



Regular Research Article

Trading peace for hazard management? peace agreement implementation and United Nations peace operations during natural hazards

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ABSTRACT

Although United Nations Peace Operations (UNPOs) can strengthen capacity and improve responses to natural hazards, the core peace operation and ability to produce peace can become victims of crisis management success. Natural hazards can impede UNPOs' activities and peace accord implementation through three mechanisms: 1) UNPOs activities are diverted to immediate humanitarian assistance, away from core UNPOs' activities; 2) changes to the bargaining process; and 3) lower opportunity costs of violence and increased opportunities to renege on agreements or call for renegotiations. We compare peace agreement implementation with UNPOs versus peace agreement implementation without UNPOs when facing natural hazards. In an analysis of countries with comprehensive peace agreement implementations between 1992 and 2015 we find that natural hazards during UNPOs deployment see lower subsequent peace agreement implementation relative to hazards in countries without UNPOs. We see these findings as consistent with greater dependency on UNPOs, creating greater tension between responses to natural hazards and peace implementation. Further analysis to unpack the three mechanisms suggests support for the first two mechanisms.

1. Introduction

In May 2021, South Sudan experienced its worst floods in 60 years. Widespread flooding impacted people and their livelihoods across South Sudan, leading to more than 835,000 affected people in 33 of 78 counties by the end of the year.³ The United Nations Mission in South Sudan (UNMISS) built more than 70 km of dykes to protect the city of Bentiu (UNMISS, 2021a). In 2022 when intense rainfall again hit South Sudan and caused more flooding, UNMISS worked to rebuild the road (UN Peacekeeping, 2022) and provided food assistance items to flood-affected areas (United Nations Security Council, 2022). However, success in containing flooding and the diversion of limited resources to manage the immediate disaster might have had unintended consequences. These events generated extra humanitarian needs at a time when the COVID-19 pandemic had already strained the fragile situation

in the country. The severe floods between May–November 2021, probably the most severe floods since 1960 s, affecting 9 out of 10 states (Borgomeo and Chase, 2023), exacerbated the challenges to the fragile peace agreement (Tarif et al., 2025).⁴ On 9 December 2021, the Interim Chairperson of the reconstituted Joint Monitoring and Evaluation Commission expressed concern over the delays in the implementation of transitional security arrangements including the unification of forces (United Nations Security Council, 2022).⁵ Violent events spiked in December 2021, and the highest number of incidents occurred during the period of severe flooding (Gaduel, 2022). In 2023, signatory parties to the Revitalized Peace Agreement and key stakeholders raised concerns over delays in the implementation of the road map, including constitution-making process and elections (United Nations Security Council, 2023).

The December 26, 2004, tsunami hit the region of Aceh in Indonesia

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³ Reliefweb. "South Sudan: Floods 2021–2022." Available at: <https://reliefweb.int/disaster/fl-2021-000108-ssd>.

⁴ The severity is reported as seen in flood insecurity that between 2021 and 2023, as much as 87 percent of the population suffered from severe flood insecurity.

⁵ This is not the only cause of the delay in implementation. However, our main point here is that any concerns for implementation delays had been or were in the process of being resolved by the time the disaster occurred.

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hard, with a death toll close to 234,000 (Soesastro and Atje, 2005). While the Free Movement of Aceh (GAM) were the first respondents, both GAM and the Indonesian government recognized that both sides were victims and rescuers confronting the same reality. Emerging cooperation fosters mutual respect and long-term trust between parties (Gaillard, Clavé, and Kelman, 2008). The arrival of international aid led the Indonesian government to restrict the movement of aid workers and materials to minimize the chance of attacks by GAM (Gaillard, Clavé, and Kelman, 2008; McCulloch, 2005). In August 2005, the Government of Indonesia and GAM signed a Memorandum of Understanding, which detailed the agreement and principles that guided the transformation process. Other disasters shifted attention closer to Jakarta leading to short delays in the implementation of the peace agreement.⁶ However, on December 11, 2006, a peaceful election took place, recognized by all parties involved as a true expression of the people's will (Gaillard, Clavé, and Kelman, 2008). The two examples raise an interesting puzzle, namely whether UNPOs help provide crisis management during natural hazards yet in doing so deflect away from core UNPOs and ability to produce peace.⁷

There is a wealth of recent research on how natural hazards' impact conflict and peace processes (Chung and Rhee, 2022; Eastin, 2016; Fjelde and von Uexkull, 2012; Haer and RezaeeDaryakenari, 2022; Ide, 2023; Kreutz, 2012; Nemeth and Lai, 2022; Tominaga and Lee, 2021; Walch, 2018). Yet, few studies have explored natural hazards and the ability of UN missions to fulfil their mandates, namely peace accord implementation.⁸ As the United Nations itself acknowledges, implementing comprehensive peace agreements is one of the core mandates of peacekeeping operations.⁹ UNPOs can improve natural hazard responses, but we argue that severe natural hazards can also impede UNPOs' activities and delay the implementation of peace accords through three mechanisms: (1) by creating shocks in state capacity and resources, particularly when host states are over-reliant on UNPO's to provide basic services; (2) by generating changes in the bargaining process; and (3) by decreasing the opportunity costs of violence. These processes create opportunities to renege and renegotiate peace accords, but even more so, they can undermine the legitimacy of UNPOs, derailing the implementation of current peace accords and increasing the likelihood of recurrence of conflict.

⁶ The 2004 tsunami was not the only disaster to hit Indonesia during the period 2004–2006. Other events include the October 2005 landslides in Aceh, killing at least 16 people. See Asian Disaster Reduction Center. Available at: https://www.adrc.asia/view_disaster_en.php?Lang=en&Key=901 (Last accessed on 5 January 2026). There was also the December 2006 flood in Aceh, which forced tens of thousands to flee their homes. See Asian Disaster Reduction Center. Available at: https://www.adrc.asia/view_disaster_en.php?lang=en&KEY=1025 (Last accessed on 5 January 2026).

⁷ Here, our intention is not to investigate individual cases but rather to explore general patterns of how UNPOs respond to natural hazards that occur while missions are deployed.

⁸ In this study, we define the peace accord implementation period as the period following the signature of a comprehensive peace agreement. As we will introduce our research design later, we use the Peace Accord Matrix Implementation Dataset (PAM_ID; Joshi, Quinn, and Regan, 2015) to identify the peace accord implementation period. We use the term natural hazard instead of natural disaster since a disaster is triggered by natural hazards (Chaudhary and Piracha 2021; Cui et al. 2021; Wisner and Wisner 2004). Thus, natural hazards are described as processes that have the potential to cause natural disasters (Chaudhary and Piracha 2021). For instance, geographical hazards are related to earthquakes and volcanic activities, hydrological hazards are related to floods, landslides, and wave action, and meteorological hazards are storms, extreme temperatures, and fog (Chaudhary and Piracha 2021). Exposure to these natural hazards is not sufficient for disasters to emerge (Chaudhary and Piracha 2021).

⁹ United Nations Peacekeeping. Mandates and the Legal Basis for Peacekeeping. Available at: <https://peacekeeping.un.org/en/mandates-and-legal-basis-peacekeeping> (accessed 28 February 2025).

Recent studies have shown that UNPOs are important for peace accord implementation (Campbell and Di Salvatore, 2024; Maekawa, Ari, and Gizelis, 2019; Mailhot, 2024). UNPOs may not have the capacity to address natural hazards and at the same time keep on track with the implementation of their mandates. In fact, environmental elements have rarely been incorporated into peacekeeping mandates (Diehl 2018).¹⁰ Neither, there is a record of deployment of preventive UNPOs related to climate change (Diehl 2018). In practice, UNPOs often divert their resources and efforts to manage natural hazards when host countries experience catastrophic events, but engagement with natural hazards has not been part of formal deployment or mandates. Thus, it is important to investigate how UNPOs' management of natural hazards can change the course of conflict or peacemaking efforts.

We assess our argument using a sample of comprehensive peace agreements from 1992 to 2015. We compare peace agreement implementation with UNPOs versus peace agreement implementation without UNPOs, upon facing natural hazards. The results show that as we see more natural hazards during PKO deployment, we also observe a lower implementation of comprehensive peace accords. Triangulating our findings with interviews and qualitative evidence, we find that UNPOs prioritize humanitarian assistance in the wake of natural hazards at the expense of fulfilling their mandates and implementing peace agreements. States that rely on UNPOs to provide public goods and governance experience could lead to the continuation of conflict or further instability in the host country when faced with a decline in UNPOs' activities.

2. Impact of natural hazards on conflict and peace

According to Disasters Year Review 2022, the average flood occurrence between 2002 and 2021 was 168, and 176 in 2022 (CREG, 2023). In vulnerable countries, natural hazards can adversely affect the economy and political stability (Raddatz, 2007). Natural hazards can induce scarcity and marginalization, especially in more vulnerable societies (Homer-Dixon, 1999; Homer-Dixon and Blitt, 1998), and motivate resorting to violence, further undermining state capacity (Nel and Righarts, 2008). Hazards can also impact military capabilities and personnel, infrastructure, and the ability to maintain legitimacy (Nemeth and Lai, 2022), or opportunities to supply critical public and relief services (Enia, 2008). A lower ability to provide services and relief to the population can shift the balance in contests over hearts and minds between the government and rebels, especially in the periphery or marginalized areas where the state is already weak. The speed and quality of response and resilience of local and national institutions can contribute to changes in bargaining strength (Enia, 2008; Walch, 2014). Furthermore, depending on conflict dynamics, mistrust can increase, especially in marginalized communities, further complicating the ability of parties to reach an agreement. In general, natural hazards tend to increase the risk of civil conflict in low- and middle-income countries with mixed political regimes and sluggish economic growth (Brancati, 2007; Nel and Righarts, 2008), and increase the risk of terrorism in countries with low to middle GDP per capita (Berrebi and Ostwald, 2011).

However, common threats and challenges can also help overcome cleavages, increase cooperation, cohesion, and solidarity, and create

¹⁰ Diehl (2018) mentions two exceptions United Missions in Liberia and United Nations Organization Stabilization Mission in the DR Congo; however, he points out that those mandates were related to natural resources rather than natural hazards. In 2021, the Security Council rejected in a contentious vote a draft resolution to include climate-related risks as a central component of UN conflict prevention measures. While 12 members voted in favor, India and the Russian Federation voted against it and China abstained. The Russian Federation vetoed the draft resolution. <https://press.un.org/en/2021/sc14732.doc.htm> (accessed on 9 September 2025).

new alliances with common interests (Haer and RezaeeDaryakenari, 2022). In countries where UN PKOs are not present, natural hazards may increase the likelihood of conflict, but 23% of studies find that natural hazards reduce the likelihood of conflict, especially violent armed conflict (see Canavan and Ide, 2024, for a systematic review). The complexity and vicious cycles between natural hazards, inherent vulnerability, and conflict reduce the adaptability of countries to increasing numbers of environmental disasters (Buhaug and von Uexkull, 2021). In some countries, such as Burundi, where floods hit during the Arusha Accord implementation, actors failed to achieve cooperation in dealing with the floods or the implementation of the peace agreements. Instead, the Palipehutu-Forces nationales de libération (FNL) in Burundi inflicted violence and undermined humanitarian access. However, in other cases, such as the Aceh region, where the 2006 tsunami and other natural hazards hit before and after the accord implementation, local actors increased cooperation, supporting a successful peace agreement implementation (Gaillard, Clavé, and Kelman, 2008). The GAM and the government both engaged in humanitarian relief and successfully implemented post-conflict elections.

Our analysis considers countries that already have a peace agreement, so we can reasonably expect a higher likelihood of cooperation in cases of environmental hazards, even when PKOs are not present in the country (Caso, Hilhorst, Mena, and Papyrakis, 2024; Ide, 2023; Pelling, 2003; Petrova and Rosvold, 2024; Reinhardt and Lutman, 2022; Streich and Mislán, 2014). Petrova and Rosvold (2024), using evidence from Pakistan, suggest that relief by the government can increase political trust if the government refrains from using violence against civilians. At least in the short term, attacks against civilians by rebel forces decline and sometimes open a window of opportunity to cooperate and implement peace agreements (Haer and RezaeeDaryakenari, 2022).

However, such effects are often conditioned on state capacity (Berrebi and Ostwald, 2011; Brancati, 2007; Carlin, Love, and Zechmeister, 2014; Ghimire, Ferreira, and Dorfman, 2015; Gizelis and Wooden, 2010; Nel and Righarts, 2008). The limited bureaucratic and administrative capacity of states experiencing intrastate conflict prevents governments from commanding compliance from subnational entities or mustering the necessary administrative capacity to distribute public goods and implement agreements (Cole, 2015; Doyle and Sambanis, 2000, 2006; Tallberg, 2002). Bureaucratic capacity requires the ability to manage budgets as well as the capacity to set priorities. In post-conflict countries, UNPOs often supplement and support struggling governments by providing expertise and monitoring policy deviations (Campbell and Di Salvatore, 2024; Maekawa, Ari, and Gizelis, 2019). As such, UNPOs facilitate peace accord implementation by supplementing the government's capacity. The literature also converges that PKOs can reduce violence by mitigating the incentives to renege on agreements and increasing the cost of fighting (Hultman, Kathman, and Shannon, 2014; Ruggeri, Dorussen, and Gizelis, 2017; Smidt, 2020).

However, what happens when natural hazards hit countries where UNPOs have been deployed? We argue that in these cases, a trade-off between providing emergency relief and conducting core mission tasks emerges for UNPOs. This is particularly acute for weaker countries, where governments are dependent on UNPOs to provide governance. For instance, during the COVID-19 pandemic, UN mission efforts to strengthen the institutional capacity of local stakeholders, state authority, and civil society were postponed or canceled (De Coning, 2020; Lijn, 2022; United Nations, 2020). In Haiti, where seven UN peace operations have been deployed since 1993, the country has experienced a series of natural hazards from hurricanes to the devastating 2010 earthquake, confidence in government institutions remains very low, heavily relying on peacekeepers to provide public goods and support local institutions (Bakaki and Dorussen, 2023). In such cases, dependency on UNPOs to deliver governance can impact the host country more than countries without UNPO presence, where domestic actors cannot rely on international capacity to mobilize and organize resources. We identify three mechanisms through which natural hazards

can impede UNPOs' activities and peace accord implementation. The following section outlines these mechanisms in detail.

3. Natural hazards and UNPOs' trade off

3.1. Shocks in state capacity and resources

The engineering corps of UNPOs are often engaged in emergency responses during natural hazards, such as earthquakes or floods, or during refugee crises (Boutellis and Smith, 2014). For example, UN soldiers from the health services of the Brazilian Battalion (BRABATT) and the Brazilian Mariners Task Group established rescue operations and offered first aid to the victims of the 2010 Haiti earthquake, as did UN peacekeepers after Hurricane Mitch in Guatemala (Wisner, 2012). Peacekeepers sometimes respond by collaborating with humanitarian agencies. In 2004, after Hurricane Jeanne hit Haiti, peacekeepers from the UN Stabilization Mission in Haiti (MINUSTAH) escorted humanitarian convoys and provided security to food distribution centers in support of humanitarian agencies (Braga, 2010). The mission temporarily redeployed military and police personnel to Gonaïves to provide security at distribution points and warehouses and to support relief activities (United Nations Security Council, 2004a).

This diversion of resources from implementing core mission mandates reduces the availability of resources required to implement peace agreements. Since UNPOs substitute or heavily enhance the state capacity of fragile states, and in some cases, missions temporarily even directly control the transitional administration, the host state becomes dependent on PKOs to provide public goods and governance (Doyle and Sambanis, 2000; 2006; United Nations, 2008). The substitution of state capacity by international actors creates a negative circle, further dampening local capacities (Call and Cousens, 2008). UNPOs create a dependency of the state on the presence of peacekeepers to provide goods and services in addition to security. Under such conditions, natural hazards divert UNPOs' resources and personnel to humanitarian assistance, limiting the availability of resources for capacity-building. In July 2024, South Sudan experienced floods when UNMISS engaged in creating dykes. On August 6, 2024, the Chair of the National Elections Commission announced that voter registration and other pre-election activities could not start due to a lack of funds (United Nations Security Council, 2024). The permanent constitution-making and unification of the forces also delayed its implementation, ultimately resulting in the postponement of the elections (Sudan Tribune, 2024). UNMISS could have supported the process, but it did not because of the diversion of limited resources and personnel.

3.2. Changes in bargaining processes

Signing an agreement is an important barrier, but bargaining between parties continues after that. At any point during the subsequent implementation process, parties to the conflict may withdraw from an agreement and return to violence. Negotiated settlements are often highly sensitive to changes in the relative power of actors, and the actual distribution of potential power is often uncertain, especially since implementing agreements often has important redistributive implications. Walter (2009) highlights how efforts to settle civil wars through agreements often involve incomplete information and commitment problems that often require a third party to implement and enforce agreements (Walter 2009). Furthermore, in civil wars, there is often the risk that spoilers not included in the original agreement can derail the bargaining process (Quinn, Joshi, and Melander, 2019; Stedman, 1997). Natural hazards often undermine the bargaining process between the government and rebel groups, shifting bargaining power in favor of the government. When the host country of a UNPO experiences natural hazards, the UN facilitates the coordination of international humanitarian assistance and primarily coordinates with the host government. For instance, when South Sudan experienced floods, the UNMISS,

humanitarian partners, and the state government set up a Flood Emergency Response Technical Group to tackle disaster relief (UNMISS, 2021b). Thousands of affected civilians received assistance from International Organization for Migration, the World Food Programme, the Food and Agriculture Organization, UNICEF and the UN Refugee Agency (UNMISS, 2021b). In the case of Haiti, MINUSTAH worked closely with UN coordination structure with the support of the UNDP, the UN country team agencies, and other international humanitarian organizations (United Nations Security Council, 2024).

As an unintended consequence, local communities increase their levels of collaboration with the central government (Berman, Shapiro, and Felter, 2011). Inevitably, the government increases its grip on regions where aid is provided, potentially improving the perception that the government is capable of providing support, at least in cases where the government has not been involved in violent acts (Berman, Shapiro, and Felter, 2011; Findley, 2018; Petrova and Rosvold 2024; Walch, 2018; Weintraub, 2016). This process can create positive feedback loops, where the government increases its reach in affected areas, thus mitigating any trust-depressing effects (Livert, Weaver, and Bordón, 2025; Rhein and Jansesberger 2024). Increasing trust in the government can destabilize peace accord implementation in three possible ways. First, rebel groups might perceive any improvements in public perception of the government or their increasing territorial reach as a potential threat. Rebels might try to offset such shifts in their relative bargaining power, spoiling the implementation of the peace agreement (Haer and RezaeeDaryakenari, 2022). Second, any relative bargaining power shifts driven by UNPO activities may not be easily detectable, as citizens' perceptions and popular shifts are hard to observe. This can lead to miscalculations of the power of balance, leading to the recurrence of war (Daly, 2022). Third, the territorial management of natural hazards reduces territorial control and weakens the ties of rebels to local communities, thus reducing their incentives to collaborate (Walch 2014, 2018). For these reasons, incentives to renege on or spoil peace implementation might increase during PKOs.

3.3. Reductions in opportunity cost of violence

Natural hazards, such as floods, create a sequence of events and situations that impact the cost of violence, especially in countries where UNPOs are present. To prevent violence from recurring, the opportunity costs of renegeing on an agreement must be increased. Since natural hazards affect both conflict parties, both experiencing loss of personnel and resources, it is possible that there is a ripe moment when both the government and rebels are less willing to resume violence (Nemeth and Lai 2022). Alternatively, as mentioned in the previous section, UNPO's diversion of resources might change the relative power of the fighting parties, altering their incentives to commit to previous peace agreements and contributing to implementation failures and the renewal of violence (Quinn, Joshi, and Melander 2019). One of the most important tasks of UNPOs is to contain violence and increase the cost of recurring fighting by rebels and governments through routine patrols. Patrols deter the resumption of fighting and serve as valuable sources of community information for peacekeepers (Bove and Ruggieri, 2019; Ruggieri, Dorussen, and Gizelis 2017). However, when roads become inaccessible due to floods, routine patrols are obstructed, and peacekeepers cannot engage with local communities to get an accurate snapshot of general security conditions and humanitarian needs, as illustrated in narratives by former peacekeepers.¹¹ Thus, the inability to patrol certain areas diminishes peacekeepers' ability to acquire information on the timing and location of future violent incidents, potentially decreasing the opportunity cost of violence for rebel groups. Such a reduction in opportunity cost leads to an increase in violence and lower levels of peace accord implementation (Fjelde, Hultman, and Nilsson, 2019; Ruggieri,

Dorussen, and Gizelis, 2017). The continuation of fighting makes conflict parties reluctant to disarm and demobilize because of fears of vulnerability and sensitivity to possible violations of agreements (Walter, 1999). Delays in disarmament and demobilization further signal a lack of willingness to settle, discouraging disarmament and causing a vicious circle of implementation failure (Maekawa, 2024). For example, in South Sudan, the delay in the unification of forces led to the postponing of the election in 2024 (Sudan Tribune, 2024).

Furthermore, residual violence hinders civil society (Elayah and Verkoren, 2019). Beyond the loss of information and oversight by peacekeepers, flooding impacts the continuation of workshops and training in conflict management. The impact on civil society is crucial for monitoring the implementation of peace accords and holding the fighting parties accountable (Joshi et al., 2025). Women's organizations play an important role in mobilizing resources, bridging communities, and inducing constructive engagement between the UN and local actors (Gizelis, 2011). Combined disruptions from flooding and the continuation of violence hamper such mitigating activities by civil society, making it easier for groups to continue the cycle of violence while decelerating peace accord implementation.

Hypothesis. *Based on these discussions, we derive the following hypothesis:*

H: Natural hazards when PKOs are deployed lead to lower subsequent peace agreement implementation.

4. Research design

We test the hypotheses using a sample of comprehensive peace agreement implementations. The sample was obtained from the Peace Accord Matrix Implementation Dataset (PAM_ID; Joshi, Quinn, and Regan, 2015). The sample includes 33 comprehensive peace agreements¹² for civil wars covering the years from 1992 to 2015. According to Joshi, Quinn, and Regan (2015; 552-553), the data cover comprehensive agreements in terms of the inclusion of major parties and substantive underlying issues. Such agreements are only slightly less likely to break down than other types of accords. This dataset enables us to accurately evaluate the proposed mechanisms, particularly the potential resource diversion of UNPOs during natural hazards. We chose this sample because we would not be able to observe the failure of the implementation of peace accords otherwise, since partial agreements tend to include first aid agreements such as humanitarian relief. Thus, variations in provisions are crucial for exploring the trade-off between saving lives and delaying other provisions of accord implementation.

We defined the dependent variable, *CPA Implementation Score* as the annual peace accord rate, following Joshi, Quinn, and Regan (2015). The PAM_ID dataset contains 51 different types of provisions, including institutions, security, rights, external arrangements, and other arrangements (Joshi, Quinn, and Regan, 2015). According to Joshi, Quinn, and Regan (2015), for each type of provision, an implementation level is identified based on specific benchmarks of implementation. Initiation was identified through observed events and after initiation. Progress was evaluated by considering viability, likely products, steps, and completeness in relation to full implementation (Joshi, Quinn, and Regan, 2015). For each CPA provision, an implementation level of 0 indicates no implementation, 1 indicates minimum implementation, 2

¹² Although there were originally 34 peace agreement cases, one case was dropped as information on covariates was not available. The countries in our sample include Angola, Bangladesh, Bosnia and Herzegovina, Burundi, Cambodia, Republic of Congo, Ivory Coast, Croatia, Djibouti, El Salvador, Guatemala, Guinea-Bissau, India, Indonesia, Lebanon, Liberia, Macedonia, Mali, Mozambique, Nepal, Niger, Papua New Guinea, Philippines, Rwanda, Senegal, Sierra Leone, South Africa, Sudan, Tajikistan, Timor-Leste, and the United Kingdom.

¹¹ Interview with a UN staff member who used to work for UNMISS.

indicates intermediate implementation, and 3 indicates full implementation. Since signatories are responsible for implementation, an outcome produced can be considered a joint outcome of relevant actors, although the data do not record which actor implemented it.

We take the sum of each provision’s implementation score in a given year and divide it by the expected value of full implementation (Joshi, Lee, and Mac Ginty, 2017).¹³ To evaluate the hypothesis, we compare peace agreement implementation with UNPOs versus peace agreement implementation without UNPOs during natural hazards. In the following sections, we explain how we identify UNPOs presence and natural hazards during peace accord implementation.

Independent variables:

Our independent variable is *Natural Disaster Count* (ln), which counts the number of natural hazards in a country in a given year. To identify natural hazards, we use the Emergency Event Database (EM-DAT), developed by the Center for Research on the Epidemiology of Disasters (CRED). EM-DAT includes all hazards from 1900 until present, conforming to at least one of the following criteria: 10 or more people dead; 100 or more people affected; the declaration of a state emergency; a call for international assistance.¹⁴ Although the EM-DAT includes both natural and technological hazards, we focus on natural hazards. The EM-DAT originally included a wide range of natural hazards. In our sample, the proportion of each hazard type is as follows: drought (0.05%), earthquake (0.06%), epidemics (0.18%), extreme temperature (0.03%), flood (0.36%), insect infestation (0.00%), landslide mass movement (0.08%), storm (0.19%), volcanic activity (0.02%), and wildfire (0.02%). We count how many of these hazards are observed in a given year. Since the distribution of the count variable is positively skewed, we use log-transformation. We interact Natural Disaster Count (ln) with UNPO to test the hypothesis.

To operationalize the presence of the UNPO, we identified whether a UNPO was deployed in a country in a given year using data from the IPI Database (Perry and Smith, 2013). IPI data records the number of personnel for both peacekeeping operations and special political missions. UNPO is a binary indicator that takes the value 1 if UNPO is deployed in a country in a given year and 0 otherwise. As an alternative measure of UNPO, we use the number of UNPO personnel (*UNPO size*). Because the distribution of this variable is positively skewed, we use log transformation.

Identification strategy.

The biggest challenge in analyzing the effect of natural hazards with and without UNPOs on peace agreement implementation is that the impact of natural hazards is not exogenous to the countries where UNPOs are deployed. However, the timing of natural hazards is exogenous because they are not predictable in advance to impact the deployment of UNPOs. It is also possible that UNPOs are deployed in countries that tend to experience episodes of violent conflict and are more fragile and susceptible to damage by natural hazards (Andersson, 2000; Fortna, 2004; Gilligan and Stedman, 2003; Mullenbach, 2005; Oudraat, 1996; Stojek and Tir, 2015). We address these issues by utilizing matching techniques to ensure that both countries with and without UNPOs have a similar propensity to experience natural hazards. Thus, we use Coarsened Exact Matching to reduce the imbalance of covariates (Iacus, King, and Porro, 2012).

Appendix Table B shows the determinants of UNPOs. We measure the experience of natural hazards experience by a measure of the cumulative number of natural hazards observed over the sample period until the given year. The estimated coefficient for this variable on UNPO deployment, is negative and statistically significant (Appendix Table B). We find no evidence that natural hazards lead to stronger UNPOs mandates or preventive deployment of UNPOs, at least in our sample duration. This is consistent with Diehl’s (2018) results that

environmental variables do not influence peacekeeping deployment and a failed adoption of a UN Security Council resolution in 2021. If anything, in our results UNPO deployment appears to be less likely in countries with more previous natural hazards. We also find no evidence of a consistent impact of vulnerability or the number of people affected by hazards as can be seen for the coefficients for Total affected $t-1$ (ln) (Appendix Table B). In terms of other variables, we find a positive and statistically significant coefficient for power-sharing provision. Thus, we use cumulative natural hazards $t-1$ (ln) and Power-sharing provision as covariates for matching. CEM was performed using the MatchIt package (Stuart, King, Imai, and Ho, 2011) in R. Continuous variables were matched using the Sturges formula. After matching, 226 observations remained in the sample. A total of 128 observations without UNPO were matched with 98 observations with UNPO. Fig. 1 shows that both covariates’ balance improved under 0.1 threshold.¹⁵

Control variables:

We further control for factors that might influence both UNPO deployment and peace accord implementation.

First, the past CPA implementation score can impact on the deployment of UNPO and the current CPA implementation score. Some UNPOs are mandated to support or assist in peace agreements. For instance, the mandate of the United Nations Mission in the Republic of South Sudan (UNMISS) included the support for implementation of the Revitalized Agreement.¹⁶ In this sense, as higher levels of overall peace accord implementation are achieved, missions are more likely to be terminated. Moreover, a previous study showed that past CPA implementation scores are positively associated with present CPA implementation scores (Maekawa, Ari, and Gizelis, 2019). Thus, we control for a one-year lagged dependent variable. To account for potential bias,

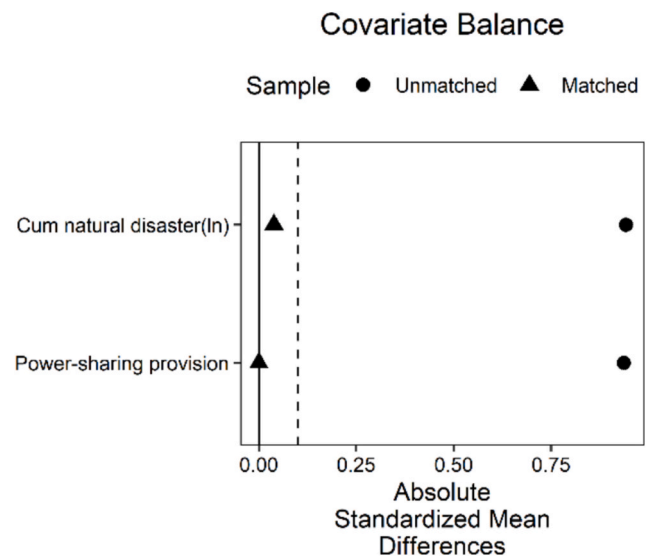


Fig. 1. Covariate Balance.

¹⁵ Please note that the cumulative number of natural hazards is negatively correlated to the deployment of UNPOs (Appendix Table B). There is no evidence that UNPOs are selected in countries prone to natural hazards. As we mentioned earlier, climate concerns are not included in the conflict management decisions by the Security Council. Some of the countries that rank high in natural hazard propensity have never experienced the deployment of UNPOs, even during conflict episodes, such as the Philippines and Pakistan, which both rank among the top 10 countries for geographical, hydrological, and meteorological disaster events (Chaudhary and Piracha 2021).

¹⁶ United Nations Security Council Resolution 2625. (2022). S/RES/265 (2022).

¹³ We removed the UN provisions from the score calculation.

¹⁴ EM-DAT <https://www.emdat.be/>.

we also estimate the models without the lagged dependent variable in Appendix Table C (Keele and Kelly, 2006).

Second, as country characteristics, we control for *GDP p.c.* (ln), *Population* (ln), *Polity2*, *Power-sharing provision*, and *Military size* (ln). First, UNPOs are more likely to be deployed in countries with weak state capacities. In post-conflict reconstruction, peacebuilding is dependent on a government's ability to exercise effective authority over economic, political, and military matters (DeRouen et al., 2010). Lack of state capacity often contributes to the implementation failures of peace accords. We use log-transformed GDP per capita as a proxy for state capacity (Fearon and Laitin, 2003). The data are based on Gleditsch (2002). Second, Gilligan and Sergenti (2008) show that the populations of countries in which the UN intervened were smaller than those of countries in which they did not intervene. Considering that populous countries are more prone to civil wars (Collier and Hoeffler, 2004), peace accords implementation is more likely to fail in such countries. We control for the log-transformed population using Gleditsch (2002). Third, the UNPO is less likely to be deployed in non-democratic countries (Andersson, 2000). The level of democracy particularly influences the implementation of electoral provisions. For the level of democracy, we use Polity 2 from the Polity IV Dataset (Marshall and Gurr, 2018). Power-sharing governments may influence the incentives to renegotiate peace agreements. To control for power-sharing agreements, we use a binary measure of whether the CPA includes the provision of transitional power-sharing government using PAM_ID dataset (Joshi, Quinn, and Regan 2015). We also expect that state armed forces will respond to natural hazards impacting the agreement implementation (Eastin, 2016). Overall, peacekeeping is less likely to be deployed to countries with large army (Fortna 2004). Thus, we control for Military size (ln), measured as the log of military personnel (thousands) in the host state, using Correlates of War Project National Material Capabilities (NMC) Dataset version 6 (Singer, 1988; Singer, Bremer, and Stuckey, 1972). We consider these control variables as particularly relevant to our analysis because countries vulnerable to hazards are also more vulnerable to conflict because of underlying institutional weaknesses.

We also control for conflict characteristics, *Cumulative intensity*, and *Conflict duration* (ln). The UN is more likely to intervene in conflicts with high military and civilian deaths (Gilligan and Stedman, 2003). Conflicts with high intensity and longer duration can lead to generating mistrust among conflict parties, derailing the implementation of an agreement (Kydd, 2000; 2006). To account for cumulative intensity, we use information from the UCDP Conflict Termination Dataset (Kreutz, 2010). Conflict intensity takes the value 1 if the conflict since the onset has exceeded 1,000 battle-related deaths; otherwise, it takes the value 0. To account for conflict duration, we use log-transformed conflict duration.

Although the timing of natural hazards is exogenous to UNPOs and peace accord implementations, their impact may be endogenous to how countries manage natural hazards. Hazard-prone countries tend to be more vulnerable to the overall effects of hazards that impact the implementation of peace accords. Thus, we control for the Cumulative number of natural hazards t_{-1} . To account for population vulnerability, we control for the Total number of affected t_{-1} . Finally, we control for the year count to account for the possibility that easy issues have been resolved faster, and the implementation process has been stalled before the occurrence of natural hazards.

To avoid post-treatment bias, all control variables, except the lagged dependent variable and hazard variables, are measured one year before the signature of the CPA. Because time-series, cross-section data displays both contemporaneous correlation across units and unit-level heteroscedasticity (Bailey and Katz, 2011), panel-corrected standard errors were derived after estimating the linear regressions (Beck and Katz,

1995).¹⁷ We do not use fixed effects in this analysis since the binary indicator of UNPO measurement lacks within-country variation. Instead of providing within-country comparisons, we provide cross-country assessments.

Appendix Table A-II shows a balance table for cases with and without UNPOs. The balance table shows that countries without UNPOs are more prone to natural hazards than those with UNPOs. This suggests that UNPOs are often deployed in countries that experience fewer natural hazards. Therefore, the negative impact of UNPOs during natural hazards on peace accord implementation is underestimated, rather than overestimated

5. Results and discussion

Table 1 reports the linear regression models with PCSE for comprehensive peace agreement implementation scores using a matched sample. Models (1) and (2) use the binary measure of UNPO, while Models (3) and (4) use the continuous measure of UNPO size. Models (1) and (3) present the results without interaction. The results show that while the binary measurement of UNPOs is positive and statistically significant, UNPO size is not statistically significant. Since our hypothesis indicates a conditional relationship where natural hazards exacerbate implementation failure in countries where peacekeepers are deployed compared to countries without UNPOs deployment, we interact the main independent variable with the incident of natural hazards in Models (2) and (4). To interpret the interactive model, Fig. 2 plots the effects of natural hazards on the implementation score with UNPO (left) and without UNPO (right) obtained from Model (2). When no peacekeepers are deployed in a country, increasing the log of natural hazard count from minimum (0) to maximum (2.2) leads to changes in the predicted implementation score from 69.444 with a 95% confidence interval of [67.7, 71.1] to 71.35 with a 95% confidence interval of [69.5, 73.2]. The confidence intervals overlap. When peacekeepers are deployed in the country, increasing the log of natural hazard count from minimum (0) to maximum (2.2) leads to changes in the predicted implementation score from 69.98 with a 95% confidence interval of [68.5, 71.5] to 66.03 with a 95% confidence interval of [63.9, 68.2]. In Model (4), where the personnel size of UNPO is used, the interaction term is negative and statistically significant. These results support the hypothesis that a larger number of natural hazards decrease the levels of peace accord implementation if UNPOs are deployed. However, when we drop the lagged dependent variable, the results for UNPO size are not statistically significant, though the model of binary UNPO remains the same (Appendix Table C).

This might happen because our dependent variable increases over time but does not increase once full implementation has been achieved. The previous year's implementation scores increase the current year's implementation score because of the incremental nature of peace accord implementation. Since the model with the lagged dependent variable captures changes in increments, delays in the implementation of the agreement can have a significant bearing in the process.

Regarding the control variables, in alignment with expectations, military size has a positive and statistically significant effect on the implementation score. On the contrary, higher levels of conflict intensity delay improvements in the implementation score. Interestingly, the year count is negative and statistically significant. This suggests that while the implementation of peace accords faces challenges over time, natural hazards exacerbate the implementation process if peacekeepers divert resources away from the required mandate.

As a robustness check, we re-run our models using random effects to consider the possibility that differences across agreement cases

¹⁷ Because the samples were unbalanced, we calculated the elements of the contemporaneous pairwise correlation. Models were estimated using the `xtpcse` package in Stata.

Table 1

Linear regression models with PCSE for comprehensive peace agreement implementation scores (using matched sample).

	(1) Implementation score		(2) Implementation score		(3) Implementation score		(4) Implementation score	
Natural disaster count (ln)	-0.165	(0.558)	1.278	(0.744)	-0.195	(0.615)	0.868	(0.708)
UNPO	1.427*	(0.666)						
Implementation score t_{-1}	0.899***	(0.032)	0.893***	(0.031)	0.903***	(0.032)	0.902***	(0.032)
GDP p.c.(ln) $pre\text{-}deployment$	-0.597	(0.386)	-0.467	(0.388)	-0.667	(0.360)	-0.637	(0.352)
Population(ln) $pre\text{-}deployment$	-0.156	(0.358)	-0.382	(0.380)	-0.114	(0.356)	-0.323	(0.389)
Polity2 $pre\text{-}deployment$	0.006	(0.067)	-0.032	(0.067)	0.003	(0.065)	-0.015	(0.067)
Power-sharing provision	1.529*	(0.626)	0.929	(0.646)	2.008*	(0.848)	1.605	(0.880)
Military size (ln) $pre\text{-}deployment$	1.050*	(0.518)	1.162*	(0.518)	0.885	(0.487)	1.155*	(0.463)
Cum intensity $pre\text{-}deployment$	-3.159***	(0.946)	-3.053**	(0.947)	-3.000**	(0.942)	-3.021**	(0.921)
Conflict duration (ln) $pre\text{-}deployment$	-0.313	(0.455)	-0.394	(0.448)	-0.278	(0.429)	-0.512	(0.406)
Cum natural disaster (ln) t_{-1}	-0.041	(0.552)	0.480	(0.532)	-0.128	(0.558)	0.357	(0.549)
Total affected (ln) t_{-1}	-0.009	(0.079)	0.001	(0.077)	-0.007	(0.081)	0.006	(0.078)
Year count	-0.757***	(0.189)	-0.802***	(0.184)	-0.799***	(0.205)	-0.876***	(0.199)
UNPO			4.551**	(1.416)				
UNPO*Natural disaster count (ln)			-3.276*	(1.290)				
UN personnel (ln)					0.071	(0.130)	0.442*	(0.194)
Natural disaster count (ln)*UN personnel (ln)							-0.483**	(0.151)
Constant	19.087***	(3.744)	17.707***	(3.905)	20.040***	(3.812)	19.369***	(3.965)
Observations	226		226		226		226	
R ²	0.9122		0.9146		0.9113		0.9142	

Standard errors in parentheses.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

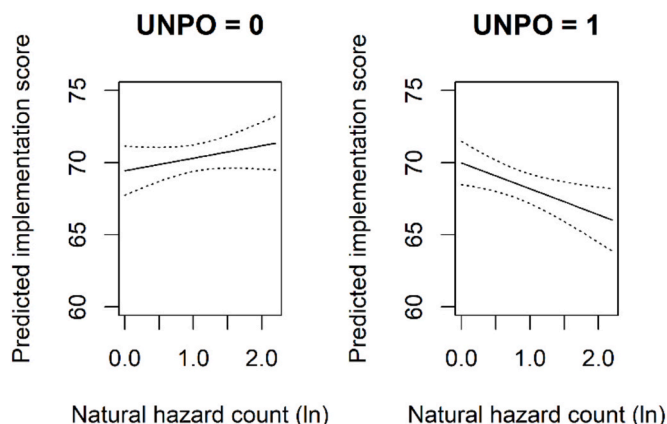


Fig. 2. Predicted implementation score for countries without UNPO (left) and for countries with UNPO (right) with 95% confidence intervals.

influence the implementation score (Appendix Table D). We also include year dummy variables in the model. Because UNPOs’ deployment is influenced by their annually reviewed budgets, the inclusion of year dummy variables would account for the selection process of UNPOs. The result shows that the presence of UNPOs, rather than the size, matters. Second, [Petrova and Rosvold \(2024\)](#) found that disaster relief efforts mitigate the negative implications of violence exposure on political trust only when governments are not involved in violent activities. We control for pre-deployment cumulative number of one-sided violence by government using UCDP One-sided Violence Dataset ([Davies et al., 2024](#); [Eck and Hultman 2007](#)) (Appendix Table E). The main results remain.

5.1. Disaggregating natural hazards

Not all natural hazards may interact similarly with the proposed mechanisms. Some hazards, such as floods, storms, and earthquakes occur rapidly, whereas others, such as droughts, develop over a longer period. Rapid- and slow-onset hazards have distinct effects ([Rhein and Jansesberger 2024](#)). The former has more distinct implications for UNPOs. Furthermore, not all hazards physically impede operations of peacekeeper patrols. We expect floods and storms to impede operations more severely by blocking roads, whereas drought episodes have less of

an impact on peacekeepers’ ability to patrol areas as planned. Compared to floods and storms that affect large areas, earthquakes are more localized to the epicenter where the destruction is most severe. Moreover, severe earthquakes that damage road networks are rare. Thus, we created three variables: Floods/Storms count, Earthquake count, and drought count. Appendix Table F shows that UNPOs are affected only by floods/storms in terms of implementing peace agreements. This finding suggests that hazards that physically impede patrols and operations have a greater impact on UNPOs and peace accord implementation.

We also run disaggregate hazard models without the interaction term to see the effects of hazards on peace accord implementation (Appendix Table G). Only earthquakes have a positive and statistically significant effect on peace accord implementation.

5.2. Disaggregating personnels

It is possible that only trained personnel, such as formed police units (FPU) or troops, go to areas affected by natural hazards, while non-trained personnel, such as civilian police or observers, do not. We investigate the trained versus non-trained personnel effects in Appendix Table H. The results show that only trained personnel combined with hazards decrease peace accord implementation, providing further support to the diversion mechanism if troops of FPUs do not engage in core activities.

5.3. Further analysis I: Testing state capacity mechanism

We argue that dependence on UNPO weakens state capacity when UNPO’s activity is diverted to emergency response. This logic suggests that the negative effect of natural hazards on peace accord implementation is greater when state capacity is low since UNPO substitutes state capacity. Appendix Table I shows that indeed, the higher state capacity the lower the number of peacebuilding mandates (Tasks Assigned to Missions in their Mandates (TAMM) dataset: [Lloyd, 2021](#)), supporting the assumption that UNPOs supplement state capacity when the state capacity is low. In this analysis, we only look at observations where UNPO are deployed in a given year, interacting *Natural hazard (ln)* with *GDP p.c. (ln)* (Appendix Table J). [Fig. 3](#) shows that the negative effect of natural hazards on peace accord implementation is mitigated by higher state capacity, as measured by GDP per capita. This suggests that in countries where governments depend on UNPO to provide

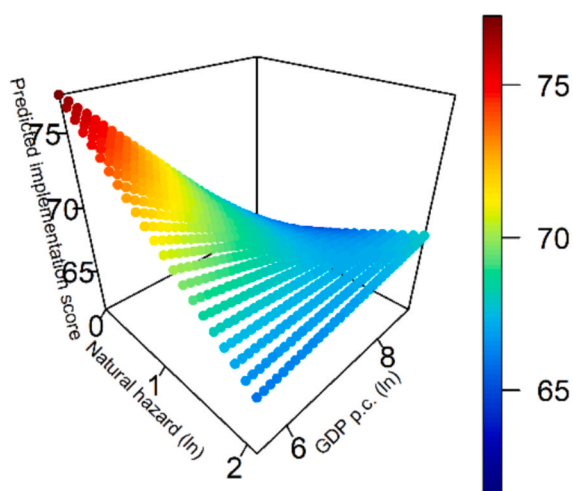


Fig. 3. Predicted implementation score for different values of GDP per capita (ln) and Natural hazard count (ln).

governance, UNPO diversion of resources delays peace accord implementation unless countries have higher levels of capacity and are able to cope with natural hazards.

5.4. Further analysis II: Testing diverting activities mechanism

We test this mechanism in two ways. First, we test the mechanism by focusing on UNPOs mandates that support the diversion of resources. According to an interview with past UNMISS staff, even if the mandate does not directly mention natural hazards, UNPOs are able to act within their mandates while delivering support; for example, civilian protection mandates allow PKOs to engage with hazard relief. Thus, we investigate the mandates, *Civilian protection (PoC)* or *Humanitarian assistance* mandates using the TAMM dataset (Lloyd, 2021). Since those mandates are non-random, we conduct matching using CEM where we include covariates that are statistically significantly associated with those mandates (see Appendix Section 9). Using the matched sample, Fig. 4 shows the predicted implementation score for UNPOs without such mandates (left panel), with mandates (right panel). The result suggests that humanitarian mandates do not affect peace accord implementation regardless of changes in natural hazards. Although this is contrary to expectations, the finding is good news that humanitarian mandates do not adversely impact natural-hazard management. One possible interpretation of this effect is that civilian protection and humanitarian assistance mandates increase external aid not only as funds but also as additional personnel who could work on the ground. If this is the case, UNPOs' activities may be less diverted because external personnel may supplement the diversion.

Furthermore, we test the mechanism by only looking at natural hazards that occur outside peacekeepers' deployment areas. We count how many natural hazards occurred within the same grid cell of peacekeepers' deployments, and by using this information and the total number of natural hazards, we create the variable *Natural hazards count outside of peacekeepers (ln)*. We utilize PRIO-grid-cells (Tollefsen, Strand, and Buhaug, 2012), the Geocoded Disasters Dataset (Rosvold and Buhaug 2021), and the Geocoded Peacekeeping Operations dataset (Gil et al., 2020) to identify the overlap of natural hazards and peacekeepers' deployments. Table 2 shows that natural hazards outside areas of peacekeepers' deployment do not affect the peace accord implementation. Overall, the current empirical analysis does not render support to the diverting activities mechanism.

5.5. Further analysis III: Testing bargaining mechanism

The diversion of resources by UNPOs can also improve perceptions of government capability (Berman, Shapiro, and Felter, 2011; Findley, 2018). We test this argument using an unexpected event during the survey design, enabling a natural experiment (Harding and Nwokolo, 2024; Munoz, Falco-Gimeno, and Hernandez, 2020). After checking Afrobarometer rounds 2, 3, 4, 5, 6, and 7, we found a case where floods occurred during the round while a UNPO had been deployed in the country. The case is Sudan, from Afrobarometer round 7.¹⁸ In this case, the interviews were conducted between July 22, 2018, and August 25, 2018. According to EM-DAT, there were floods in West Kordofan, Kassala, Elgizira, Sennar, and Northern states, which started on July 23, 2018, and ended July 30, 2018. Between August 1, 2018, and September 4, 2018, there was another flood in Kassala, West Kordofan, and Khartoum. According to different sources, Northern Darfur and Red Sea state were also affected (Reliefweb, 2018a). We use observations on 22 July 2018 as the control group (Value 0 for the *Treat* variable) and observations after 24 July 2018 as the treatment group (Value 1 for the *Treat* variable).¹⁹

$$Y_i = \delta \text{Treat}_i + \beta X_i + \epsilon_i$$

Y_i is a four-scale level of trust measurement: 0 = Not at all, 1 = Just a little, 2 = Somewhat, 3 = A lot. The question for the trust we use is about trust in (1) president and (2) ruling party.²⁰ X_i is a demographic control vector including age, gender, education level, and perceived change in severity of flooding over the past 10 years.²¹ We expect that δ is positive due to UNPO activities as mentioned in the theory section. At that time, the United Nations – African Union Hybrid Operation in Darfur (UNAMID) had been deployed in Sudan. UNAMID was providing water, medical, and material support to affected people as well as rehabilitating roads (Radio Dabanga, 2018; Reliefweb, 2018b; UNAMID, 2018). Even if UNAMID engagement was limited to certain areas, upon knowing the hazard management activities of peacekeepers, people are expected to increase their trust in the government at the national level.

Although it is not a perfect comparison, we found another case where there was no UNPO and an unexpected flood occurred during the Afrobarometer round. This is the case in Tanzania, where interviews were conducted between April 30, 2017, and June 17, 2017. An unexpected flood occurred from 8 May 2017 and ended on May 16, 2017, affecting several parts of the country (EM-DAT). We use observations before 7 May 2017 as the control group (Value 0 for the *Treat* variable) and observations after 9 May 2017 as the treatment group (Value 1 for the *Treat* variable).²²

Table Q (Appendix Section 10) and Fig. 5 show that in Sudan, flood exposure increased trust in the ruling party, and this is statistically significant. In Tanzania, flood exposure did not affect trust in the president or the ruling party (Appendix Section 10 and Fig. 6). A recent study of evidence from a survey also shows that earthquakes in Mexico decreased general political trust (Frost et al., 2025). This supports the argument that in Sudan, where UNAMID engaged in hazard relief, trust in the government increased, winning hearts and minds, while in

¹⁸ Available at <https://www.afrobarometer.org>.

¹⁹ The day when the flood started was removed as time of flood and interview are unknown.

²⁰ We removed Don't know, refused to answer, and missing. As a result, for trust in president model, there were 990 treated and 15 untreated observations while there were 983 treated and 14 untreated observations in the trust in ruling party model.

²¹ Regarding flood severity perception, 1=Much more severe, 2=Somewhat more severe, 3=Stayed the same, 4=Somewhat less severe, 5=Much less severe.

²² For trust in president model, there were 1953 treated and 359 untreated observations while there were 1946 treated and 359 untreated observations in the trust in ruling party model.

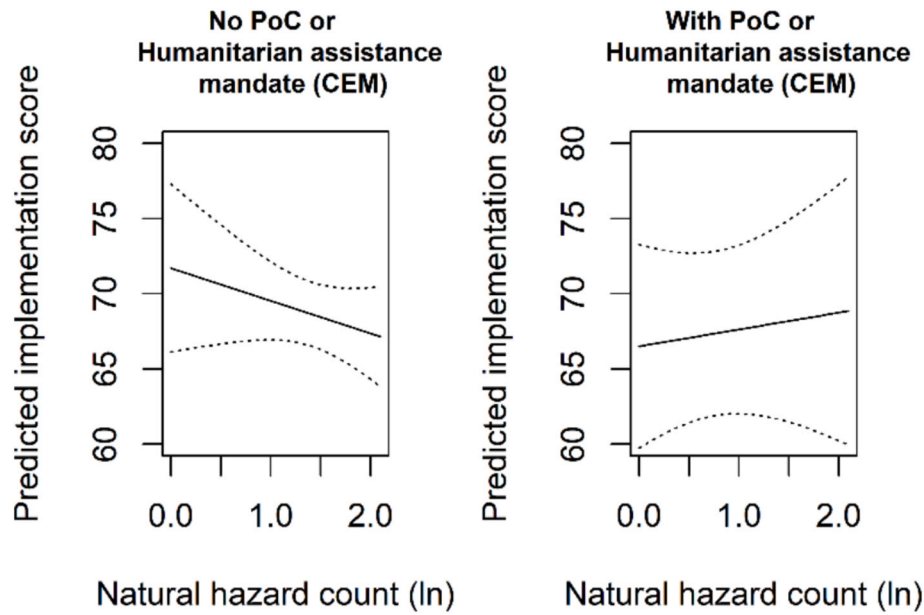


Fig. 4. Predicted implementation score after matching.

Table 2

Linear regression models with PCSE for comprehensive peace agreement implementation scores (Natural hazards occur outside of peacekeepers' locations).

	(1) Implementation score	
Natural hazards count (ln) outside of PKO location	2.499	(1.431)
UNPO	1.089	(0.689)
UNPO* Natural hazards count (ln) outside of PKO location	-3.118	(2.234)
Natural hazards count (ln) overlap with PKO location	-0.176	(1.006)
Implementation score t-1	0.909***	(0.027)
GDP p.c.(ln) pre-deployment	-0.200	(0.296)
Population(ln) pre-deployment	-0.653*	(0.300)
Polity2 pre-deployment	-0.031	(0.080)
Power sharing provision	2.116*	(0.866)
Military size (ln) pre-deployment	0.288	(0.364)
Cum intensity pre-deployment	-2.213*	(0.974)
Conflict duration (ln) pre-deployment	0.661	(0.470)
Cum natural hazards (ln) _{t-1}	-0.168	(0.336)
Total affected (ln) _{t-1}	-0.092	(0.078)
Year count	-0.718***	(0.185)
Constant	20.199***	(3.923)
Observations	271	
R ²	0.9193	

Standard errors in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

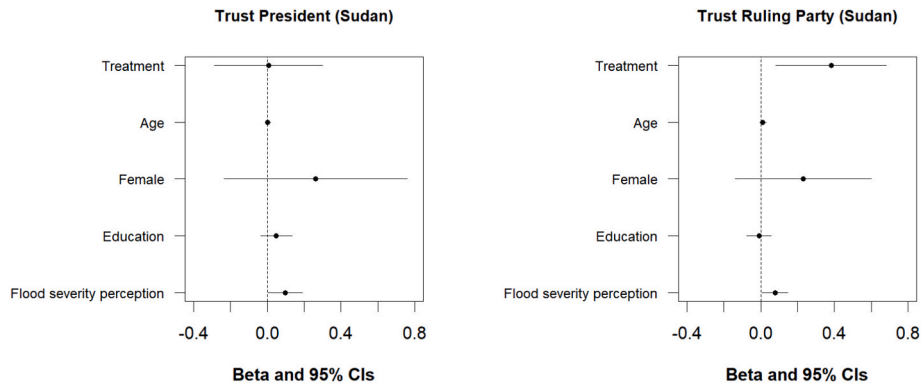


Fig. 5. Effect of flood exposure on trust in Sudan.

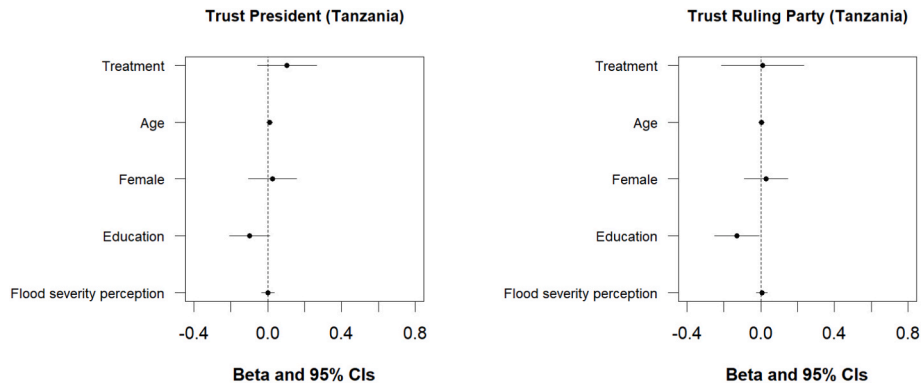


Fig. 6. Effect of flood exposure on trust in Tanzania.

Effect of Natural hazard on UN fatalities caused by malicious acts

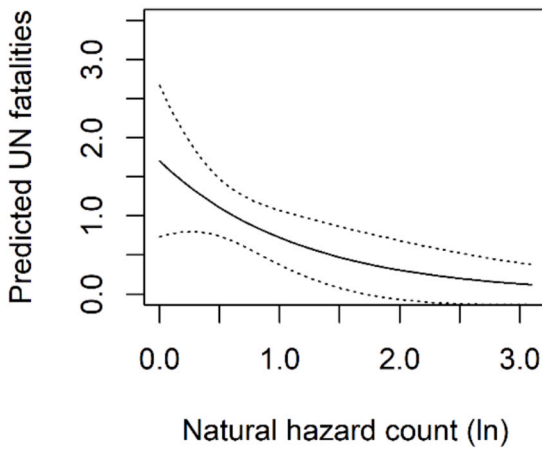


Fig. 7. UN fatalities caused by malicious acts.

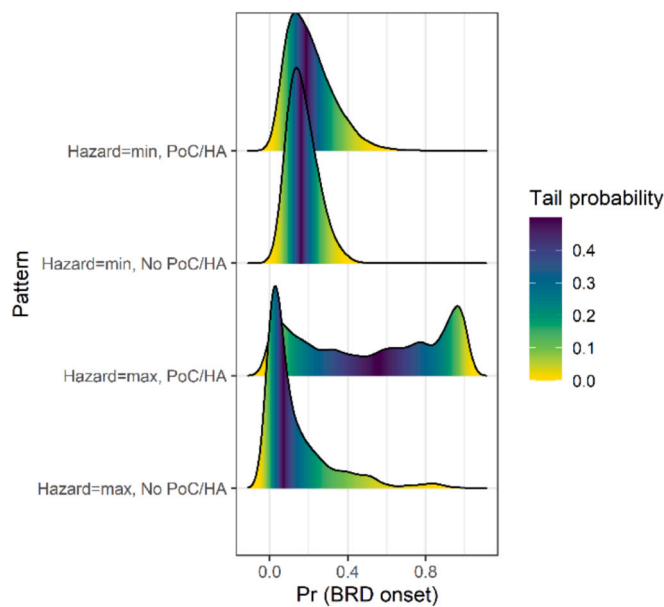


Fig. 8. Onset of battle-related deaths.

countries without peacekeepers, trust is not necessarily boosted.

5.6. Further analysis IV: Testing the opportunity cost of violence argument

We test the opportunity cost of the violence mechanism by exploring whether attacks on peacekeepers increase during natural hazards. If we record higher levels of attacks, we may find support for the idea that delays in implementation lead to lower opportunity costs of violence. An alternative explanation is that diverting resources might reinforce the government and strengthen its position against the rebels. We use UN fatalities caused by malicious acts to capture hostile deaths based on Henke’s (2019) dataset. Fig. 7 shows that as the number of natural hazards increases, the UN fatalities caused by malicious acts decrease. Appendix Table O provides full results.

Second, we explore whether battle-related deaths occur while the UN diverts activities during natural hazards.²³ We utilize matched data and use for further analysis II, where we consider the Civilian Protection/Humanitarian Assistance mandate of the UN sample. As mentioned, these mandates enable PKOs to divert their activities. Since these mandates were established in hard cases, we use a matched sample. Appendix Table P provides the full results. Owing to the small number of observations, we conducted simulations. Fig. 8 shows the density plot obtained by simulating the parameters from a multivariate normal distribution 1000 times. The color represents tail probability. We produced a density plot for four patterns: (1) Minimum natural hazards with both mandates, (2) Minimum natural hazards without mandates, (3) Maximum natural hazards with both mandates, and (4) Maximum natural hazards without mandates. Fig. 8 shows that as the number of natural hazards increases, when UNPOs have those mandates, the predicted probability of battle-related deaths onset increases only slightly. For this analysis, we also conducted a sensitivity analysis following the method proposed by Cinelli, Ferwerda, and Hazlett (2020) and Cinelli and Hazlett (2020), see Appendix Section 12. Figure B in the Appendix shows that the direction of the effect for the interaction term is not robust to confounding factors one, two, or three times as strong as the observed covariate, the year count variable.

5.7. Further analysis V: Testing enhanced cooperation argument in counterfactual scenario

In a counterfactual scenario, the UN is absent and natural hazards occur. We argue that the government and rebel groups often cooperate to manage the aftermath, leading to an increase in trust and cooperation among the fighting parties. In Aceh, Indonesia, a series of hazards hit during the peace accord implementation, including volcano eruptions,

²³ We use the UCDP Battle-Related Death Dataset (Davies, Engström, Pettersson, and Öberg, 2024).

earthquakes, and floods, shifting the local governments' attention to managing the hazards (Gaillard, Clavé, and Kelman, 2008). This led to a delay in drafting the Aceh Governance Law and in preparing new identification documents for local citizens, postponing local elections (Gaillard, Clavé, and Kelman, 2008). However, short-term defection does not yield further defections in peace accord implementation. When elections were held a few months later than planned, they were peaceful (Gaillard, Clavé, and Kelman, 2008). Even if natural hazards do not bring immediate peace agreement implementation, as time passes since the hazards, the overall levels of peace accord implementation increase. In contrast, when UNPOs are present, the diversion of resources has lasting effects, and peace accord implementation remains at low levels. In Appendix Section 13, we use the sample matched on UNPO deployment to conduct sub-sample analyses: one without UNPOs and one with UNPOs. For each sample, we include two main independent variables – *Natural hazard count (ln)* and *Time since the last natural hazard*.²⁴ The former captures the immediate effects during hazards, while the latter captures the delayed effects. The result in Appendix Table Q shows that in the sample without UNPOs, time since the last natural hazard does not influence. However, in the sample with UNPOs, as time since the last natural hazard increases, the level of peace accord implementation decreases. This highlights the trade-off UNPOs face when implementing peace agreements while battling hazards.

5.8. Further analysis VI: Testing resource mobilization mechanism

We expect that the presence of UNPO influences the resource mobilization by the international community during incidents of natural hazards. The added resources and aid inflows tend to support governments, shifting the bargaining power in favor of the government and at the expense of rebels. We evaluate our assumption on the impact of UNPOs on resource mobilization by testing whether UNPOs or personnel size increase aid during natural hazards (Appendix Table R). The measurement of aid is from AidData (Tierney et al., 2011).²⁵ The results show that UNPOs and personnel size increase disaster prevention and preparedness aid inflows providing support for the overall resource mobilization mechanism. We do not include the aid variable in our main models since we think this is likely to be a post-treatment variable, i.e., reflecting an outcome likely influenced by UNPOs, and if so, including the variable can cause post-treatment bias (Montgomery, Nyhan, and Torres, 2018). We show in Appendix Table S that if we include an interaction between disaster aid inflows and UNPOs in the model we find no statistically significant conditional effects on agreement implementation. Our theory does not claim that the effect of UN peace mission during disasters depends on the amount of aid inflows, but rather we claim – as is supported by empirical evidence – that aid inflows follow UNPO engagement, which in turn impacts the contest between the government and rebel groups. UN often make efforts to raise the profile of disaster and increase awareness (O'Brien et al., 2006). The Reports of the Secretary-General, with information about countries where UNPKOs are deployed, often highlights details of humanitarian situations associated with natural hazards. In the case of South Sudan, for example, the effects of heavy rains and floods on hunger were highlighted in the UN Report on December 2020 (United Nations Security Council, 2020). The reporting often prompts other UN humanitarian agencies to cooperate with UNPOs and deliver assistance when needed. For instance, in March 2021, UN launched the South Sudan humanitarian response plan, asking for \$1.7 billion in funding to enable UN aid agencies and partners to deliver assistance (UN News, 2021).

²⁴ This variable takes the value zero during natural hazards and increases by one after the natural hazards.

²⁵ Using the data, we identified “Disaster prevention and preparedness” purpose aid and aggregate such aid at the recipient country level.

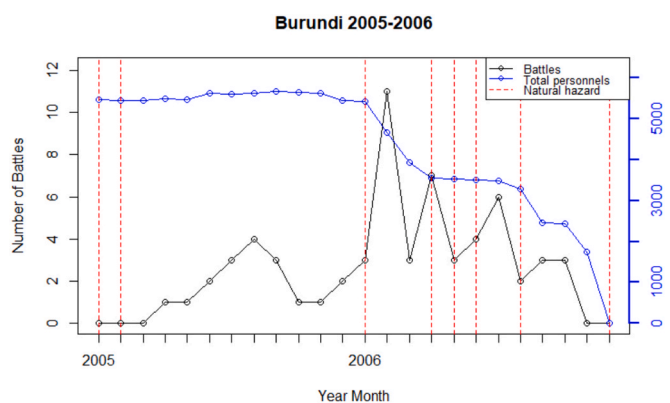


Fig. 9. Natural hazards and number of battles in Burundi 2005–2006. (The number of battles was obtained from the ACLED Dataset (Raleigh, Linke, Hegre, and Karlsen, 2010). The total number of personnel was obtained from data by Kathman (2013).)

5.9. Further analysis VIII: Case study – Burundi

This section provides a short case analysis of Burundi in order to trace the relationship between UNPOs, natural hazards, and peace agreement implementation. We chose this case to illustrate a possible scenario when natural hazards occur. While the hazards are geographically confined, as we argue many consequences manifest at the national level. The case of Burundi illustrates that the diversion of resources influenced the decision of rebels excluded from the peace agreement to attack government forces and civilians.²⁶ In Burundi, after the conflict parties signed an Arusha peace agreement in 2000, the United Nations Operation in Burundi (ONUB) was established in May 2004. The mandate included humanitarian assistance and protection of civilians. ONUB military personnel had cross-over tasks regarding its operational activities including monitoring the ceasefire arrangements, assisting the investigation into the Gatumba massacre, monitoring the implementation of disarmament, demobilization and reintegration activities, and escorting non-governmental organizations and food convoys to the assembly areas (United Nations Security Council, 2004b). During 2005 and 2006, Burundi suffered from several natural hazards, including droughts, storms, and floods, which caused food shortages and emergency needs in several areas, severely damaging public infrastructures (OCHA, 2005a). In January 2005 when a hailstorm hit, WFP supplied 1,789 metric tons of food assistance to over 250,442 persons in various provinces, implying the increased resource mobilization (OCHA, 2005b). In May 2005, it was reported that the ONUB military component provided 12 to 18 daily escorts not only to ONUB, UN agencies, and NGOs but also food convoys, suggesting that ONUB forces were diverted to support the management of natural hazards rather than focusing on the implementation of the peace agreement (United Nations Security Council, 2005b). While UN agencies and personnel addressed the humanitarian needs, the Palipehutu-Forces nationales de libération (FNL), who had been excluded from the peace accord started using violence to hinder humanitarian access (United Nations Security Council, 2005a). FNL continued the violent attacks against the newly integrated National Defence Force (NDF) of Burundi (United Nations Security Council, 2005c). FNL violence continued from April 2005 to October 2006.²⁷

According to the Pretoria Protocol, the NDF was composed of

²⁶ According to United Nations Security Council (2005a), “Violent attacks by FNL on Government forces and innocent civilians, and confrontations between the National Defence Force and FNL continued, especially in some western provinces”.

²⁷ The information is from ACLED Dataset (Raleigh, Linke, Hegre, and Karlsen, 2010).

government armed forces and the National Council for the Defence of Democracy – Forces for the Defence of Democracy (CNDD-FDD) rebels. Thus, demobilization in Burundi was linked to the security sector reform of NDF. In May 2005, 3 months after the disaster, progress on the security sector reform and demobilization were reported as slow (United Nations Security Council, 2005b, 2005c). Shortages of military personnel and continuous attacks from the FNL due to the diversion of ONUB forces delayed the reform and demobilization process.

The natural hazards did not end in 2005. In May 2006, after a week of heavy rainfall, floods displaced thousands in the north-western province of Bubanza. At that time, ONUB directly provided help by diverting the floodwater back to the riverbeds. There was personnel dispatch of its civil engineers to flooded areas (Reliefweb, 2006a). ONUB engineers cleared the cemetery of Mpanda, which was flooded, and repaired a bridge on the main road (Reliefweb, 2006b). Deputy Force commander of ONUB evaluated needs related to the flood emergency and diverted resources to flood management (United Nations, 2006). Simultaneously, very little progress in the areas of security sector reform was reported in the same period, while the FNL carried out attacks even in the vicinity of the Second Vice President's residence (United Nations Security Council, 2006). Fig. 9 highlights that the increase in battle-related deaths occurred before the drawdown of ONUB personnel, and it was associated with natural hazards early in 2005.

To summarize, in the case of Burundi, natural hazards affected ONUB operations through emphasis on humanitarian assistance at the expense of the security sector reform and overall security leading to increased violence and intensified attacks by the FNL, a non-signatory group that used the diversion of resources by ONUB as an opportunity to continue fighting (Quinn, Joshi, and Melander 2019; Stedman, 1997).

6. Conclusion

Natural hazards often occur during the peacebuilding processes. Conflict parties and peacebuilders are challenged by such unexpected events. This study investigates how natural hazards influence UNPO during the period of peace accord implementation. We argue that severe natural hazards impede UNPOs' activities and delay peace accord implementation through three possible mechanisms: (1) by creating shocks in state capacity and resources due to diverted UNPO activities to temporal humanitarian assistance, which delays policy delivery associated with peace accords; (2) by changing the bargaining process; and (3) by reducing the opportunity costs of violence due to disturbed patrols. All three mechanisms create opportunities to renege and renegotiate peace agreements, disturbing the implementation of current peace accords. Using a sample of comprehensive peace agreement implementation between 1992 and 2015, the empirical findings show that when UNPOs are deployed, the level of implementation declines as the number of natural hazards increases. Through extended analyses and using Afrobarometer data, we obtained support for two mechanisms: shocks in state capacity and resources, and changes in the bargaining process in favor of the government.

These findings have important implications. When countries become too dependent on UNPOs during the time of peace accord implementation, environmental hazards can lead to lower implementation scores and even peace accord implementation failure. Promoting programs to enhance host states' resilience during the phase of peace accord implementation might mitigate such effects. For PKOs, it is important to maintain routine tasks while diverting some of their activities to temporary humanitarian activities while battling natural hazards.

Nevertheless, our study has some limitations. Importantly, we relied on cross-country comparisons in this study since we are interested in the levels of peace accord implementation across cases as the outcome, and our theory also focuses on country-level dynamics of how UNPOs influence peace accord implementation given natural hazards. Future research should consider within-country comparisons, holding country-specific contexts constant and theorizing subnational-level mechanisms.

This study has several implications for future research. Extant studies show that UNPOs supplement state capacity (Campbell and Di Salvatore, 2024; Doyle and Sambanis, 2000; 2006). Our study shows an unintended consequence of such supplemented state capacity when natural hazards hit vulnerable states. It would be important to investigate how natural hazards during UNPOs influence outcomes other than peace accord implementation. For instance, future studies might explore whether fighting among other groups deteriorates or recurs due to diverted UNPOs' activities. Alternatively, both negative outcomes and positive outcomes may be important to explore. For instance, thanks to the diverted activities of UNPOs, humanitarian hazards may be less severe than in countries without UNPOs. Second, future research should explore how PKOs are able to support the host country's hazard resilience during peacebuilding. Although PKOs might enhance fragility because of a decline in core UNPOs activities, they also engage in activities to enhance the resilience of the host state. These processes might have diverse outcomes for the host states. Related to this point, it would be important to collect data on UNPOs' diversion activities to identify hazards management strategy and the effectiveness. Finally, future research should explore whether the findings extend to other forms of intervention by regional organizations or international actors beyond UNPOs.

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CRediT authorship contribution statement

Wakako Maekawa: Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Data curation, Conceptualization. **Theodora-Ismene Gizelis:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.worlddev.2026.107387>.

Data availability

The replication data will be available on Harvard dataverse.

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