by seven states described in the main text and fixed probabilities that determine the likelihood that one conflict stage follows another.

After defining the different stages, one can simply look at how often each state followed another and record the probabilities in a matrix, which we call the transition matrix. Table A1 reports on this matrix. It shows, for example, that the likelihood that peace follows peace is 96 percent. The likelihood that armed conflict follows peace is 2.3 percent. The 0% probabilities in the table are determined by the definitions we used. For example, it is impossible to transition from peace to recovery or to the second year of civil war. From the

[14] In addition, an analysis of the initiatives funded by the extra budget resources shows again a striking focus on postconflict situations.

first year of civil war a country can only transition to another year of civil war or to the first year of recovery.

**Table A1. Likelihood of Transitions in Framework**

| | | transition from | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | peace | high-risk peace | armed conflict | first year of civil war | other year of civil war | first year of recovery | 2nd to 5th year of recovery |
| transition to | peace | 96.04% | 15.50% | 17.26% | 0% | 0% | 0% | 4.33% |
| | high-risk peace | 1.55% | 73.25% | 3.10% | 0% | 0% | 0% | 10.58% |
| | armed conflict | 2.32% | 5.75% | 75.44% | 0% | 0% | 0% | 4.81% |
| | first year of civil war | 0.09% | 5.50% | 4.20% | 0% | 0% | 17.81% | 9.13% |
| | other year of civil war | 0% | 0% | 0% | 57.33% | 77.20% | 0% | 0% |
| | first year of recovery | 0% | 0% | 0% | 42.67% | 22.80% | 0% | 0% |
| | 2nd to 5th year of recovery | 0% | 0% | 0% | 0% | 0% | 82.19% | 71.15% |

The matrix makes clear why it makes sense to distinguish the first year of civil war and the first year of recovery. In both cases the state is less stable in the first year—i.e., it is more likely that recovery follows the first year of conflict than any other conflict year.

Note, that we define the recovery such that it includes years with peace, high-risk peace, and armed conflict. We do this to have a consistent definition of "recovery." This also explains why the transition period from the first year of recovery to peace, high risk, and armed conflict is 0%. The transition likelihoods in the second to fifth year of recovery are explained by the fact that after the fifth year all countries can again transition to peace, high risk, and armed conflict (or to the first year of civil war, obviously). Note that the probability of going back to an outbreak of civil war falls from 17.81 percent to 9.13 percent after the first year of recovery.

## Simulating GDP

The framework simulates the GDP loss as follows: First, consider a counterfactual transition matrix. The parameter $1-\tau$ is used to model the decrease of the transition probability to conflict. This probability mass is added to the likelihood of transitioning to stable peace. In addition, it is assumed that the likelihood of remaining in high-risk peace decreases by a share of $(1-\tau)0.5$. For our main experiment we assume that $\tau=0.5$ so that prevention is assumed to work in 50 percent of all cases. As an example, assume that original transition probabilities from high risk to peace, high risk, armed conflict, and civil war are 0.1, 0.7, 0.1, and 0.1, respectively. Then, in the counterfactual, the probability distribution would change to 0.375, 0.525, 0.05, and 0.05, where the likelihood of transitioning to peace—0.375—comes from $0.1+0.25*0.7+0.5*0.1+0.5*0.1$. The remaining probabilities in the transition matrix are kept as originally estimated. The changes to the transition matrix in the neutral case are depicted in Table A2. We show the changes in the optimistic and pessimistic case below.

**Table A2. Alternative Scenario Transition Matrixes**

*Panel A: Pessimistic scenario*

| transition to \ transition from | peace | high-risk peace | armed conflict | first year of civil war | other year of civil war | first year of recovery | 2nd to 5th year of recovery |
|---|---|---|---|---|---|---|---|
| peace | 96.04% | 27.47% | 17.26% | 0% | 0% | 0% | 4.33% |
| high-risk peace | 1.55% | 64.09% | 3.10% | 0% | 0% | 0% | 10.58% |
| armed conflict | 2.32% | 4.31% | 75.44% | 0% | 0% | 0% | 4.81% |
| first year of civil war | 0.09% | 4.13% | 4.20% | 0% | 0% | 17.81% | 9.13% |
| other year of civil war | 0% | 0% | 0% | 57.33% | 77.20% | 0% | 0% |
| first year of recovery | 0% | 0% | 0% | 42.67% | 22.80% | 0% | 0% |
| 2nd to 5th year of recovery | 0% | 0% | 0% | 0% | 0% | 82.19% | 71.15% |

*Panel B: Optimistic scenario*

| transition to \ transition from | peace | high risk peace | armed conflict | first year of civil war | other year of civil war | first year of recovery | 2nd to 5th year of recovery |
|---|---|---|---|---|---|---|---|
| peace | 96.04% | 51.41% | 17.26% | 0% | 0% | 0% | 4.33% |
| high-risk peace | 1.55% | 45.78% | 3.10% | 0% | 0% | 0% | 10.58% |
| armed conflict | 2.32% | 1.44% | 75.44% | 0% | 0% | 0% | 4.81% |
| first year of civil war | 0.09% | 1.38% | 4.20% | 0% | 0% | 17.81% | 9.13% |
| other year of civil war | 0% | 0% | 0% | 57.33% | 77.20% | 0% | 0% |
| first year of recovery | 0% | 0% | 0% | 42.67% | 22.80% | 0% | 0% |
| 2nd to 5th year of recovery | 0% | 0% | 0% | 0% | 0% | 82.19% | 71.15% |

Second, we regress GDP growth on the seven states using country fixed effects. We use the regression coefficients but ignore the individual country fixed effect coefficients to represent the estimated GDP growth in each state and keep them in the growth vector g^{c} with dimensions 7×1 for each country c. Ignoring the fixed effects means that we artificially lower the growth rate in our simulations. This lowers the benefit of prevention. We return to this point in the robustness checks.

Third, we consider the initial state vector $s_o$^{c} with 1×7 dimension for each country c. For a given country, we look to the last year in the sample, Y, and define the initial state vector $s_o$^{c} accordingly. For example, if the last year of the sample is 2014 and the state of a given country x in that year is 4 then we set the initial state vector to be $s_o$^{x}=(0,0,0,1,0,0,0)—that is, the column of the vector equal to 1 corresponds to the initial state and the rest of the vector elements equal to zero.

Finally, we start simulating by using the following formula:

$$GDP\_\{Y+1\}^\{c\}=s_o^\{c\}(P)(1+g^\{c\})GDP\_\{Y\}^\{c\}.$$

where GDP_{Y+1}^{c,l} is the GDP in the year Y+1, for each country c, and P is the modified transition matrix. More specifically, for a given country, we compute the simulated next year's GDP by using the initial state vector, the estimated growth vector, and the counterfactual transition matrix. Multiplying the initial state vector and the counterfactual transition matrix, we obtain the vector containing the probabilities of transition to each of the states from the initial state. By multiplying the result by the estimated growth vector we

obtain the expected GDP growth given the initial state. Using this number together with the initial GDP, one gets the expected one-year ahead average GDP. Then, we get the expected two-years ahead GDP by multiplying again by P, and so on, so that for any t-years ahead the equation becomes:

$$GDP_{Y+t}^{c}=s_{o}^{c}(P)^{t}(1+g^{c})GDP_{Y}^{c} \text{ for } t=1,...,T.$$

We end up having for each country a path of expected GDP consistent with the estimated individual fitted GDP growth and the constructed counterfactual transitions. We also do the same using the original estimated transition matrix. Hence, to compute the GDP loss, one just needs to compare the actual GDP with one of the counterfactual GDPs.

One can compute the difference between expected GDP in the status quo and the expected GDP with prevention. Because the estimated GDP growth in civil war states is lower than in other states, the constructed counterfactual transitions matrices above makes any counterfactual world better in terms of GDP growth. That is because in the counterfactual world, countries are more likely to stay away from armed conflict and civil war. Hence, any counterfactual expected GDP will be larger than the actual expected GDP, and this happens for any forward iteration and country.

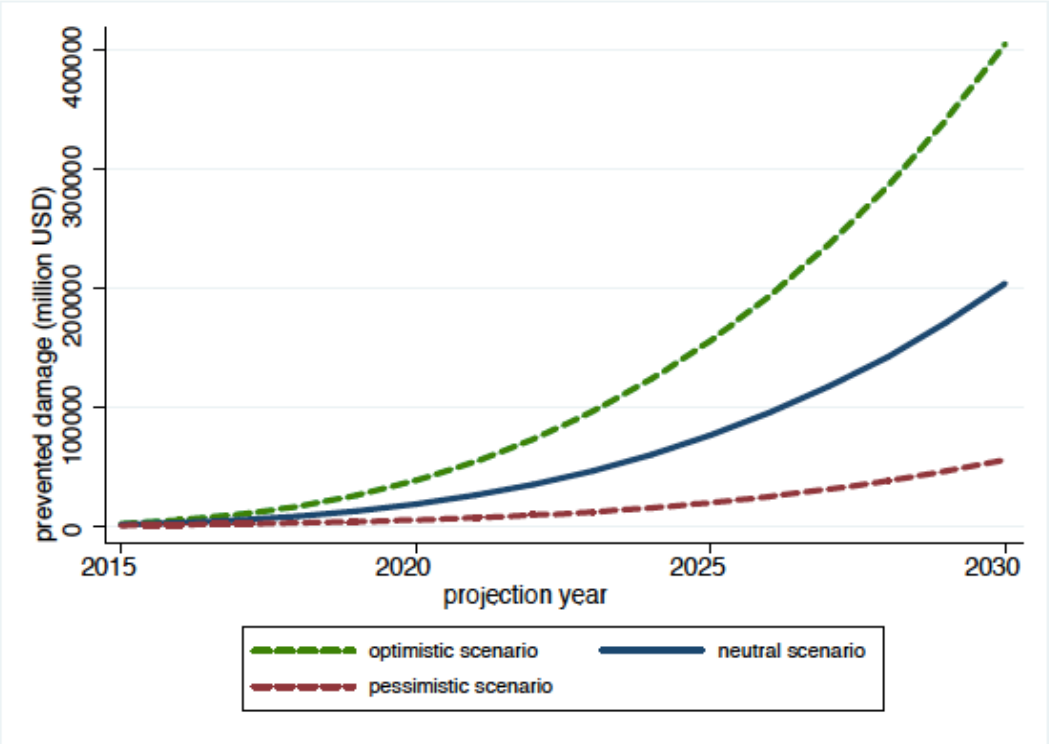
Summing over all countries in our sample and taking the difference between world GDP in the status quo and with prevention reveals the benefit of prevention.

## Robustness Checks

The first important choice made in the report is regarding which countries should be included in the simulation. The key thought experiment one must dare engage in here is to consider which countries, potentially, might end up in a situation with armed conflict and civil war. The cut-off we choose includes as the richest countries Oman, Portugal, and Venezuela. We do so because violence is actually present in Venezuela. However, the results are qualitatively robust to picking a lower cut-off in which Libya is the richest country in the sample. The average discounted prevented damage in the neutral scenario would then be US$33.1 billion instead of US$34.2 billion.

We conducted ample experimentation with the parameters of the model to make sure that results are qualitatively robust to changing parameters. Figure A1 shows how the simulated benefit from prevention changes in the three scenarios if we allow the sample countries to grow by their previous growth rates—i.e., if we add the country fixed effects from the panel regression of growth to the simulated growth rates. Note that this does not impact how conflict affects growth; it only affects the baseline growth, which in turn affects the accumulated benefits from higher growth rates without conflict. The benefit in the neutral scenario now becomes more than US$200 billion after fifteen years, which is more than US$50 billion greater than what is reported in the text. Of course, nothing else changes in other parts of the simulation in this scenario.

**Figure A1. Simulation with Country Fixed Effects**




Finally, we use the within forecasting model from Mueller and Rauh (2017) to do the forecasting that delivers the definition of high risk. Forecasting in the within model is less precise and does not focus on the "usual suspects." Mueller and Rauh show that this leads to a much higher awareness regarding new instabilities. In other words, a prevention system with such a forecast would need to intervene in a much broader set of countries, and much more quickly. At the same time, the set of countries that can fall into high risk is a lot larger so that the benefits of prevention are much more spread out. The modified transition matrix displayed in Table A3 demonstrates this. It shows a much higher likelihood that countries at peace enter high risk, and a much higher likelihood that countries in high risk transition to stable peace again.

**Table A3. Alternative Transition Probabilities in the Within Model**

| | | transition from | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | peace | high-risk peace | armed conflict | first year of civil war | other year of civil war | first year of recovery | 2nd to 5th year of recovery |
| transition to | peace | 90.13% | 45.89% | 17.26% | 0 | 0 | 0 | 9.62% |
| | high-risk peace | 6.90% | 48.57% | 3.10% | 0 | 0 | 0 | 5.29% |
| | armed conflict | 2.59% | 3.25% | 75.44% | 0 | 0 | 0 | 4.81% |
| | first year of civil war | 0.39% | 2.29% | 4.20% | 0 | 0 | 17.81% | 9.13% |
| | other year of civil war | 0 | 0 | 0 | 57.33% | 77.20% | 0 | 0 |
| | first year of recovery | 0 | 0 | 0 | 42.67% | 22.80% | 0 | 0 |
| | 2nd to 5th year of recovery | 0 | 0 | 0 | 0 | 0 | 82.19% | 71.15% |

The system defined this way would intervene much more (in about ten cases each year) and would therefore generate more costs and benefits. It would also, over the years, intervene in an increasing number of cases. The reason is that prevention now pushes more countries toward stable peace, but stable peace is much more likely to generate high-risk situations. Strikingly, this system, built on a within forecast with lower precision, would still yield positive and even stronger benefits across all three scenarios, as shown in Table A4.

**Table A4. The Business Case in the Within Model**

Spending, damages, and costs are all in US$ millon per year

| | scenario | | |
|---|---|---|---|
| | optimistic | neutral | pessimistic |
| prevented damage | 100565 | 59344 | 25219 |
| saved costs | 775 | 553 | 298 |
| additional cost | -761 | -4096 | -8867 |
| **net savings per year** | **100579** | **55801** | **16649** |

*Notes: Prevented damage is the prevented economic damage and deaths. Saved costs are the costs saved from late intervention costs that become unnecessary with prevention. Additional costs are the extra costs needed for prevention efforts. The table shows the business case under different assumptions regarding effectiveness and the growth damage caused by conflict and the cost of prevention. In the optimistic scenario, the conflict damage is assumed to be one standard deviation higher than the main estimate (-5.2% during civil war) and the effectiveness of interventions is assumed to be high (75% success rate) and to cost only US$100 million per year. In the neutral scenario, the conflict damage is assumed to be as estimated (-3.9% during civil war) and the effectiveness of interventions is assumed to be intermediate (50% success rate) at a cost of US$500 million per year. In the pessimistic scenario, the conflict damage is assumed to be one standard deviation lower than the main estimate (-2.5% during civil war) and the effectiveness of interventions is assumed to be low (25% success rate) and cost US$1 billion per year. All numbers are yearly averages calculated as discounted values from a 15-year period with a 3% discount rate.*

Table A4 clearly illustrates the higher additional costs caused by the prevention system compared to Table 3. What is striking in this system is that the differences between the neutral, optimistic, and pessimistic scenarios increase dramatically. However, this is entirely driven by the prevented damage and not saved costs.