

# Simulating the Effect of Peacekeeping Operations 2010–2035

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**Abstract.** We simulate how a set of different UN policies for peacekeeping operations is likely to affect the global incidence of internal armed conflict. The simulation is based on a statistical model that estimates the efficacy of UN peacekeeping operations (PKOs) in preventing the onset, escalation, continuation, and recurrence of internal armed conflict. The model takes into account a set of important conflict predictors for which we have projections up to 2050 from the UN and the IIASA. The estimates are based on a 1970–2008 cross-sectional dataset of changes between conflict levels and new data on PKO budgets and mandates. The simulations show a strong effect of PKOs on the global incidence of major conflicts, although restricted to operations with robust mandates. Extensive use of ‘transformational’ PKOs can reduce the global incidence of the most lethal conflicts with 65%.

**Keywords:** Armed conflict, Simulations, UN Peacekeeping operations, Conflict prevention, Statistical modeling, Demographic projections.

## 1 Introduction

Peacekeeping has become a common tool for resolving conflicts and establishing conditions for a stable peace in war-torn countries. In this paper, we use simulations based on a statistical model to evaluate the potential of peacekeeping operations (henceforth PKOs) for reducing future conflict. The model specification builds on research on peacekeeping as well as on other trends and factors that influence the risk of conflict. The simulations evaluate different scenarios of peacekeeping in the period 2010–2035, varying budgets and mandates.

Existing research on peacekeeping shows that PKOs are important for building peace, but has been unable to assess the total substantive impact on the risk of conflict, taking into account long-term effects and regional diffusion. By using simulations, we are able to incorporate such indirect effects of PKOs. We specify eight PKO scenarios based on previous research, own statistical estimations of relevant factors, and reports by UN sources about the likely future of peacekeeping. One clear trend in recent years is a larger PKO budget and stronger mandates. The scenarios reflect different potential

policies specifying PKO expenditures and mandates, in which countries PKOs are deployed, and when. The findings imply that the more the UN is willing to spend on peacekeeping, and the stronger the mandates provided, the greater is the conflict-reducing effect.

## 2 Methodology

### 2.1 Data

The dependent variable in this study is a three-category variable denoting whether there is a minor conflict, a major conflict, or no conflict going on in a country in a given year. The conflict data are from the 2009 update of the UCDP/PRIO Armed Conflict Dataset (ACD) [3, 2]. The ACD records conflicts at two levels, measured annually. Minor conflicts are those that pass the 25 battle-related deaths threshold but have less than 1000 deaths in a year. Major conflicts are those conflicts that pass the 1000 deaths threshold. We only look at internal armed conflicts, and only include the countries whose governments are included in the primary conflict dyad (i.e., we exclude other countries that intervene in the internal conflict).

We use data on PKOs from three different sources: Doyle and Sambanis' coding of two types of PKOs [1]: **Traditional missions** comprise missions that are restricted to observing truces, troop withdrawals, or buffer zones, policing e.g. buffer zones, or assisting in negotiations. Traditional missions are always deployed with the consent of the parties to the conflict. **Transformational missions** include consent-based 'multidimensional missions' where mandates are extended with activities intended to go to the roots of the conflict, such as economic reconstruction or reform of the police, and 'enforcement missions' that do not require the consent of both parties, drawing on the authority of UN Charter articles 25, 42, and 43 to apply force to protect the activities of the operation. In order to capture the size of the PKO, we have coded the yearly expenditure for each mission, based on UN General Assembly's published *appropriation* resolutions from 1946 to the present. For PKO years without expenditure data we use the average for the mission type as our best guess.<sup>4</sup>

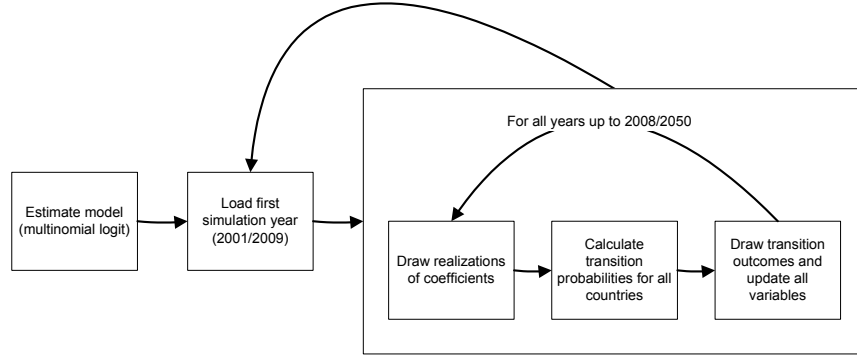
We include predictor variables that are associated with the risk of conflict and for which we have good projections for the 2010–2035 period: the proportion of males aged 20–24 years with secondary or higher education of all males aged 20–24 [7, 8]; Log infant mortality, log total population, the percentage of the population aged 15–24 years of all adults aged 15 years and above [9]. We also include a set of conflict variables: information on conflict status at  $t - 1$ , the log of the number of years in each of these states up to  $t - 2$ , and conflicts in neighboring countries. Projections for the conflict variables are produced by the simulation procedure itself.

### 2.2 Simulation Procedure

To evaluate the efficacy of peace-keeping operations we estimate the statistical relationship between the incidence of conflict and the presence of PKOs of various types and budget sizes, controlling for other factors that have been shown to affect the risk of

<sup>4</sup> A small number of missions are funded directly through the UN's operating budget, and yearly expenditure data are harder to single out from other budget items. For further details on the PKO data, see [4].

Fig. 1. Simulation Flow Chart



conflict.<sup>5</sup> Assessing the predictive performance of variables is extremely important in order to evaluate policy prescriptions [10]. Our statistical model specification necessitates generating predictions through simulation for other reasons. The unit of analysis in our study is the country year, and the models are estimated on data for all countries for the 1970–2008 period. Since PKOs may have effects that extend beyond that year and that country, simulation for all countries over longer periods allows quantifying the effect of UN policies over a long period (2010–2035) and tracing the effect on neighboring countries. The methodology is described in detail in [5].

The general setup of the simulation procedure is shown in Fig. 1. It involves the following steps: (1) specify and estimate the underlying multinomial logistic regression model on data for 1970–2008; (2) make assumptions about the distribution of values for all exogenous predictor variables for 2009 and projected changes after that; (3) start simulation in 2009 for the actual forecasts; (4) draw a realization of the coefficients of the multinomial logit model based on the estimated coefficients and the variance-covariance matrix for the estimates; (5) calculate the 9 probabilities of transition between levels for all countries for the first year, based on the realized coefficients and the projected values for the predictor variables; (6) randomly draw whether a country experiences conflict, based on the estimated probabilities; (7) update the values for the explanatory variables, contingent upon the outcome of step 6; (8) repeat (4)–(7) for each year in the forecast period, e.g. for 2009–2035, and record the simulated outcome; (9) repeat (3)–(8) 1,000 times to even out the impact of individual realizations of the multinomial logit coefficients and individual realizations of the probability distributions.

The simulation methodology is the most accurate hitherto developed in conflict research. [5] shows that the model specification yields an AUC of 0.937 – with  $p > 0.5$  as the cutoff, it correctly predicts about 63% of conflicts (minor or major) 7–9 years after the last year of data, with about 3.5% false positives.<sup>6</sup>

<sup>5</sup> For a review of conflict risk variables, see [6]. We carry out a systematic evaluation of the predictive performance of the control variables in [5].

<sup>6</sup> To assess the predictive performance, [5] estimates the relationship between predictors and risk of conflict based on data for 1970–2000, simulates up to 2009 and

**Table 1.** Estimation Results, Determinants of Minor/Major conflict

| PKO variable     | Minor            | Major            | Minor           | Major            |
|------------------|------------------|------------------|-----------------|------------------|
| Log expenditures | -0.00792 (-0.18) | -0.259** (-3.11) |                 |                  |
| Traditional      |                  |                  | -0.0757 (-0.28) | -0.462 (-1.14)   |
| Transformational |                  |                  | -0.0934 (-0.29) | -2.816** (-2.68) |
| <i>N</i>         | 5942             |                  | 5942            |                  |
| log likelihood   | -1518.4          |                  | -1516.2         |                  |

*t* statistics in parentheses. \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Estimated coefficients for other predictors not shown.

### 2.3 Specifying PKO Scenarios

We specify eight different scenarios to explore the effect on the global incidence of conflict of various UN policies. The following rules guide most of them: (i) PKOs are assumed to be initiated if the conflict is major (more than 1,000 deaths in the previous year) and the conflict has lasted for at least two years; (ii) PKOs remain for five years after last year with conflict activity (more than 25 annual deaths); (iii) PKOs are never deployed in permanent UNSC members; (iv) except in scenarios 4, 7, and 8, PKOs are deployed only in countries that have smaller populations than 100 millions in 2009.

The first scenario (S1) is a comparison scenario where the UN terminates all PKO activity in 2010. We specify three scenarios in which the UN chooses to spend different amounts on each mission, ignoring the mandates – 100 million USD per PKO per year (S2), 800 million (S3), and 800 million plus deployment in large countries (S4). The final four scenarios vary the mandates of the PKOs, ignoring the budget of the mission: traditional mandates (S5); transformational mandates (S6); transformational mandates, also in large countries (S7); as S7, but deployment in first year of conflict (S8).

## 3 Results

### 3.1 Estimation Results

We estimated a multinomial logistic regression model with our conflict variable as the dependent variable and PKO and the other variables as predictors. Table 1 shows the results for the PKO variables from the statistical estimation.<sup>7</sup> All simulations shown below are based on these estimates.

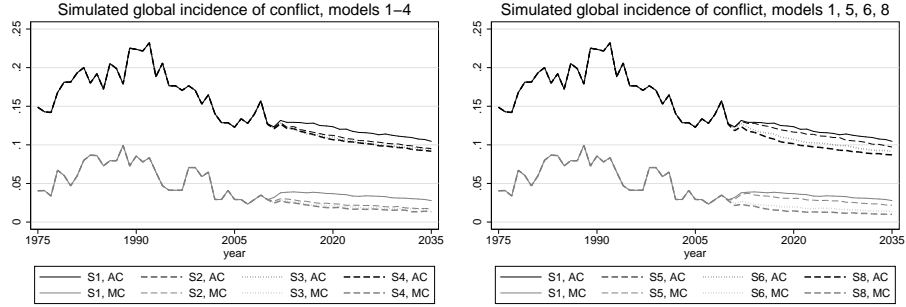
### 3.2 Prediction Results

Figure 2 compares the simulated proportion of countries in conflict in the comparison scenario with the proportion in the other scenarios. Socio-economic development variables are important predictors of conflict, and our UN/IIASA forecasts expect positive changes for most countries over the next 25 years. Hence, we predict a moderate decline

<sup>7</sup> compares simulation results for 2007–2009 with the most recent conflict data available for the same years [3].

<sup>7</sup> The other estimates are reported in [4].

**Fig. 2.** Simulated Incidence of Conflict 2010–2035, Globally, Both Conflict Levels.



Left: Budget scenarios (S1–S4). Right: Mandate scenarios (S1, S5, S6, S8).

in the proportion of countries in conflict even without any PKOs, and an incidence of major conflict at the same level as in 2004–08.<sup>8</sup> In the left panel, we compare the baseline scenario with scenarios S2, S3, S4 varying the budget of missions (ignoring their mandates). The set of black lines represent the incidence of all armed conflicts, the gray set major conflicts only. All three scenarios imply a reduction in the incidence of conflict. The conflict reduction is substantial for major conflicts. In 2035, the predicted incidence of conflict for the most extensive scenario is less than half that of the comparison scenario. The reduction in the incidence of minor conflict, however, is negligible. There is little difference between the predictions for the various budget levels.

The right panel shows the predicted incidence of conflict varying the mandates of the PKOs. As expected from the estimates in Table 1, the effect of varying mandates is stronger than that of varying budget. The predicted reduction in the incidence of both levels of conflict is about 2%, and the reduction in the incidence of major conflict is about the same. This means that the most extensive scenario reduces the risk of major conflict in 2035 with about two thirds.

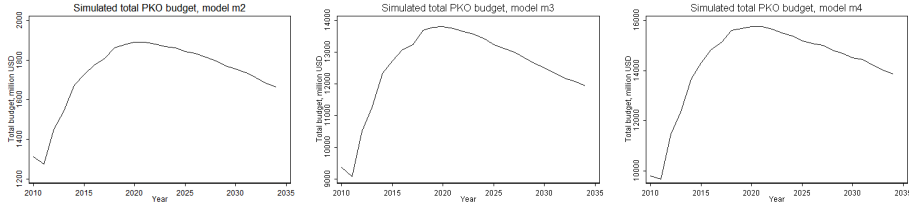
The simulated indirect effect of PKOs on minor conflict is weak. However, it is not so that PKOs merely reduce the *intensity* of conflict. If that was the case, the incidence of both levels of conflict would not be reduced in any of the scenarios. Our simulations imply that for every successful transition from major to minor conflict due to the presence of a PKO, there is one transition from minor conflict to no conflict.

Our model allows capturing long-term and spatial effects of conflict. The estimates for ‘log time in status’ variables (not shown in Table 1) indicate that the probability of no conflict increases strongly with several consecutive years of peace, and decreases with several consecutive years of conflict. Likewise, conflicts in neighboring countries increase the risk that conflicts erupt. Given that Table 1 shows that PKOs have a clear short-term effect, we expect the difference between scenarios to increase over time. There are indications that this is the case. The simulated difference between the no-PKO and PKO scenarios in Fig. 2 clearly widens from the first year of simulation up to 2020. After the initial 10 years, the lines are roughly parallel. The lines become parallel considerably earlier for the incidence of major conflict.

How expensive are these scenarios? Figure 3 shows the average simulated total budgets for UN PKOs under scenarios S2, S3, and S4. The low-budget scenario (S2)

<sup>8</sup> [5] discusses the uncertainty of the simulated results.

**Fig. 3.** Simulated Total UN PKO Budgets, 2010–2035

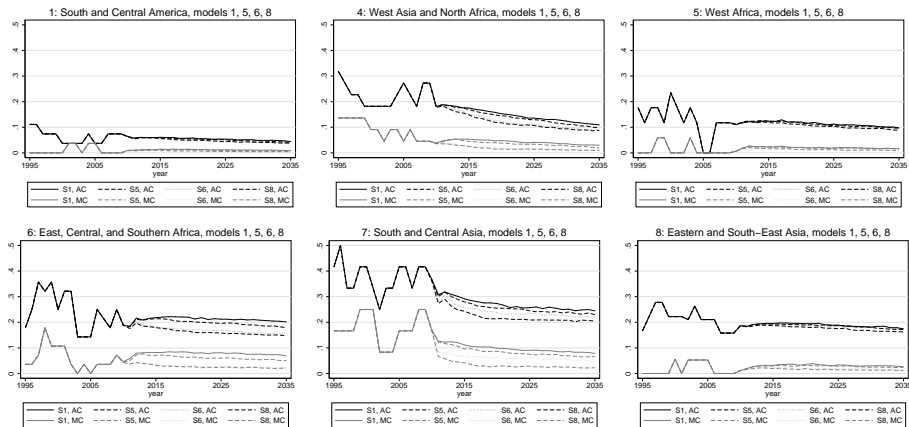


would imply a strong reduction in UN peace-keeping expenditures, whereas the other two scenarios represent an increase in total annual expenditures of 50–70% compared to what the UN spent in 2009. The simulations show that the budget would only increase for approximately ten years, and then start decreasing as a consequence of the reduction in the incidence of conflict.

### 3.3 Regional Effects

We define 8 regions. In Fig. 4, we show the simulated incidence of conflict in six of these regions for scenarios S1, S5, S6, and S8. We also plot the observed proportion of countries in conflict for the 1995–2008 period for each region. Since there are only a handful of conflicts within each region, individual conflicts are discernible in the plots. In the 1995–2004 period in West Africa, for instance, the total number of conflicts fluctuated between 2 and 4. In the 2010–25 projections for this region, 10% of the countries are in conflict. This corresponds to about 2 conflicts every year. The expected number of major conflicts (more than 1,000 battle-related deaths) is less than 0.5 for this region.

**Fig. 4.** Simulation 2010–2035, Both Conflict Levels, Six Regions.



PKOs have the strongest effects in regions 4, 6, and 7. The other three regions have had few major conflicts in the post-Cold war period, and the model predicts a continued low incidence of these conflicts. Since PKOs in our scenarios are initiated only in major conflicts, we predict fewer deployments in these regions, and they therefore only marginally affect the regional incidence of conflict.

In the other three regions, however, PKOs substantially reduce the number of conflicts. In ‘West Asia and North Africa’, we see a strong decline in the incidence of conflict because of the relatively high levels of socio-economic development in the region. Particularly in the first 15 years of the simulation, PKOs with strong mandates reinforce this declining trend. Since there are few large countries in the region, there is little difference between S6 and S8.

The ‘East, Central, and Southern Africa’ and ‘South and Central Asia’ regions are the ones with the highest incidence of conflict after the Cold War (and in our simulations). In region 6, scenario S6 (with enforcement mandates for all conflicts in smaller countries) reduces the predicted incidence of major conflict from about 8% of the countries to about 3% – from more than two conflicts every year to less than one. In region 7, the predicted incidence of conflict is about 11-12% in 2015 and slowly decreasing under the comparison scenario. In scenario S6 the predicted incidence decreases to about 7%. Scenario S8, which allows for PKOs in large countries (but not in the permanent members of the UNSC) and deployment in the first year of a major conflict reduces the incidence by another couple of percents.

## 4 Conclusion

We have evaluated the prospects of PKOs in reducing conflict in the future by simulating different scenarios for UN PKO deployment policies. The results show that PKO has a clear conflict-reducing effect. The effect of PKOs is largely limited to preventing major armed conflicts. PKOs have the strongest effect in the traditionally conflict-prone regions West Asia and North Africa, East, Central, and Southern Africa, and South and Central Asia.

In one of the most extensive scenarios, in which major armed conflicts are met with a PKO with an annual budget of 800 million USD, the global incidence of major armed conflict is reduced by half relative to a scenario without any PKOs. The total simulated UN peacekeeping budget increase by 50–70 percent relative to 2009 levels. Moreover, the total PKO budget would increase for about ten years, and then start decreasing again as a result of a reduced number of conflicts in the world. In another scenario, which specifies that major conflicts get a PKO with a robust, ‘transformational’ mandate from the first year, the risk of conflict is reduced by two thirds in 2035 compared to a scenario without any PKO.

Previous research has shown that peacekeepers are fairly good at keeping peace but less able at ending violent conflict. Our findings suggest that PKO may also be an effective tool for ending conflict if accompanied with a strong mandate and a sufficient budget. This implies that theories focusing on the credibility of the commitment by the UN are probably the most useful for understanding how PKO can help warring parties lay down their arms.

## References

1. M. W. Doyle and N. Sambanis. *Making War & Building Peace: United Nations Peace Operations*. Princeton: Princeton University Press, 2006.
2. N. P. Gleditsch, P. Wallensteen, M. Eriksson, M. Sollenberg, and H. Strand. Armed conflict 1946–2001: A new dataset. *Journal of Peace Research*, 39(5):615–637, 2002.
3. L. Harbom and P. Wallensteen. Armed conflicts, 1946–2009. *Journal of Peace Research*, 47(4):501–509, 2010.
4. H. Hegre, L. Hultman, and H. Nygård. Evaluating the conflict-reducing effect of un peace-keeping operations. Paper presented to the National Conference on Peace and Conflict Research, Uppsala, September 9-11, 2010.
5. H. Hegre, J. Karlsen, H. M. Nygård, H. Strand, and H. Urdal. Predicting armed conflict 2010–2050. Typescript, University of Oslo.
6. H. Hegre and N. Sambanis. Sensitivity analysis of empirical results on civil war onset. *Journal of Conflict Resolution*, 50(4):508–535, 2006.
7. S. K. Lutz, Wolfgang; Anne Goujon and W. Sanderson. *Reconstruction of Population by Age, Sex and Level of Educational Attainment for 120 Countries 1970–2000*. IIASA, Laxenburg, Austria, 2007.
8. V. S. Samir, KC; Bilal Barakat and W. Lutz. *Projection of Populations by Age, Sex and Level of Educational Attainment for 120 Countries for 2005–2050*. IIASA IR-08-xx. IIASA, Laxenburg, Austria, 2008.
9. United Nations. *World Population Prospects. The 2006 Revision*. UN, New York, 2007.
10. M. D. Ward, B. D. Greenhill, and K. M. Bakke. The perils of policy by p-value: Predicting civil conflicts. *Journal of Peace Research*, 47(4):363–375, 2010.