Balancing the Power: A Comparative Analysis of Hydropower Development and Conflict in the Global Renewable Energy Transition

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Abstract

As the global community increasingly turns to renewable energy solutions to combat climate change, hydropower development is often heralded as a sustainable path to economic growth. However, the impacts of hydropower projects on local environments, economies, and political stability—particularly in regions already vulnerable to conflict—remain underexplored. This research seeks to fill this gap by examining the effects of hydropower development shocks on conflict levels in areas with weak governance and pre-existing tensions. Using a difference-in-differences framework, the study uncovers patterns in how hydropower projects influence conflict. While there is variation across different contexts, the most common finding is that, although conflict generally spikes in the immediate aftermath of hydropower development, it tends to decrease over time and remain low in the long term, ultimately reaching levels lower than pre-hydropower conditions. These findings suggest that early-stage instability is a critical factor in the hydro-development-conflict relationship, underscoring the need for policymakers to prioritize stability and inclusive governance during the initial phases of hydropower projects. This research contributes to a deeper understanding of how renewable energy projects shape conflict dynamics and opens the door for future research to more specifically explore the mechanisms driving these patterns.

Keywords: Hydropower development, Renewable energy, Conflict, Political stability, Governance, Resource management, Resource curse, Difference-in-differences, Economic development, Inequality

Hydropower development, a widely employed solution in sustainable energy strategies, is increasingly intersecting with complex sociopolitical landscapes. While these projects promise clean energy and economic growth, they also have the potential to cause significant disruptions to local communities. As global demand for renewable energy increases, understanding the potential for conflict arising from hydropower projects becomes increasingly important. The sociopolitical implications of hydropower are significant, as evidenced by the historical context where large-scale dam projects have led to displacement and social unrest, highlighting the need for a comprehensive understanding of these dynamics (Uddin et al. 2023; Bene, Scheidel, and Temper 2018). However, this project extends this understanding by examining the large-scale, long-term dynamics of armed conflict triggered by these developments.

Despite the expanding body of research on hydropower, a notable gap persists in our understanding of the specific mechanisms through which these projects contribute to the exacerbation of social and political tensions, particularly on a global scale and through quantitative analysis. Existing studies often focus on the environmental impacts of hydropower, neglecting the broader social and political dimensions. For instance, while some literature emphasizes the ecological consequences of hydropower projects, such as habitat disruption and changes in river ecosystems, there is a lack of quantitative analysis that connects these environmental changes to social conflict (Rieu-Clarke 2020; Habit et al. 2018). This study aims to bridge this gap by examining how hydropower development, particularly in regions with weak governance and resource scarcity, can trigger conflict (Adhikari et al. 2023; Jusi 2011).

The findings of this study have significant implications for policymakers, international organizations, and private sector actors involved in hydropower development. By identifying the causal relationship between hydropower development and conflict, policymakers can design targeted interventions to mitigate risks and promote sustainable development. The integration of sociopolitical considerations into hydropower planning is essential, as highlighted by the need for comprehensive assessments that consider both ecological and social factors (DeRolph, Schramm, and Bevelhimer 2016; Peters et al. 2021). Moreover, the political economy in which hydropower projects are embedded often dictates their outcomes, with governance quality playing a crucial role in determining whether these projects lead to conflict or cooperation (Creţan and Vesalon 2017).

Through a series of quasi-experimental analyses, this research contributes to the existing literature by shedding light on the the causal impact of hydropower development on conflict and the how specific regional contexts shape conflict outcomes. It explores how factors such as governance quality, economic development, and social inequality interact with hydropower development to influence conflict (King and Brown 2018; Ray et al. 2018). Specifically, hydropower serves as a medium through which these fundamental components of society are experienced, potentially exacerbating or sometimes alleviating tensions and conflicts. To address these research questions, this study employs a difference-in-differences (DID) analysis to estimate the causal impact of hydropower development on conflict outcomes. The DID approach leverages the staggered timing of hydropower project implementation across different regions to isolate the treatment effect. By comparing the changes in conflict levels in regions with and without hydropower projects, we can assess the causal impact of these projects on conflict at a larger scale (Adhikari et al. 2023; Ghimire 2021).

The subsequent sections of this paper are organized as follows. First, I will provide a review of the existing literature on hydropower development and conflict, and how this contributes to my argument and hypotheses. Next, I will present these hypotheses and then discuss my research methodology, including the data sources and estimation strategy. I will then present and discuss the empirical findings, analyzing the causal impact of hydropower development on conflict at both the regional and country levels. Finally, I will discuss the policy implications of the findings and conclude the paper.

The Green Resource Curse: Hydropower Development and Conflict

Hydropower development introduces significant disruptions to local environments, economies, and governance systems, leading to conflicts over land use, water rights, and the allocation of benefits (Molle, Mollinga, and Wester 2009; Ziv et al. 2012). In regions with weak or exclusionary governance, such projects can amplify pre-existing grievances, transforming localized discontent into broader resistance movements. This is particularly evident in politically unstable areas, where the lack of inclusive planning and community involvement exacerbates mistrust and fosters opposition, often escalating into violent conflict (Gleick 2003; Wolf 2007). Moreover, in resource-dependent regions, hydropower projects often exacerbate the resource curse[1] by concentrating economic benefits among the elites or powerful, leaving marginalized communities excluded from the wealth generated by such projects. This dynamic can further entrench inequality and deepen social tensions, providing fertile ground for conflict actors to mobilize support (Bakker 2012; Hensengerth 2015). This concentration of resources in the hands of a few, combined with weak governance, intensifies existing inequalities and can destabilize regions further (Pahl-Wostl et al. 2007). This section explores how hydropower development exacerbates conflict, with a particular focus on how governance, regional context, and the distribution of resources shape the outcomes of such projects (Käkönen 2008; Pahl-Wostl et al. 2007).

At its core, hydropower development represents a disruption to local environments, economies, and governance systems. Hydropower projects may lead to conflicts over land use, water rights, and the allocation of benefits, particularly, it must be reiterated, in areas subject to weak or exclusionary governance. In politically unstable areas, these projects can amplify pre-existing grievances, turning localized discontent into broader resistance movements. For example, Huber and Joshi (2015) note that inadequate inclusion of local communities in project planning exacerbates mistrust and fosters opposition, which may escalate to violent conflict. The resource curse can manifest in such settings, where the wealth generated from hydropower development is captured by elites, leaving local populations disenfranchised and more susceptible to conflict-driven mobilization.

Moreover, hydropower projects frequently lead to disparities in wealth and access to resources. These inequalities can fuel social tensions and provide opportunities for conflict actors to mobilize support. Ni et al. (2022) highlight that marginalized communities often view such projects as instruments of external exploitation, while Ogino, Nakayama, and Sasaki (2019) observe that rebel groups can exploit these grievances, portraying themselves as defenders of local interests. This dynamic not only escalates violence but also destabilizes political systems, as factions compete for control over hydropower-related resources (Dukpa et al. 2024). In regions already grappling with resource dependence, the unequal distribution of hydropower's benefits further entrenches the resource curse, exacerbating political and economic instability.

Economic shocks associated with hydropower development are another important factor. Rapid economic change can lead to displacement, increased competition for resources, and spikes in conflict, as noted by Adhikari et al. (2023). These dynamics are particularly pronounced in resource-

[1] The resource curse, a widely recognized concept, refers to the paradox where countries rich in natural resources often experience less economic growth and worse development outcomes due to factors such as poor governance, corruption, and inequality. This phenomenon has been observed in numerous contexts, including hydropower development, where benefits tend to be concentrated among powerful elites, exacerbating social and political tensions (Auty 2001; M. L. Ross 2012; Bates 2008).

dependent regions, where hydropower projects can disrupt traditional livelihoods without delivering on the economic benefits promised to offset the costs. The resource curse exacerbates these challenges, as resource-rich areas often fail to diversify their economies, making them more vulnerable to the volatility associated with large infrastructure projects. Environmental degradation further compounds these issues: beyond the obvious repercussions are political consequences, as communities facing ecological instability may well be expected to resist projects perceived as threats to their survival (Rai and Khawas 2021).

Alternative Perspective: Opportunities for Stability

While the existing literature predominantly suggests that hydropower projects lead to conflict escalation, an alternative perspective proposes that these projects may also create conditions conducive to stability. The assumption is that effective governance and inclusive planning may even transform hydropower projects into instruments of peace. Opperman et al. (2023) discuss how integrating hydropower into broader energy and socio-economic policies can address local grievances, reducing tensions over time. Similarly, Yüksel and Arman (2013) advocate for restructuring renewable energy policies to prioritize equitable resource distribution, fostering long-term stability.

These alternative outcomes depend on adaptive governance frameworks that balance economic, social, and environmental needs. For example, Jager and Smith (2008) suggest that sustainable reservoir management can support ecosystem preservation while fostering cooperation among stakeholders. Such approaches demonstrate the potential for hydropower projects to serve as tools for conflict resolution, provided that they are managed inclusively and equitably.

Regional Variation in Conflict Dynamics

The dynamics of conflict surrounding hydropower development may not be uniform across different regions. Figure 1 shows a global map of levels of unrest with hydropower plant locations overlaid. The figure suggests that the impact of hydropower development on conflict may vary across different regions, highlighting the importance of context in understanding the dynamics of conflict associated with infrastructure development.

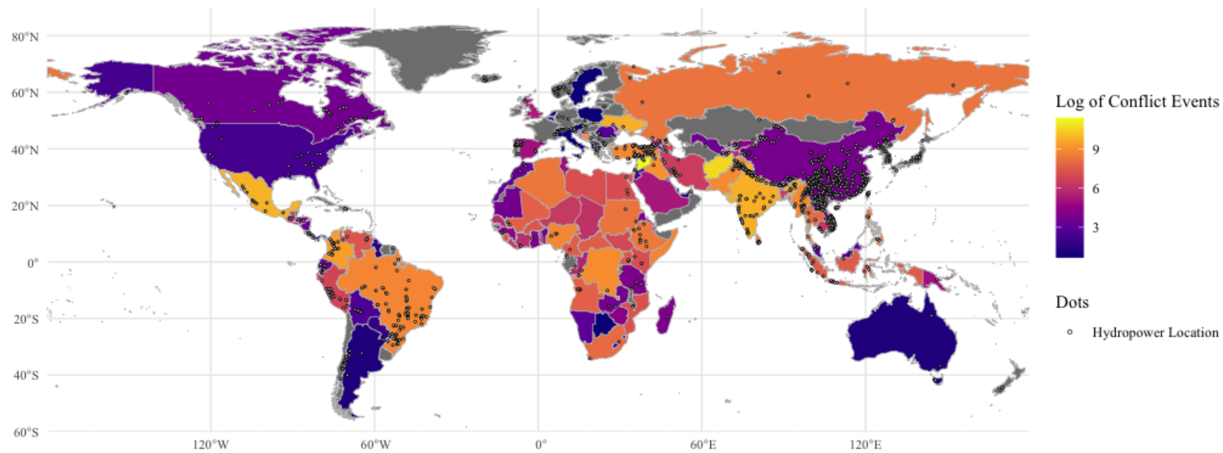

Figure 1: Global Hydropower Locations and Conflict Events (1989-2023). *The sources for this data include UCDP Georeferenced Event Dataset (GED) Global version 24.1 and the Global Hydropower Tracker from the Global Energy Monitor.*

Building on this potential variation, literature indicates that in Asia, particularly in the Himalayan region, hydropower projects often lead to positive outcomes such as enhanced cooperation among countries sharing transboundary rivers. For example, the Brahmaputra River basin, which spans China, India, Bhutan, and Bangladesh, represents a scenario where collaborative management of hydropower resources is crucial to mitigate potential conflicts over water flow and environmental impacts (Xu et al. 2023). Existing scholarship also indicates that the potential for hydropower expansion in this region necessitates stronger cooperation to ensure sustainable development and conflict reduction (Xu et al. 2023). However, there is also variation in sub-regional, country-level effects. For example, in the case of the Salween River in Myanmar, hydropower projects are closely linked to ongoing ethnic conflicts and political instability, suggesting that the introduction of large-scale hydropower can exacerbate violence rather than foster peace (Suhardiman, Rutherford, and Bright 2017).

In Africa, regional dynamics of hydropower development can augment the risks of interstate conflict, particularly in the context of shared river basins. The construction of dams on international rivers can lead to significant disputes over water allocation, as seen in various cases across the continent (I. Dombrowsky et al. 2014). The Koka reservoir in Ethiopia, for instance, has been linked to increased health risks such as malaria, illustrating how hydropower projects can have unintended social consequences that may contribute to local conflicts (Kibret et al. 2012). Furthermore, the Lake Chad region exemplifies how environmental degradation and resource scarcity can lead to violent conflict, particularly when compounded by existing vulnerabilities and socio-economic pressures (Okpara et al. 2015). This understanding of conflict dynamics challenges conventional perspectives in Asia, emphasizing that while hydropower can act as a catalyst for cooperation in some regions, it may also intensify tensions in others, depending on the specific local context. Conversely, in Southern Africa, the coexistence of conflict and cooperation suggests that not all conflict is detrimental and that some forms of cooperation can emerge even in contentious environments (Swatuk 2015).

In conclusion, although hydropower development has the potential to introduce both positive and negative outcomes, the weight of the evidence suggests that it is more likely to exacerbate conflict in regions with pre-existing vulnerabilities. These vulnerabilities—such as weak governance, resource dependency, and political instability—create conditions that amplify the destabilizing effects of hydropower projects. In such contexts, the distributional impacts of hydropower, whether related to water rights, environmental consequences, or wealth disparities, can fuel tensions and resistance movements, sometimes escalating into violent conflict. However, the literature also observes regional variation, with some cases where hydropower projects appear to reduce conflict under specific conditions. This underscores the importance of considering regional and contextual factors when assessing the full spectrum of potential outcomes from hydropower development.

Hypotheses

Building upon the existing literature on resource-based conflicts and infrastructure development, this study explores the potential causal relationship between hydropower projects and conflict outcomes from a comparative macro-level perspective. While prior research has highlighted the role of natural resource management and infrastructure projects in shaping political stability, the specific effects of hydropower on conflict dynamics remain underexplored. This gap is particularly significant given the growing global reliance on hydropower projects as a key source of clean energy and the increasing number of such projects in politically sensitive regions.

The existing literature suggests that hydropower development is likely to exacerbate conflict, particularly in regions with pre-existing vulnerabilities such as weak governance, political instability, and resource dependence. These factors can amplify the destabilizing effects of hydropower projects, particularly when they lead to competition over water rights, wealth inequalities, and environmental degradation. The hypotheses presented in this section focus on/point to the expected escalation of conflict in vulnerable regions while also considering the potential for variation across region.

> **H1:** Hydropower development, as a significant disruption to water resources and regional power dynamics, will increase the likelihood of conflict in regions directly affected by such projects, particularly in areas with pre-existing vulnerabilities such as weak governance, political instability, and resource dependency.[2]

This hypothesis posits that hydropower development introduces disruptions in the local environment and economy that may intensify competition over water resources, exacerbate inequalities, and create new political tensions, all of which heighten the risk of conflict. The likelihood of conflict is expected to be particularly pronounced in regions with governance challenges and ongoing political discontent.

> **H2:** The impact of hydropower development on conflict will vary across regions and countries due to differences in governance, political stability, and resource dependency.

This hypothesis assumes that the effect of hydropower on conflict will not be uniform and will depend on regional factors. In regions with stable and inclusive governance, hydropower projects

[2]The term "regional," as used here, can refer to regions of the world or sub-national regions within a country. In other words, it encompasses both broader geographical scales and more context-specific, localized dynamics.

may have a more neutral or even stabilizing effect, as effective management and cooperation can mitigate potential conflicts. Conversely, in regions with political instability and weak governance, hydropower development is more likely to exacerbate existing grievances and lead to escalated conflict.

Together, these hypotheses suggest that while hydropower development often heightens the risk of conflict, particularly in vulnerable regions, its impact will be shaped by local governance structures, political stability, and resource management practices. Understanding these regional variations is crucial for designing policies that minimize conflict and maximize the potential benefits of hydropower projects.

Data and Methods

The data used in this study includes geospatial information on hydropower development projects from the Global Energy Monitor's Global Hydropower Tracker, capturing hydropower projects worldwide with capacities of 75 megawatts (MW) or more (GEM 2024). The outcome variable is the count of armed conflict events, drawn from the UCDP Georeferenced Event Dataset (GED) Global version 24.1, with event counts aggregated at the unit-year level and defined as events with 50 or more battle-related deaths (Davies et al. 2024). The treatment variable represents the emergence of the first hydropower project in the given unit.

I include all countries in the lower-income and lower-middle-income group categories according to the OECD (2024) because I expect these effects to be particularly profound in more economically vulnerable areas. I analyze both the regional- and country levels. For regions, I focus on lower-income and lower-middle-income areas in the Middle East, Asia, Africa, and Latin America. At the country level, I specifically examine the Philippines, Myanmar, Venezuela, Sudan, Pakistan, Ethiopia, Mali, and Colombia.[3]

The lower-income and lower-middle-income units in the world encompass 474,480 hexagonal 1.25-degree units before disaggregating regionally and country-wise. The analysis spans the years from 1989 to 2024.

The methodology for this study tests hypotheses using the double-robust staggered treatment Difference-in-Differences (DID) framework developed by Callaway and Sant'Anna (2021). This framework is employed to assess the causal effect of hydropower development on levels of armed conflict. The analysis relies on the parallel trends assumption, which is essential for the validity of the DID approach. Formally, the model is represented by Equation 1, where Y represents conflict outcomes:

$$Y = \beta_0 + \beta_1 \text{HydropowerProject} + \beta_2 \text{Established} + \beta_3 (\text{HydropowerProject} \times \text{Established}) + \epsilon \quad (1)$$

where *HydropowerProject* indicates the implementation of a hydropower project in the region, *Established* represents the year in which the project was implemented, and ϵ denotes the error term. Due to the staggered nature of the treatment, the temporal component of when the hydropower project was *Established* is interacted with the location of the project.

To account for potential anticipatory effects, the model includes a one-year anticipation period to capture both early construction stages and behaviors influencing conflict outcomes. Given

[3]The reasons for choosing these specific countries are explained in the robustness section below.

the staggered treatment nature of the data, regions yet to receive hydropower projects ("Not Yet Treated" units) are included as control units alongside regions never treated. This approach strengthens the parallel trends assumption and enhances statistical power.

The estimation method incorporates wild bootstrapped doubly robust standard errors to address heteroskedasticity and serial correlation while mitigating potential model misspecifications. The spatial units for analysis are constructed from global hexagonal polygons at a 1.25-degree resolution. This choice of unit is designed to balance granularity with spatial coherence, ensuring a more accurate representation of regional dynamics. Using hexagonal polygons, rather than traditional political units, helps mitigate sociopolitical confounds and allows for a more precise analysis of the effects of hydropower development.

Parallel Trends

In this context, the parallel trends assumption is based on the expectation that, in the absence of hydropower development, treated and control regions would have followed similar trajectories in armed conflict. This expectation is grounded in arguments about resource abundance and scarcity, encompassing both water-related resources and economic resources or political leverage. Hydropower development can be viewed as a form of resource extraction that alters local dynamics of resource abundance and power distribution (Ogino, Nakayama, and Sasaki 2019).

In units where hydropower projects are implemented, the increased control over water and economic resources may create opportunities for development but also tensions over access, distribution, and political influence (Ahlers et al. 2015). The assumption is that, absent the hydropower treatment, both treated and control regions would face comparable resource conditions—either abundance or scarcity—that shape conflict dynamics. Resource abundance can intensify competition for control over valuable assets, including economic gains and political leverage, while resource scarcity might exacerbate pre-existing tensions (Klomp and Bulte 2013).

Given that hydropower projects alter the distribution of both water resources and economic or political power, it is expected that regions with such projects will experience changes in conflict due to shifts in resource availability and leverage. Regions without hydropower development, while potentially facing different resource pressures, are assumed to follow a parallel trend in conflict behavior before treatment. This comparison allows for a more precise estimation of the causal effect of hydropower development on conflict outcomes. All parallel trends assumptions are satisfied, as demonstrated in Figures 2-13 in the Findings section and supported by the detailed tables provided in the corresponding appendices.

Findings

The findings reveal that the impacts of hydropower development on conflict vary significantly across regions and countries. In some areas, large-scale hydropower projects have led to increased tensions, while in others, these projects have facilitated cooperation and apparent resource sharing. These differences can be attributed to a variety of factors, including the political landscape, pre-existing regional conflicts, and the specific economic conditions in each location. Most commonly, an initial spike in conflict is observed in the first several years after implementation, followed by a decrease over time, leading to overall lower levels in the long term.

Impact of Hydropower Shocks on Conflict by Region

The impact of hydropower development on conflict varies across different regions. Figure 2 shows results in Asia, where the pooled post-treatment period ATT is -5.61; however, this result is not statistically significant (Std. Error: 4.10). This suggests that, while the development of hydropower projects may offer benefits such as improved water distribution and economic opportunities, these factors do not appear to have a significant effect on reducing tensions in the region. However, approximately 15 years after the development of hydropower projects, a statistically significant decline in conflict is observed (ATT = -11.07; Std. Error: 3.46), indicating that the long-term effects of hydropower development may lead to a reduction in conflict.

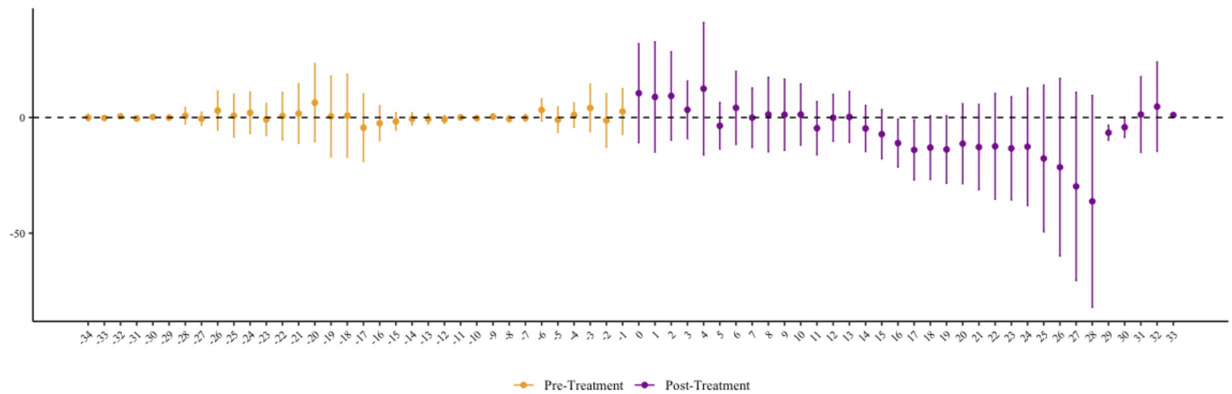

Figure 2: Event Study DID Plot for Asia. *The sources for this data include UCDP Georeferenced Event Dataset (GED) Global version 24.1 and the Global Hydropower Tracker from the Global Energy Monitor (GEM 2024). The X axis shows years to and from the time of treatment. The Y axis shows the ATT Estimates. See Appendix A, Table A.III for corresponding numeric results*. The parallel trends assumption in this model is satisfied.

Figure 3 shows how in Africa, hydropower development does not show a significant effect on conflict. The pooled ATT is 0.32, suggesting a slight increase in conflict, but this result is not statistically significant (Std. Error: 0.47). The data indicates that the introduction of hydropower projects neither exacerbates nor alleviates existing tensions in the region.

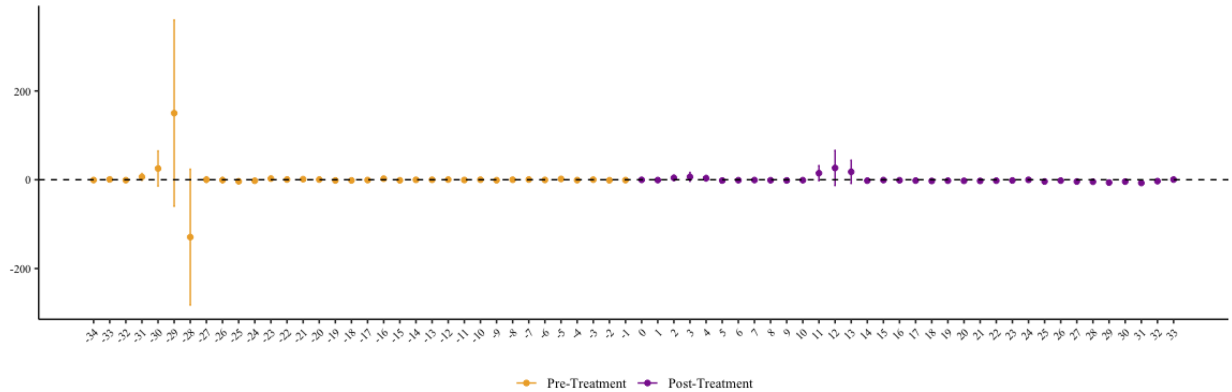

Figure 3: Event Study DID Plot for Africa. *The sources for this data include UCDP Georeferenced Event Dataset (GED) Global version 24.1 and the Global Hydropower Tracker from the Global Energy Monitor. The X axis shows years to and from the time of treatment. The Y axis shows the ATT Estimates. See Appendix A, Table A.IV for corresponding numeric results*. The parallel trends assumption in this model is satisfied.

Similar to Africa, in Latin America, hydropower development does not appear to have a noticeable impact on conflict (see Figure 4). The pooled ATT is -0.27, but this result is not statistically significant (Std. Error: 0.18). This suggests that other factors may play a more significant role in influencing conflict dynamics in the region.

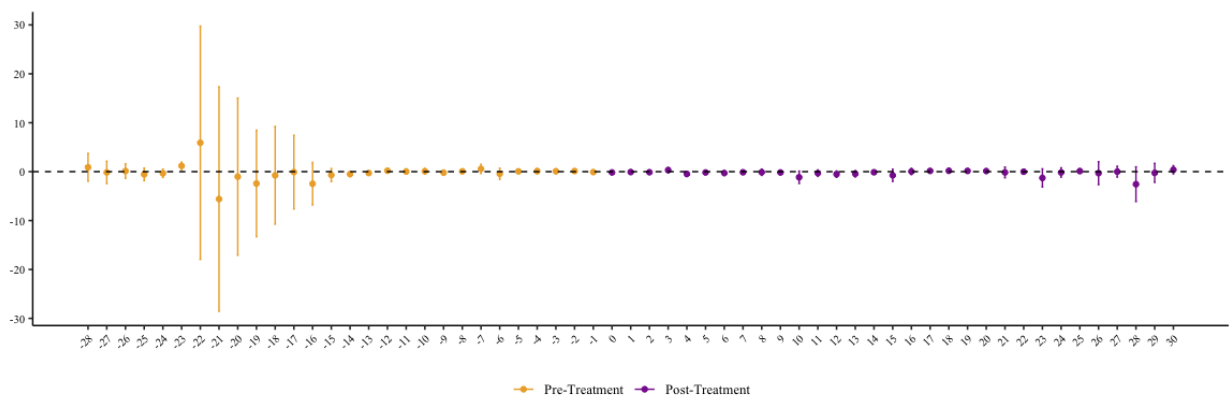

Figure 4: Event Study DID Plot for Latin America. *The sources for this data include UCDP Georeferenced Event Dataset (GED) Global version 24.1 and the Global Hydropower Tracker from the Global Energy Monitor. The X axis shows years to and from the time of treatment. The Y axis shows the ATT Estimates. See Appendix A, Table A.V for corresponding numeric results*. The parallel trends assumption in this model is satisfied.

Figure 5 shows that although pretrends are unstable, indicating unique characteristics of the Middle East where the hydropower shock cannot be isolated, the development of hydropower projects appears to be associated with an increase in conflict. This is statistically significant with the pooled ATT at 11.07 (Std. Error: 5.5594). The data suggests that units likely to receive these projects are already correlated with higher levels of conflict. This makes it challenging to attribute the increase in violence directly to the hydropower development, as pre-existing tensions and factors also play a significant role.

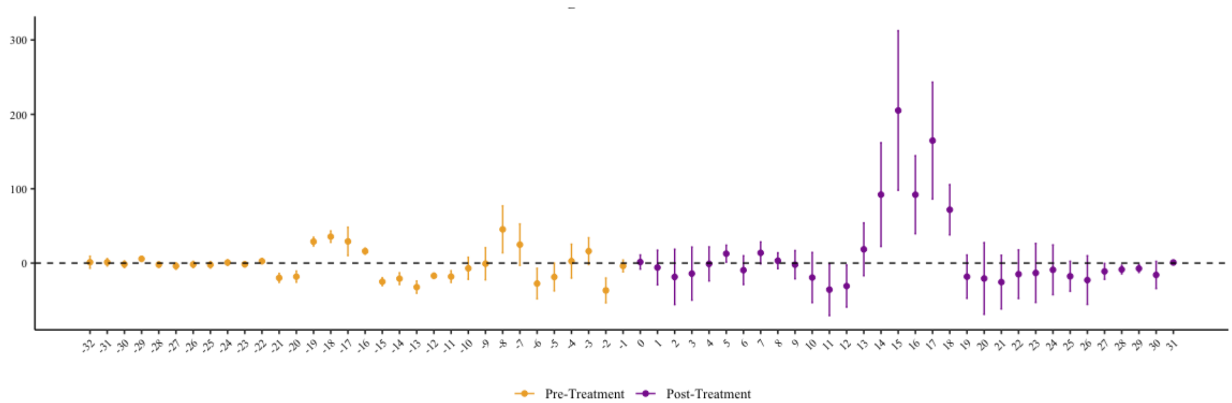

Figure 5: Event Study DID Plot for the Middle East. *The sources for this data include UCDP Georeferenced Event Dataset (GED) Global version 24.1 and the Global Hydropower Tracker from the Global Energy Monitor. The X axis shows years to and from the time of treatment. The Y axis shows the ATT Estimates. See Appendix A, Table A.VI for corresponding numeric results*. The parallel trends assumption in this model is not satisfied.

In all, the relationship between hydropower development and conflict outcomes varies significantly across regions, with distinct patterns emerging. These regional differences can be summarized in Table I:

Table I: Regional Trends in Hydropower Development and Conflict

Region	Trend
Africa and Latin America	No discernible trend
Asia	Hydropower development slightly decreases conflict over time
Middle East	Unstable pre-trends and unique local factors

In both Sub-Saharan Africa and Latin America, hydropower development does not show a clear or consistent effect on conflict outcomes. The data from these regions suggest that hydropower projects neither strongly increase nor decrease conflict levels. This could be due to other more dominant factors, such as entrenched political instability, weak governance structures, or ongoing social and economic inequalities, which tend to overshadow the potential conflict-mitigating effects of hydropower. In these regions, hydropower development may be just one factor among many influencing conflict, with no discernible pattern of its impact on broader conflict dynamics.

In contrast, Asia shows a more consistent pattern where hydropower development appears to slightly decrease conflict over time.[4] The gradual benefits of hydropower—such as improved access to energy, better water management, and the potential for regional cooperation—seem to contribute to stability in some parts of the region. Over time, these factors may help alleviate resource

[4]This effect aligns with the findings of of Xu et al. (2023) as specified above.

competition and promote peacebuilding efforts, reducing the likelihood of conflict Naranjo-Silva and Castillo (2021) and Intralawan et al. (2019). However, this trend may not be universal across all Asian countries, as regional and local dynamics play a crucial role in shaping the outcomes.

The Middle East presents a more complex case. The data show unstable pre-trends in regions where hydropower plants are introduced, indicating that hydropower development in this region is associated with areas already predisposed to conflict. This suggests that the locations in the Middle East receiving hydropower plants often have unique sociopolitical conditions that correlate with an increased likelihood of conflict Sithirith (2021). In these cases, hydropower development may exacerbate existing tensions, particularly over water rights or ethnic and territorial disputes. The region's complex political and resource distribution dynamics mean that hydropower is often intertwined with pre-existing conflict risks, making it a less clear-cut factor in conflict outcomes compared to other regions Matthews and Motta (2015).

These findings suggest that the relationship between hydropower development and conflict is complex and context-dependent, likely influenced by context-specific characteristics. This warrants a deeper dive into country-level dynamics to better understand the nuanced effects of hydropower development on conflict.

Impact of Hydropower Shocks on Conflict by Country

In this analysis, I categorize countries into three groups based on their response to hydropower shocks and subsequent conflict dynamics. This approach allows me to identify country-specific dynamics that were not revealed at the regional level. The first group consists of countries where conflict consistently decreases after a hydropower shock. The second group includes countries where conflict consistently increases following a hydropower shock. The third, and most prevalent group, comprises countries that experience an initial spike in violence, followed by a gradual decrease over time.

First, for countries where conflict consistently decreases after a hydropower shock, the *Philippines* and *Venezuela* are identified. In the case of the Philippines, the pooled ATT is -1.01 (Std. Error: 0.19), which is statistically significant (see Figure 6). The first statistically significant post-treatment period occurs 5 years after the implementation of the hydropower shock, with an ATT of -1.30 (Std. Error: 0.43) . For Venezuela, the pooled ATT is -2.51 (Std. Error: 0.32), which is also statistically significant (see Figure 7). The first statistically significant post-treatment period occurs in the first year after the hydropower development shock, with an ATT of -3.13 (Std Error: 0.35). These results suggest that in both countries, the hydropower shock is associated with a steady decrease in conflict levels over time, indicating that the shock may lead to a stabilization or improvement in the security environment in these regions.

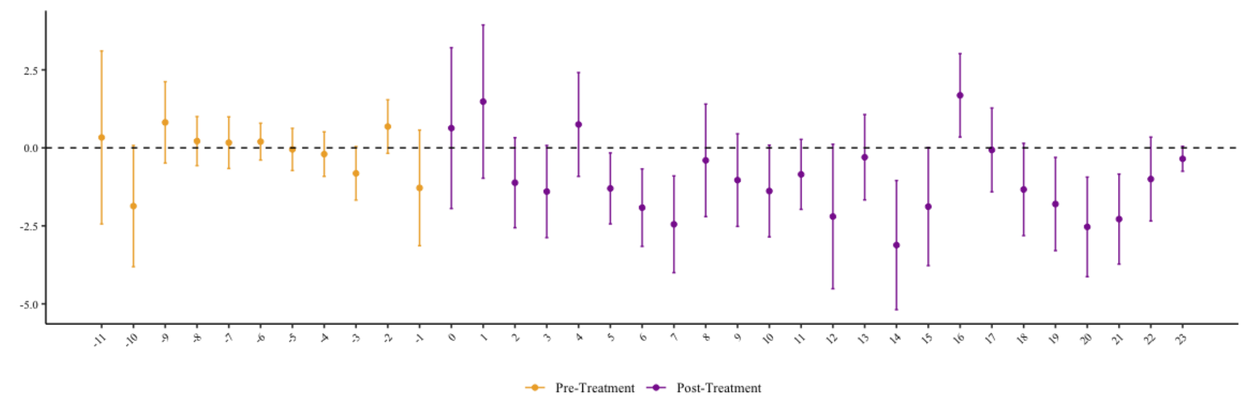

Figure 6: Event Study DID Plot for the Philippines. *The sources for this data include UCDP Georeferenced Event Dataset (GED) Global version 24.1 and the Global Hydropower Tracker from the Global Energy Monitor. The X axis shows years to and from the time of treatment. The Y axis shows the ATT Estimates. See Appendix B, Table A.VII for corresponding numeric results*.

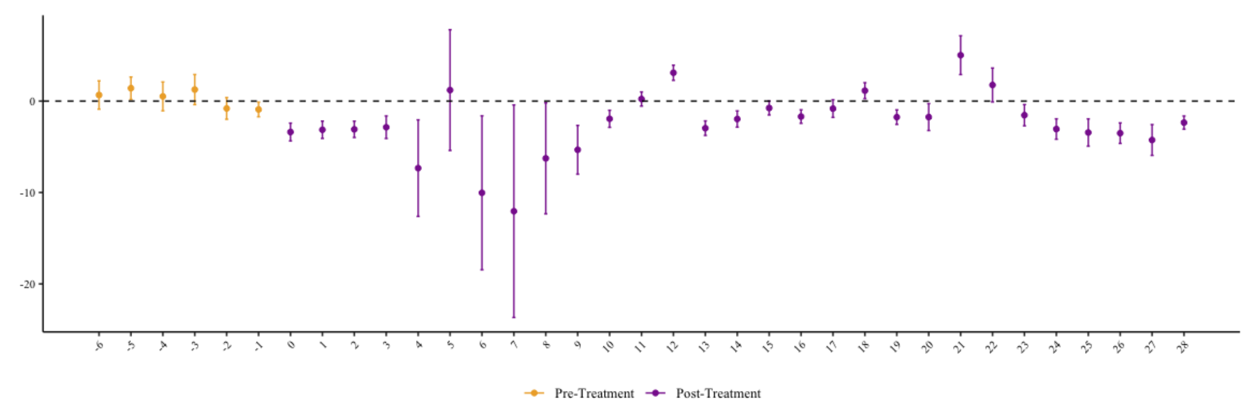

Figure 7: Event Study DID Plot for Venezuela. *The sources for this data include UCDP Georeferenced Event Dataset (GED) Global version 24.1 and the Global Hydropower Tracker from the Global Energy Monitor. The X axis shows years to and from the time of treatment. The Y axis shows the ATT Estimates. See Appendix B, Table A.VIII for corresponding numeric results*.

Second, I show results for countries where conflict consistently increases after a hydropower shock. *Sudan* and *Myanmar* are examples of countries in this category. In Sudan, the pooled ATT is 7.32 (Std. Error: 5.44), which is statistically significant (see Figure 8). The first statistically significant post-treatment period occurs just two years after the hydropower shock, with an ATT of 24.73 (Std. Error: 1.67). In Myanmar, the pooled ATT is 2.41 (Std. Error: 0.55)), which is also statistically significant (see Figure 9). The first statistically significant post-treatment period occurs four years after the hydropower shock, with an ATT of 4.52 (Std. Error: 0.90). These results suggest that hydropower shocks in both Sudan and Myanmar are associated with an increase in conflict, indicating that the shocks may exacerbate tensions or contribute to the escalation of violence. However, these effects seem to stabilize over time, approximately five years after the shock in Sudan and ten years in Myanmar.

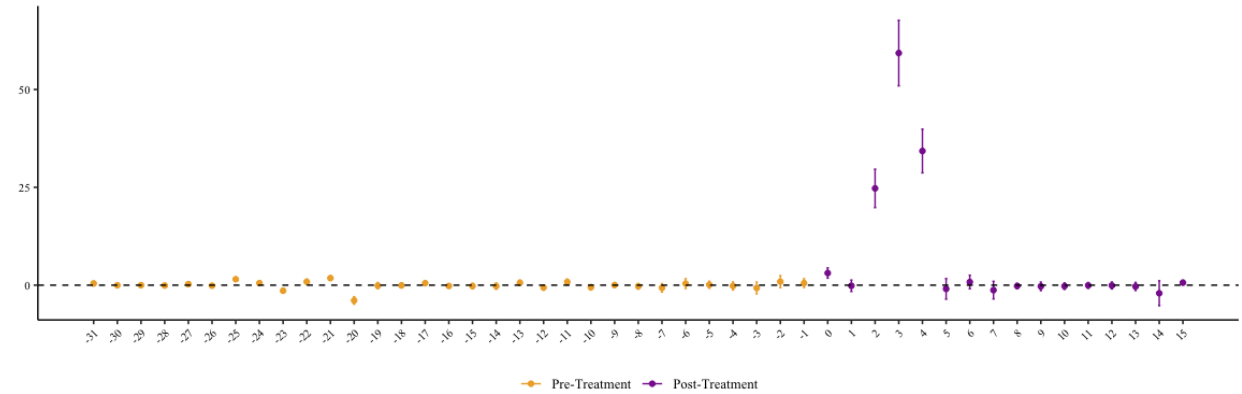

Figure 8: Event Study DID Plot for Sudan. *The sources for this data include UCDP Georeferenced Event Dataset (GED) Global version 24.1 and the Global Hydropower Tracker from the Global Energy Monitor. The X axis shows years to and from the time of treatment. The Y axis shows the ATT Estimates. See Appendix B, Table A.IX for corresponding numeric results.*

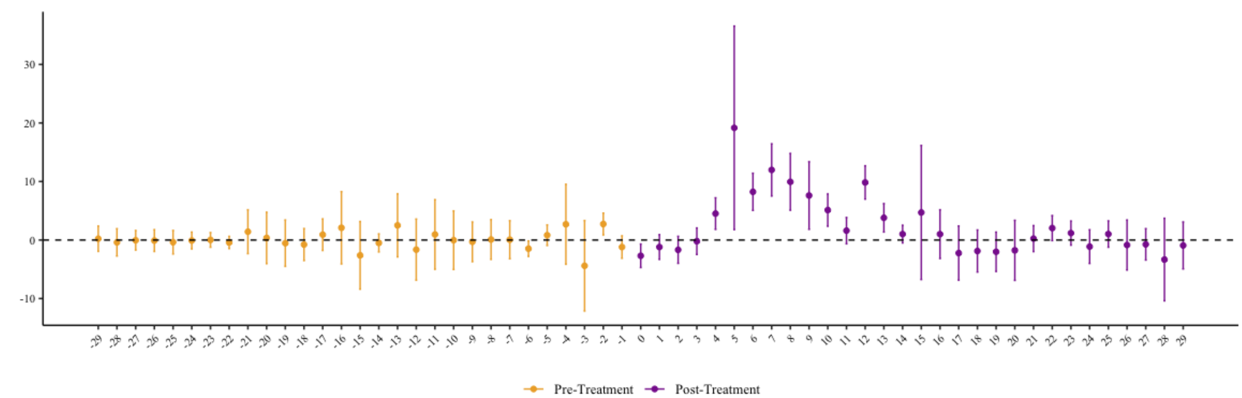

Figure 9: Event Study DID Plot for Myanmar. *The sources for this data include UCDP Georeferenced Event Dataset (GED) Global version 24.1 and the Global Hydropower Tracker from the Global Energy Monitor. The X axis shows years to and from the time of treatment. The Y axis shows the ATT Estimates. See Appendix B, Table A.X for corresponding numeric results.*

Finally, countries that experience an initial spike in violence, followed by a decrease over time, include *Pakistan*, *Ethiopia*, *Mali*, and *Colombia*. These countries exhibit a common pattern where a hydropower shock initially triggers a rise in conflict. However, after some time, conflict levels decrease, potentially reflecting a long-term stabilization effect or adaptation to the shock. These countries show the most complex dynamics, where short-term impacts are more volatile, but longer-term trends suggest a reduction in violence.

For *Pakistan*, the pooled ATT is statistically significant at -19.59 (Std. Error: 6.54), with the first positive spike occurring one year post-treatment at ATT 77.95 (Std. Error: 18.75) (see Figure 10). The first negative post-treatment period occurs 12 years after the hydropower shock, with ATT -19.42 (Std. Error: 2.66), and conflict continues to decline thereafter.

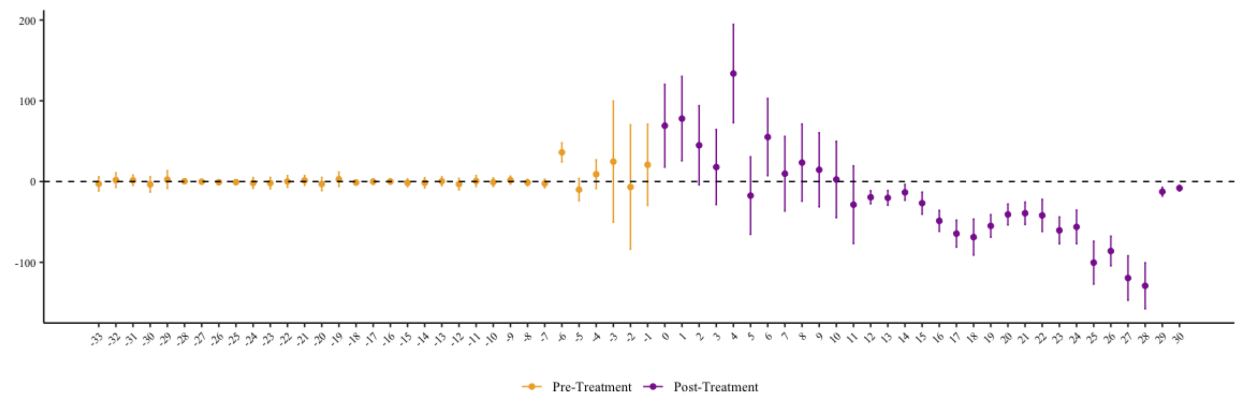

Figure 10: Event Study DID Plot for Pakistan. *The sources for this data include UCDP Georeferenced Event Dataset (GED) Global version 24.1 and the Global Hydropower Tracker from the Global Energy Monitor. The X axis shows years to and from the time of treatment. The Y axis shows the ATT Estimates. See Appendix B, Table A.XI for corresponding numeric results.*

For *Ethiopia*, as shown in Figure 11, the pooled ATT is statistically significant at 12.57 (Std. Error: 0.91), with the first positive spike occurring one year post-treatment at ATT 1.89 (St. Error: 0.49). The first negative post-treatment period occurs 17 years after the hydropower shock, with ATT -5.98 (Std. Error: 1.74).

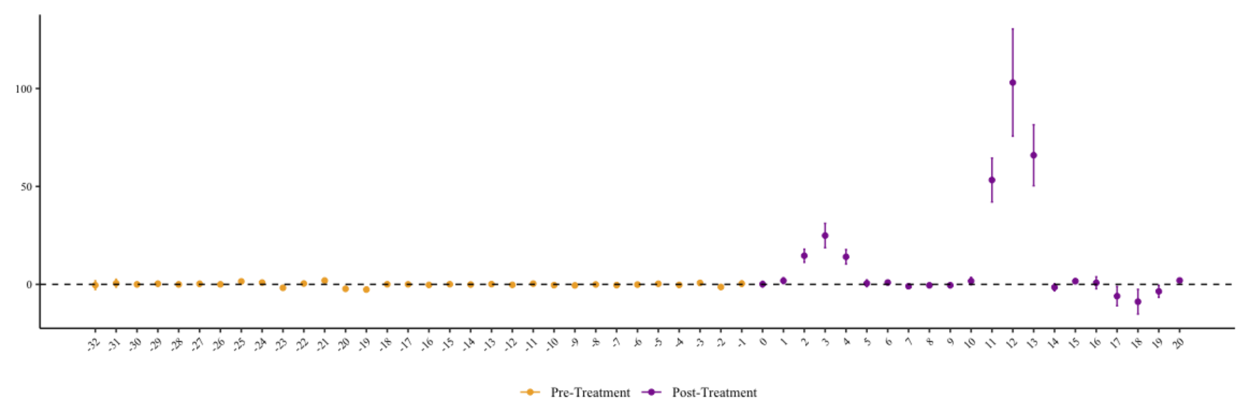

Figure 11: Event Study DID Plot for Ethiopia. *The sources for this data include UCDP Georeferenced Event Dataset (GED) Global version 24.1 and the Global Hydropower Tracker from the Global Energy Monitor. The X axis shows years to and from the time of treatment. The Y axis shows the ATT Estimates. See Appendix B, Table A.XII for corresponding numeric results.*

For *Mali*, the pooled ATT is statistically significant at -1.98 (Std. Error: 0.19) (see Figure 12). The first positive spike occurs 2 years post-treatment with an ATT of 2.92 (Std. Error: 0.69). The first negative post-treatment period is observed 6 years later, with an ATT of -0.25 (Std. Error: 0.07).

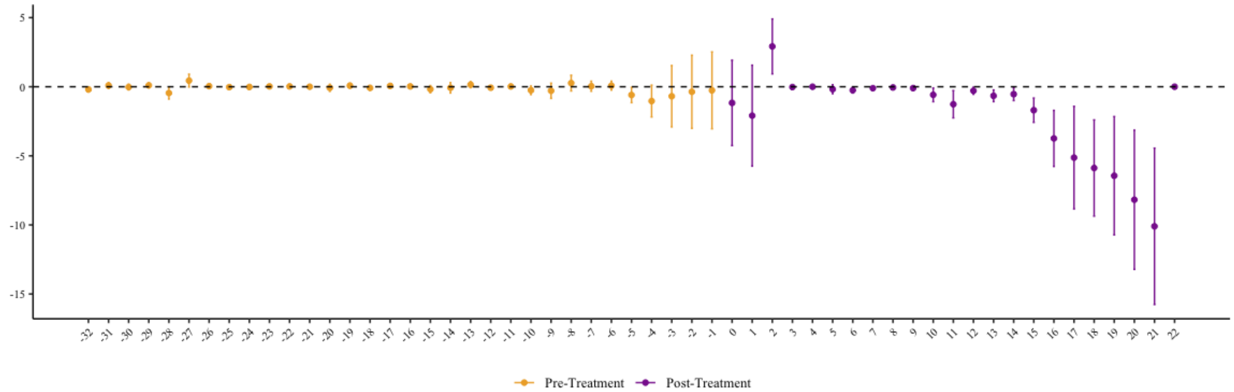

Figure 12: Event Study DID Plot for Mali. *The sources for this data include UCDP Georeferenced Event Dataset (GED) Global version 24.1 and the Global Hydropower Tracker from the Global Energy Monitor. The X axis shows years to and from the time of treatment. The Y axis shows the ATT Estimates. See Appendix B, Table A.XIII for corresponding numeric results.*

in Figure 13 for *Colombia*, the pooled ATT is statistically significant at -4.81 (Std. Error: .99), with the first positive spike occurring one year post-treatment at ATT 21.21 (Std. Error: 2.73). The first negative post-treatment period occurs six years after the hydropower shock, with ATT -6.11 (Std. Error: 0.83).

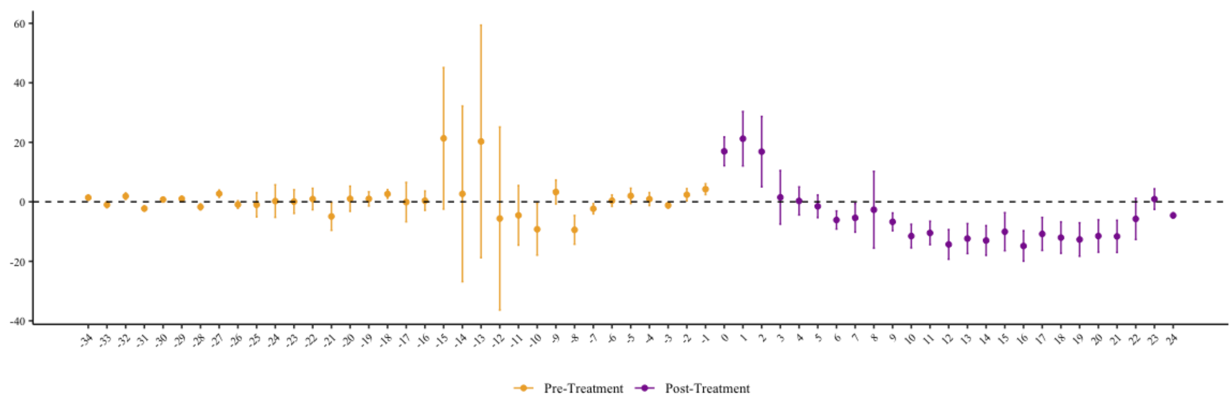

Figure 13: Event Study DID Plot for Colombia. *The sources for this data include UCDP Georeferenced Event Dataset (GED) Global version 24.1 and the Global Hydropower Tracker from the Global Energy Monitor. The X axis shows years to and from the time of treatment. The Y axis shows the ATT Estimates. See Appendix B, Table A.XIV for corresponding numeric results.*

This analysis highlights the diverse impact of hydropower shocks on conflict dynamics across selected countries. To summarize these unique country-level differences, Table II shows country categories based on how they responded to hydropower shocks and subsequent conflict dynamics.

Table II: Conflict Trends After Hydropower Shocks

Trend	Countries
Consistent Decrease	Philippines, Venezuela
Consistent Increase	Sudan, Myanmar
Initial Spike, Then Decrease	Pakistan, Ethiopia, Mali, Colombia

Philippines and Venezuela both fall into the category where a consistent *decrease* in conflict is observed. In these countries, the onset of hydropower shocks is followed by a steady decrease in conflict levels. This suggests that, for these nations, hydropower development leads to stabilization, likely through improved resource management, economic benefits, and regional cooperation. In the Philippines, hydropower projects can mitigate competition for water resources, thereby alleviating tensions among neighboring regions. Effective management of these resources can lead to a more equitable distribution of water, fostering collaboration among local communities (Opperman et al. 2023). In Venezuela, hydropower plays a crucial role in stabilizing the economy and enhancing energy access. The country's reliance on hydropower has historically provided significant electricity, essential for economic activities and local development (Nhiakao, Yabar, and Mizunoya 2022). These findings suggest that hydropower projects can positively impact conflict dynamics in regions with stable governance and effective management. The economic benefits, including improved energy access and economic opportunities, can foster local cooperation and reduce conflict (Rasul 2015).

Sudan and Myanmar are examples of countries where hydropower shocks are associated with an *increase* in conflict. In both cases, hydropower development appears to exacerbate existing tensions, leading to heightened violence M. Ross (2004). In Sudan, hydropower projects trigger disputes over water rights in regions already fraught with ethnic tensions (Ali 2023), while in Myanmar, such developments intensify local conflicts between ethnic groups and the central government over resource control (Alrajoula et al. 2016). The lack of inclusive stakeholder engagement and inadequate environmental assessments in both countries contribute to these tensions, as marginalized communities feel threatened by large-scale projects (Sterl et al. 2021; Aung, Fischer, and Azmi 2020). In these cases, hydropower development does not alleviate conflict but instead exacerbates the challenges of managing shared resources in fragile states (Tun 2019; Allam and Eltahir 2019).

Pakistan, Ethiopia, Mali, and Colombia exhibit the most common pattern where hydropower shocks lead to an *initial rise* in conflict, followed by a *gradual decrease*. This pattern suggests that while hydropower may initially trigger disputes—possibly due to resource allocation conflicts—over time, these countries may experience stabilization as communities adapt to the new resource distribution or as governance structures evolve to manage the changes. In Ethiopia, hydropower projects on the Nile River have led to tensions with downstream countries, but the potential economic benefits and improved infrastructure may contribute to conflict resolution over time (Degefu, He, and Jian 2015). Similarly, in Pakistan, the construction of large dams and hydropower projects has historically caused conflicts between provinces; however, the long-term benefits of improved water management and energy supply can help reduce those tensions (Buhaug 2015). The governance of shared water resources, as seen in various hydropower projects, plays a crucial role in mitigating conflicts and fostering cooperation among affected communities (Ingrid Dombrowsky and Hensengerth 2018). Moreover, the adaptation of local communities to these hydropower developments can lead to improved livelihoods and more sustainable resource management, ultimately contributing to conflict resolution (Ochieng et al. 2022).

These findings highlight the importance of considering both regional and country-specific dynamics when assessing the impact of hydropower on conflict, suggesting that the relationship between development projects and conflict is influenced by a range of political, economic, and social factors Polanco (2018) and Baurzhan, Jenkins, and Olasehinde-Williams (2021).

Robustness

To ensure robustness in the analysis, I overlay a hexagonal grid with a resolution of 1.25 degrees on the global map. This choice of grid is motivated by the need for a consistent spatial representation that accounts for the Earth's curvature, as rectangular grids can lead to uneven area distributions, especially near the poles. Hexagonal grids, in contrast, offer a more uniform coverage with less distortion in terms of spatial area, making them ideal for analyzing global patterns (Kimerling et al. 1999). The 1.25-degree resolution provides a balanced trade-off between granularity and computational feasibility, ensuring that the spatial resolution is sufficient to capture relevant regional dynamics without overwhelming the model with excessive detail. This approach is widely used in geospatial analysis, providing both clarity and precision. The resulting grid can be visualized in Figure A.14 in Appendix E.

The countries included in this analysis were selected for several reasons. Initially, I focused on countries within the OECD's lower and lower-middle-income groups, as these nations are often characterized by distinct economic and developmental challenges that make them particularly relevant for studying the impact of hydroelectric development on conflict (OECD 2024). The focus on these groups ensures a more homogeneous sample, reducing the potential for confounding factors related to income disparities or differences in industrial development. To investigate the causal relationship between hydroelectric development and conflicts, I ran a difference-in-differences loop across all countries in these groups. However, most models did not converge, primarily due to insufficient pre-treatment trends, overly unbalanced pre- and post-treatment periods, or the presence of 'too small' groups (Callaway and Sant'Anna 2021). Several models that did converge yielded null results, indicating the presence of many additional confounders influencing hydroelectric development in these countries. Such null findings align with regional evidence, particularly for Africa and Latin America, where the complexities of development and political dynamics often obscure clear causal relationships. A detailed summary of the country selection process and model results can be found in Table A.XV in Appendix C.

Finally, for robustness, I ran several alternative model specifications, including dropping the anticipation period and using a never-treated control group instead of the not-yet-treated control group. Dropping the anticipation period allows for insight of excluding any pre-treatment effects that could potentially bias the results aside from the development itself, ensuring that only the post-treatment period is considered in the estimation of treatment effects. Using a never-treated control group, as opposed to the not-yet-treated group, provides a more stringent, or conservative, test by comparing treated countries to those that have never been exposed to the treatment, further minimizing potential bias from spillover or other treatment-related factors. These alternative specifications yield results that remain highly consistent across models, reinforcing the robustness of the findings. The average pooled ATT estimates for these alternative models are presented in Table

A.XVI in Appendix D.

Discussion

To recap the findings, the regional impact of hydropower development on conflict varies. In Asia, while the pooled post-treatment effect is not statistically significant, there appears to be somewhat of long-term decline in conflict observed approximately 15 years after hydropower development. In contrast, in Africa and Latin America, hydropower development does not have an effect on conflict at the regional level. Finally, in the Middle East, the pre-existing tensions and instability somehow correlated with green development makes it difficult to isolate the direct impact of hydropower development on conflict.

At the country level, while some countries, such as the *Philippines* and *Venezuela*, experience a decrease in conflict following hydropower development, others like *Sudan* and *Myanmar* see temporary increase in violence that stabilizes over time but does not appear to drop below the conflict level predating the introduction of hydropower. However, this third group, including *Pakistan*, *Ethiopia*, *Mali*, and *Colombia*, does reflect this trend and exhibits initial spikes in conflict, followed by a gradual, statistically significant and consistent reduction in the long run.

The variations in findings across regions and countries suggest that the effects of hydropower development on conflict are not uniform. Potential reasons for these discrepancies include governance, political stability, resource dependency, conflict financing, and economic development shocks. In the context of the Philippines and Venezuela, the results indicate that hydropower project emergence leads to a decrease in conflict. This phenomenon can be attributed to the potential for hydropower to enhance local governance structures and provide economic opportunities that foster political stability. Creţan and Vesalon (2017) emphasize the importance of political power and institutional frameworks in hydropower development, suggesting that effective governance can lead to beneficial outcomes in conflict-prone regions. The establishment of hydropower projects can necessitate collaboration among various stakeholders, enhancing social cohesion and reducing tensions.

Conversely, in Sudan and Myanmar, the introduction of hydropower projects appears to exacerbate conflict. This may be linked to the existing political and social tensions in these regions, where hydropower development may be perceived as a threat or disruption to local communities and their resources. Huber and Joshi (2015) argue that hydropower projects can generate conflicts due to the disjuncture between local expectations and the realities of project implementation, particularly in politically vulnerable areas. The lack of inclusive governance frameworks in these contexts leads to increased grievances and resistance from affected communities, thereby escalating conflict rather than alleviating it.

In Colombia, Mali, Pakistan, and Ethiopia, the initial spike in conflict following hydropower development can be attributed to resource dependency and economic shocks. These projects often disrupt local economies and resource availability, leading to increased competition for resources (De Faria et al. 2017). Rustad and Binningsbø (2012) note that natural resource management can trigger conflict recurrence, particularly when local populations feel marginalized or deprived. Disputes over land use, water rights, and the distribution of economic benefits from hydropower projects can exacerbate preexisting conflicts.

Hydropower projects often lead to disparities in wealth and resource distribution, fostering social tensions as local communities may feel marginalized by external developers or government authorities (Ni et al. 2022). Conflict actors can exploit these inequities, positioning themselves as defenders of local interests and mobilizing support against the government (Ogino, Nakayama, and Sasaki 2019). Environmental degradation and social insecurity resulting from hydropower projects amplify existing grievances, providing a narrative for rebel groups to challenge state authority (Rai and Khawas 2021). Competition for control over hydropower resources can destabilize local political dynamics, further escalating tensions (Dukpa et al. 2024).

Effective governance can integrate hydropower projects into broader energy policies, addressing socio-economic needs while minimizing negative impacts on local communities and ecosystems (Opperman et al. 2023). Yüksel and Arman (2013) emphasize the importance of restructuring policies to prioritize socio-economic considerations in renewable energy development, which can lead to more equitable resource distribution and reduced tensions. As governance frameworks evolve to integrate these principles, sustainable reservoir operation—balancing hydropower generation with ecosystem preservation—becomes increasingly feasible, offering a path toward both long-term conflict resolution and sustainable development in hydropower-impacted regions (Jager and Smith 2008).

Governments should promote inclusive public policy frameworks that engage local communities in decision-making processes related to hydropower development. This approach can help mitigate the adverse effects of resource dependency and ensure equitable distribution of the benefits of hydropower.

This study's findings suggest that hydropower's effects on conflict are highly context-dependent. A limitation of this study is the lack of strong pretreatment trends across all countries in the data, which constrains the ability to analyze the patterns across a broader set of countries. Nevertheless, future research should build on this work by focusing on the substantive dynamics in the countries where effects of hydropower development on conflict have been observed. In these cases, it will be important to identify the underlying mechanisms driving the varying results. By investigating the specific factors that influence the relationship between hydropower development and conflict in these countries, future studies can provide deeper insights into the causal pathways leading to more robust policy recommendations.

The effects of hydropower shocks on conflict are influenced by various factors, including governance, political stability, resource dependency, conflict financing, and economic development shocks. The contrasting experiences of countries like the Philippines and Venezuela versus Sudan and Myanmar highlight the critical role of governance in shaping conflict dynamics. Understanding these country-specific dynamics is crucial for policymakers seeking to mitigate the potential adverse effects of hydropower projects on peace and stability. Successful integration of hydropower projects into local economies requires a nuanced understanding of these dynamics and a commitment to fostering inclusive governance practices.

Conclusions

This study examined the relationship between hydropower development and conflict dynamics, with a particular focus on the role of governance, resource distribution, and political instability in shaping the outcomes of such projects. The findings indicate that hydropower projects can exacerbate social tensions, particularly in regions with weak governance or exclusionary political systems. Additionally, the results suggest that the resource curse framework applies not only to traditional resource extraction but also to ”green” or sustainable development projects, where disparities in wealth and power distribution can lead to conflict and political instability.

These findings contribute to the literature on environmental conflict and development by reframing the resource curse to include ”green” projects such as hydropower. By examining how hydropower development interacts with local governance systems and resource distribution, this study highlights the unintended negative consequences of seemingly positive development initiatives. The results have practical implications for stakeholders such as international development organizations, governments, and NGOs involved in hydropower projects (Ogino, Nakayama, and Sasaki 2019). These actors must consider the potential for exacerbating inequalities and local grievances when planning and implementing such projects. Policymakers must consider adopting more inclusive and transparent planning processes, ensuring that marginalized communities are engaged and that the benefits of hydropower are more equitably distributed.

The study was limited by its focus on specific geographic regions and the availability of data on the full scope of hydropower projects around the globe. Moreover, while major trends were statistically isolated, the deeper mechanisms behind the interactions between hydropower development and conflict should be further explored. Future research could examine the long-term effects of hydropower development on political stability and social cohesion across a broader range of regions and governance contexts. Additionally, further studies could investigate the role of international actors and financing in shaping the outcomes of hydropower projects, particularly in politically unstable regions.

In conclusion, this research provides valuable insights into the complex dynamics between hydropower development and conflict. By reframing the resource curse to include the environmental and social consequences of ”green” development projects, we can better understand and address the challenges associated with sustainable energy transitions in fragile states. It is essential that development initiatives consider not only environmental sustainability but also the political and social dimensions that shape their long-term success.

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Data and Code Availability

All raw source data, final data outputs, along with the code for data merging, models, and visualizations used to generate all figures and tables, will be made publicly available on the author’s GitHub repository upon the acceptance of the article. The URL details for this repository are currently redacted for double-blind peer review purposes.

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Appendices

Appendix A DID Event Results Tables for Regional Models

Tables A.III-A.VI below show the dynamic results of the Callaway and Sant'Anna (2021) double robust staggered treatment regional event plots shown above in Figures 2-5.

Table A.III: Event Study Dynamic Effects for Asia

Event Time	ATT Estimate	Std. Error	[95% Simult. Conf. Band]
Pooled	-5.6077	4.1035	[-13.6504, 2.435]
-34	0.0061	0.4801	[-1.3927, 1.4050]
-33	-0.2037	0.2588	[-0.9579, 0.5504]
-32	0.4799	0.3082	[-0.4182, 1.3780]
-31	-0.4204	0.3015	[-1.2988, 0.4580]
-30	0.2295	0.2779	[-0.5801, 1.0391]
-29	-0.0417	0.3342	[-1.0156, 0.9322]
-28	0.7428	1.2013	[-2.7577, 4.2433]
-27	-0.5268	0.9688	[-3.3497, 2.2961]
-26	3.0209	2.8729	[-5.3501, 11.3920]
-25	0.8198	2.9203	[-7.6895, 9.3291]
-24	2.0445	3.1213	[-7.0505, 11.1395]
-23	-0.8472	2.1692	[-7.1680, 5.4736]
-22	0.6268	3.2684	[-8.8968, 10.1504]
-21	1.7329	4.2170	[-10.5546, 14.0204]
-20	6.4461	5.5252	[-9.6532, 22.5454]
-19	0.4807	5.5202	[-15.6042, 16.5656]
-18	0.8100	5.7881	[-16.0554, 17.6754]
-17	-4.3736	4.7325	[-18.1632, 9.4161]
-16	-2.4934	2.5152	[-9.8224, 4.8356]
-15	-1.6777	1.2609	[-5.3516, 1.9962]
-14	-0.5581	0.8540	[-3.0464, 1.9301]
-13	-0.6225	0.7250	[-2.7351, 1.4900]
-12	-0.7940	0.5368	[-2.3582, 0.7702]
-11	0.0462	0.3645	[-1.0160, 1.1083]
-10	-0.2619	0.3126	[-1.1729, 0.6490]
-9	0.4005	0.4023	[-0.7718, 1.5728]
-8	-0.5629	0.4417	[-1.8498, 0.7241]
-7	-0.1672	0.5390	[-1.7377, 1.4032]
-6	3.2711	1.7720	[-1.8921, 8.4344]
-5	-0.9722	1.7954	[-6.2036, 4.2593]
-4	1.1048	1.6762	[-3.7793, 5.9888]
-3	4.1429	3.4653	[-5.9543, 14.2401]
-2	-1.2624	3.7469	[-12.1802, 9.6555]
-1	2.6234	3.4408	[-7.4024, 12.6492]
0	10.5262	7.8709	[-12.4081, 33.4605]
1	8.8782	7.4820	[-12.9231, 30.6796]
2	9.3324	5.5971	[-6.9765, 25.6413]
3	3.3464	3.9773	[-8.2427, 14.9355]
4	12.4527	8.6579	[-12.7750, 37.6804]
5	-3.5609	3.0718	[-12.5114, 5.3897]
6	4.1978	5.3904	[-11.5090, 19.9046]
7	-0.0628	4.3613	[-12.7708, 12.6453]
8	1.3089	5.1737	[-13.7665, 16.3843]
9	1.2230	4.8652	[-12.9532, 15.3993]
10	1.3003	4.5512	[-11.9610, 14.5616]
11	-4.6209	3.6086	[-15.1357, 5.8939]
12	-0.1051	3.5706	[-10.5093, 10.2991]
13	0.2532	3.8562	[-10.9831, 11.4895]
14	-4.7373	3.4625	[-14.8265, 5.3518]
15	-7.2053	3.5407	[-17.5222, 3.1117]
16	-11.0726	3.4615	[-21.1586, -0.9865]*
17	-14.0039	4.2500	[-26.3878, -1.6201]*
18	-12.9837	4.3658	[-25.7049, -0.2626]*
19	-13.8052	5.0919	[-28.6422, 1.0318]
20	-11.2960	5.7580	[-28.0739, 5.4820]
21	-12.7685	6.6734	[-32.2137, 6.6767]
22	-12.4423	6.9820	[-32.7867, 7.9021]
23	-13.3241	6.8242	[-33.2085, 6.5604]
24	-12.6277	8.7197	[-38.0353, 12.7799]
25	-17.7109	10.4587	[-48.1857, 12.7639]
26	-21.4668	12.9684	[-59.2544, 16.3207]
27	-29.7782	12.3708	[-65.8245, 6.2682]
28	-36.2371	14.8873	[-79.6160, 7.1419]
29	-6.5531	1.0681	[-9.6652, -3.4410]*
30	-4.1995	1.4835	[-8.5222, 0.1232]
31	1.2828	5.3614	[-14.3393, 16.9050]
32	4.7157	7.0461	[-15.8155, 25.2470]
33	1.0828	0.2265	[0.4229, 1.7428]*

Note: The asterisk (*) indicates a confidence interval that does not include zero. The control group consists of units that have not yet been treated. There is one anticipation period to account for some of the setup time, and the estimation method uses doubly robust standard errors.

Table A.IV: Event Study Dynamic Effects for Africa

Event Time	ATT Estimate	Std. Error	[95% Simult. Conf. Band]
Pooled	0.3215	0.4714	[-0.6024, 1.2454]
-34	-0.7206	0.2266	[-1.4030, -0.0381] *
-33	0.6986	0.4093	[-0.5339, 1.9311]
-32	-0.9575	0.2979	[-1.8546, -0.0604] *
-31	6.3778	2.5538	[-1.3125, 14.0681]
-30	25.3225	12.7548	[-13.0853, 63.7303]
-29	150.1318	70.2472	[-61.3999, 361.6635]
-28	-129.2917	51.8849	[-285.5300, 26.9466]
-27	0.3325	1.9935	[-5.6704, 6.3355]
-26	-0.7656	1.7773	[-6.1175, 4.5862]
-25	-3.4679	1.5073	[-8.0068, 1.0710]
-24	-2.1982	1.2153	[-5.8579, 1.4614]
-23	2.6249	1.1914	[-0.9626, 6.2125]
-22	0.5620	0.4049	[-0.6573, 1.7814]
-21	1.2924	0.4452	[-0.0482, 2.6330]
-20	0.4457	1.3562	[-3.6381, 4.5294]
-19	-1.6080	1.3856	[-5.7804, 2.5644]
-18	-1.5176	0.8080	[-3.9508, 0.9157]
-17	-0.7315	0.4429	[-2.0651, 0.6021]
-16	2.4098	1.0892	[-0.8701, 5.6898]
-15	-1.2665	1.2641	[-5.0729, 2.5398]
-14	-0.1608	0.7186	[-2.3247, 2.0032]
-13	-0.0300	0.2199	[-0.6922, 0.6322]
-12	0.3839	0.2426	[-0.3465, 1.1143]
-11	-0.5675	0.1545	[-1.0328, -0.1023] *
-10	0.1000	0.4260	[-1.1828, 1.3827]
-9	-1.0715	0.3494	[-2.1235, -0.0195] *
-8	0.0358	0.1288	[-0.3520, 0.4236]
-7	0.5301	0.2581	[-0.2471, 1.3073]
-6	-0.4377	0.6192	[-2.3024, 1.4270]
-5	1.7971	0.9104	[-0.9445, 4.5386]
-4	-0.8311	1.0031	[-3.8515, 2.1894]
-3	0.2146	0.9744	[-2.7196, 3.1488]
-2	-1.1658	0.8519	[-3.7312, 1.3995]
-1	-0.8609	0.5225	[-2.4344, 0.7127]
0	-0.2015	0.5968	[-1.9986, 1.5955]
1	-0.7834	0.5187	[-2.3454, 0.7786]
2	4.1485	1.8312	[-1.3658, 9.6627]
3	6.4787	3.2076	[-3.1801, 16.1375]
4	3.3887	2.0929	[-2.9135, 9.6910]
5	-1.7780	0.7261	[-3.9644, 0.4084]
6	-1.0368	0.5618	[-2.7285, 0.6549]
7	-0.7386	0.1713	[-1.2543, -0.2230] *
8	-1.1446	0.2057	[-1.7640, -0.5253] *
9	-1.5692	0.2171	[-2.2229, -0.9156] *
10	-0.9991	0.9422	[-3.8362, 1.8380]
11	14.8389	5.7869	[-2.5869, 32.2647]
12	26.5872	13.1290	[-12.9473, 66.1218]
13	17.8297	8.6309	[-8.1599, 43.8194]
14	-2.0235	0.2931	[-2.9061, -1.1409] *
15	-0.7643	0.2130	[-1.4057, -0.1229] *
16	-1.1721	0.4073	[-2.3984, 0.0542]
17	-1.9266	0.3303	[-2.9213, -0.9318] *
18	-2.6696	0.3455	[-3.7100, -1.6292] *
19	-2.0775	0.3966	[-3.2716, -0.8833] *
20	-2.3898	0.3298	[-3.3829, -1.3967] *
21	-2.5865	0.3991	[-3.7884, -1.3846] *
22	-2.0798	0.5148	[-3.6300, -0.5296] *
23	-1.6254	0.5878	[-3.3954, 0.1446]
24	-0.1877	0.3943	[-1.3750, 0.9995]
25	-3.8860	0.3539	[-4.9518, -2.8201] *
26	-1.9462	0.3927	[-3.1289, -0.7636] *
27	-3.9516	0.3956	[-5.1429, -2.7603] *
28	-4.4557	0.5183	[-6.0164, -2.8950] *
29	-6.2727	0.4558	[-7.6452, -4.9002] *
30	-4.1119	0.5783	[-5.8532, -2.3705] *
31	-7.2243	0.6542	[-9.1941, -5.2545] *
32	-3.1550	0.6685	[-5.1679, -1.1421] *
33	0.4171	0.0653	[0.2205, 0.6138] *

Note: The asterisk (*) indicates a confidence interval that does not include zero. The control group consists of units that have not yet been treated. There is one anticipation period to account for some of the setup time, and the estimation method uses doubly robust standard errors.

Table A.V: Event Study Dynamic Effects for Latin America

Event Time	ATT Estimate	Std. Error	[95% Simult. Conf. Band]
Pooled	-0.2676	0.1778	[-0.616, 0.0807]
-28	0.8864	1.0861	[-1.965, 3.7377]
-27	-0.1591	0.874	[-2.4536, 2.1354]
-26	0.125	0.5688	[-1.3684, 1.6184]
-25	-0.5565	0.4895	[-1.8416, 0.7286]
-24	-0.3354	0.3213	[-1.179, 0.5081]
-23	1.1782	0.2925	[0.4101, 1.9462] *
-22	5.8994	9.0827	[-17.9456, 29.7444]
-21	-5.6034	8.7404	[-28.5499, 17.343]
-20	-1.025	6.1183	[-17.0876, 15.0376]
-19	-2.4249	4.1437	[-13.3034, 8.4536]
-18	-0.7504	3.8055	[-10.741, 9.2401]
-17	-0.0888	2.8699	[-7.6231, 7.4456]
-16	-2.4662	1.6533	[-6.8067, 1.8742]
-15	-0.6938	0.5097	[-2.0321, 0.6444]
-14	-0.5007	0.1847	[-0.9855, -0.0158] *
-13	-0.2851	0.1452	[-0.6664, 0.0962]
-12	0.1878	0.1455	[-0.1942, 0.5699]
-11	0.0257	0.1942	[-0.4841, 0.5356]
-10	0.0877	0.2119	[-0.4688, 0.6441]
-9	-0.211	0.1943	[-0.7211, 0.2991]
-8	0.0664	0.1445	[-0.313, 0.4457]
-7	0.5629	0.362	[-0.3876, 1.5133]
-6	-0.4363	0.4353	[-1.5791, 0.7065]
-5	0.0609	0.1392	[-0.3045, 0.4263]
-4	0.1063	0.2025	[-0.4253, 0.638]
-3	0.0771	0.1767	[-0.3869, 0.5412]
-2	0.1224	0.1344	[-0.2305, 0.4753]
-1	-0.0914	0.0601	[-0.2491, 0.0663]
0	-0.1606	0.0594	[-0.3165, -0.0046] *
1	-0.0855	0.0567	[-0.2344, 0.0633]
2	-0.1202	0.1029	[-0.3902, 0.1499]
3	0.3105	0.2045	[-0.2263, 0.8473]
4	-0.4626	0.1947	[-0.9738, 0.0487]
5	-0.1678	0.1006	[-0.432, 0.0964]
6	-0.281	0.1865	[-0.7707, 0.2087]
7	-0.1302	0.0962	[-0.3829, 0.1224]
8	-0.1194	0.2429	[-0.7572, 0.5183]
9	-0.1711	0.1233	[-0.4948, 0.1526]
10	-1.1553	0.4819	[-2.4206, 0.1099]
11	-0.3102	0.2486	[-0.9628, 0.3424]
12	-0.5122	0.2456	[-1.157, 0.1327]
13	-0.4382	0.248	[-1.0893, 0.213]
14	-0.1248	0.1181	[-0.4347, 0.1852]
15	-0.7505	0.4762	[-2.0008, 0.4997]
16	0.0311	0.2435	[-0.6081, 0.6703]
17	0.1534	0.1074	[-0.1286, 0.4354]
18	0.1807	0.1559	[-0.2285, 0.5899]
19	0.1494	0.1574	[-0.2638, 0.5626]
20	0.1187	0.1563	[-0.2917, 0.5291]
21	-0.1566	0.417	[-1.2512, 0.9381]
22	-0.0145	0.1845	[-0.4988, 0.4699]
23	-1.284	0.706	[-3.1374, 0.5695]
24	-0.1728	0.3647	[-1.1303, 0.7847]
25	0.1173	0.1627	[-0.31, 0.5445]
26	-0.3086	0.8967	[-2.6627, 2.0454]
27	0	0.4226	[-1.1094, 1.1094]
28	-1.0398	1.1793	[-3.3415, 1.2619]
29	-0.2129	0.4313	[-1.065, 0.6392]
30	-0.1143	0.6225	[-1.3498, 1.1212]

Note: The asterisk (*) indicates a confidence interval that does not include zero. The control group consists of units that have not yet been treated. There is one anticipation period to account for some of the setup time, and the estimation method uses doubly robust standard errors.

Table A.VI: Event Study Dynamic Effects for the Middle East

Event Time	ATT Estimate	Std. Error	[95% Simult. Conf. Band]
Pooled	11.0694	5.5594	[0.1731, 21.9656] *
-32	1.1987	2.62	[-6.5774, 8.9749]
-31	1.1474	1.7296	[-3.986, 6.2809]
-30	-1.5037	1.5458	[-6.0917, 3.0842]
-29	5.7389	1.1621	[2.2896, 9.1881] *
-28	-2.0312	1.1571	[-5.4656, 1.4033]
-27	-3.8970	1.4712	[-8.2637, 0.4697]
-26	-1.8274	1.5924	[-6.5538, 2.899]
-25	-2.2629	1.4857	[-6.6726, 2.1468]
-24	0.7631	1.1395	[-2.619, 4.1452]
-23	-1.6165	1.1615	[-5.0638, 1.8307]
-22	2.6232	1.1368	[-0.7508, 5.9972]
-21	-19.8834	2.0154	[-25.8653, -13.9015] *
-20	-18.1998	2.5227	[-25.6872, -10.7123] *
-19	28.9220	2.1433	[22.5607, 35.2833] *
-18	35.6162	2.6468	[27.7603, 43.4721] *
-17	29.1831	6.8669	[8.8019, 49.5642] *
-16	16.0474	1.2972	[12.1973, 19.8974] *
-15	-24.9743	1.8622	[-30.5012, -19.4473] *
-14	-20.8772	2.7108	[-28.9228, -12.8315] *
-13	-32.2701	2.7788	[-40.5177, -24.0225] *
-12	-17.0865	1.1963	[-20.6373, -13.5358] *
-11	-18.1061	2.6023	[-25.8299, -10.3824] *
-10	-6.9871	4.8379	[-21.3461, 7.372]
-9	-0.8314	7.5378	[-23.204, 21.5412]
-8	45.3995	10.7603	[13.4624, 77.3366] *
-7	24.8317	9.6037	[-3.6725, 53.336]
-6	-27.4814	7.5834	[-49.9893, -4.9735] *
-5	-18.6619	6.3323	[-37.4565, 0.1327]
-4	2.6282	8.0044	[-21.1293, 26.3857]
-3	16.0918	6.4769	[-3.132, 35.3156]
-2	-36.7046	5.7674	[-53.8227, -19.5866] *
-1	-3.8074	2.726	[-11.8984, 4.2836]
0	1.4664	3.376	[-8.5536, 11.4864]
1	-5.9287	8.1127	[-30.0076, 18.1501]
2	-18.5585	12.882	[-56.793, 19.6759]
3	-14.1062	11.7867	[-49.0896, 20.8773]
4	-1.0597	7.706	[-23.9314, 21.812]
5	12.6736	3.9831	[0.8516, 24.4956] *
6	-9.491	6.7883	[-29.639, 10.657]
7	13.7714	4.4752	[0.4887, 27.0541] *
8	3.2023	3.77	[-7.9871, 14.3917]
9	-2.1142	6.375	[-21.0355, 16.807]
10	-19.3921	11.4	[-53.2279, 14.4436]
11	-35.6943	12.3988	[-72.4945, 1.1059]
12	-30.8392	9.633	[-59.4303, -2.2482] *
13	18.5787	10.8443	[-13.6076, 50.765]
14	92.1131	23.8471	[21.334, 162.8922] *
15	205.1803	34.2465	[103.5351, 306.8254] *
16	91.9803	18.1467	[38.1201, 145.8406] *
17	164.6901	26.7076	[85.4208, 243.9595] *
18	71.7691	11.8265	[36.6677, 106.8706] *
19	-18.2237	9.5251	[-46.4945, 10.0471]
20	-20.6646	16.5496	[-69.7846, 28.4554]
21	-25.4866	12.7915	[-63.4524, 12.4792]
22	-14.8936	11.1564	[-48.0064, 18.2191]
23	-13.2154	13.5855	[-53.5376, 27.1068]
24	-8.8669	9.9295	[-33.0505, 15.3167]
25	-17.6957	7.5406	[-40.0765, 4.685]
26	-22.8176	10.9201	[-55.2289, 9.5938]
27	-11.1014	3.3438	[-21.0258, -1.1769] *
28	-8.6122	2.1981	[-15.1362, -2.0883] *
29	-7.2585	1.8207	[-12.6625, -1.8545] *
30	-15.8912	6.3367	[-34.1908, 2.4084]
31	7.7459	3.5398	[1.7243, 13.7674] *

Note: The asterisk (*) indicates a confidence interval that does not include zero. The control group consists of units that have not yet been treated. There is one anticipation period to account for some of the setup time, and the estimation method uses doubly robust standard errors.

Appendix B DID Event Results Tables for Country Models

Tables A.VII-A.XIV below show the dynamic results of the Callaway and Sant'Anna (2021) double robust staggered treatment country event plots shown above in Figures 6-13.

Table A.VII: Event Study Dynamic Effects for the Philippines

Event Time	ATT Estimate	Std. Error	[95% Simult. Conf. Band]
Pooled	-1.0069	0.1947	[-1.3886, -0.6253] *
-11	0.3333	1.0131	[-2.5157, 3.1823]
-10	-1.8667	0.7742	[-4.0439, 0.3106]
-9	0.8167	0.4505	[-0.4503, 2.0837]
-8	0.2167	0.2953	[-0.6137, 1.047]
-7	0.1667	0.2866	[-0.6394, 0.9727]
-6	0.2	0.2174	[-0.4115, 0.8115]
-5	-0.05	0.2586	[-0.7773, 0.6773]
-4	-0.2	0.2776	[-0.9806, 0.5806]
-3	-0.8167	0.3027	[-1.6679, 0.0346]
-2	0.6833	0.3048	[-0.1737, 1.5403]
-1	-1.2833	0.6771	[-3.1873, 0.6206]
0	0.6333	1.0271	[-2.255, 3.5217]
1	1.4833	0.9806	[-1.2742, 4.2408]
2	-1.1167	0.5506	[-2.6651, 0.4318]
3	-1.4	0.5374	[-2.9114, 0.1114]
4	0.75	0.6276	[-1.015, 2.515]
5	-1.3	0.4262	[-2.4987, -0.1013] *
6	-1.9167	0.4666	[-3.2288, -0.6045] *
7	-2.45	0.535	[-3.9544, -0.9456] *
8	-0.4	0.6227	[-2.1511, 1.3511]
9	-1.0333	0.5271	[-2.5157, 0.4491]
10	-1.3833	0.5568	[-2.9491, 0.1825]
11	-0.85	0.3855	[-1.934, 0.234]
12	-2.2	0.8216	[-4.5105, 0.1105]
13	-0.3	0.5115	[-1.7384, 1.1384]
14	-3.1167	0.7615	[-5.258, -0.9753] *
15	-1.8833	0.7318	[-3.9413, 0.1747]
16	1.6833	0.4967	[0.2866, 3.08] *
17	-0.0667	0.4621	[-1.3661, 1.2328]
18	-1.3333	0.5584	[-2.9038, 0.2371]
19	-1.8	0.5411	[-3.3218, -0.2782] *
20	-2.5333	0.5988	[-4.2173, -0.8494] *
21	-2.2833	0.5321	[-3.7796, -0.787] *
22	-1	0.5053	[-2.421, 0.421]
23	-0.35	0.1544	[-0.7843, 0.0843]

Note: The asterisk (*) indicates a confidence interval that does not include zero. The control group consists of units that have not yet been treated. The estimation method uses doubly robust standard errors.

Table A.VIII: Event Study Dynamic Effects for Venezuela

Event Time	ATT Estimate	Std. Error	[95% Simult. Conf. Band]
Pooled	-2.5088	0.3187	[-3.1334, -1.8841]
-6	0.6667	0.7349	[-0.7349, 2.0682]
-5	1.4127	0.1972	[0.1972, 2.6282]
-4	0.5159	1.0098	[-1.0098, 2.0416]
-3	1.2619	0.3473	[-0.3473, 2.8711]
-2	-0.8016	1.9771	[-1.9771, 0.3740]
-1	-0.9127	1.8113	[-1.8113, -0.0141] *
0	-3.381	4.4064	[-4.4064, -2.3555] *
1	-3.1349	4.0475	[-4.0475, -2.2223] *
2	-3.0873	3.9347	[-3.9347, -2.2399] *
3	-2.8571	4.1000	[-4.1000, -1.6143] *
4	-7.3333	12.3245	[-12.3245, -2.3422] *
5	1.2063	5.1491	[-5.1491, 7.5618]
6	-10.0317	18.3426	[-18.3426, -1.7209] *
7	-12.0476	24.0695	[-24.0695, -0.0257] *
8	-6.2619	11.9526	[-11.9526, -0.5712] *
9	-5.3254	7.7842	[-7.7842, -2.8666] *
10	-1.9365	2.7783	[-2.7783, -1.0947] *
11	0.2302	0.5343	[-0.5343, 0.9946]
12	3.1032	2.2944	[2.2944, 3.9119] *
13	-2.9603	3.7426	[-3.7426, -2.1780] *
14	-1.9603	2.8626	[-2.8626, -1.0580] *
15	-0.754	1.5424	[-1.5424, 0.0345]
16	-1.6905	2.4461	[-2.4461, -0.9349] *
17	-0.8175	1.7119	[-1.7119, 0.0770]
18	1.1429	0.3055	[0.3055, 1.9803] *
19	-1.754	2.5720	[-2.5720, -0.9359] *
20	-1.746	3.2832	[-3.2832, -0.2088] *
21	5.0238	3.0723	[3.0723, 6.9753] *
22	1.7619	0.0201	[-0.0201, 3.5440]
23	-1.5397	2.7174	[-2.7174, -0.3619] *
24	-3.0556	4.1109	[-4.1109, -2.0002] *
25	-3.4365	4.7323	[-4.7323, -2.1407] *
26	-3.5079	4.6617	[-4.6617, -2.3542] *
27	-4.254	5.9302	[-5.9302, -2.5777] *
28	-2.3492	3.0745	[-3.0745, -1.6239] *

Note: The asterisks indicate statistically significant results at the 95% level. Standard errors are reported below the estimates.

Table A.IX: Event Study Dynamic Effects for Sudan

Event Time	ATT Estimate	Std. Error	[95% Simult. Conf. Band]
Pooled	11.0694	5.4441	[0.3992, 21.7396] *
-31	0.4413	0.1574	[-0.0266, 0.9092]
-30	-0.0329	0.0355	[-0.1384, 0.0726]
-29	-0.0094	0.0426	[-0.136, 0.1172]
-28	-0.0892	0.0968	[-0.3768, 0.1984]
-27	0.2698	0.1050	[-0.0424, 0.5819]
-26	-0.1306	0.0676	[-0.3315, 0.0703]
-25	1.5211	0.1581	[1.0512, 1.9910] *
-24	0.5209	0.1563	[0.0564, 0.9854] *
-23	-1.4178	0.2057	[-2.0291, -0.8065] *
-22	0.8622	0.2257	[0.1914, 1.5331] *
-21	1.8070	0.1827	[1.2638, 2.3502] *
-20	-3.9042	0.3202	[-4.8561, -2.9524] *
-19	-0.1170	0.2700	[-0.9195, 0.6856]
-18	-0.0660	0.2018	[-0.6659, 0.5339]
-17	0.5109	0.1692	[0.0080, 1.0137] *
-16	-0.2076	0.1606	[-0.6851, 0.2700]
-15	-0.2238	0.2282	[-0.9022, 0.4547]
-14	-0.2484	0.2678	[-1.0446, 0.5478]
-13	0.6003	0.2192	[-0.0514, 1.2519]
-12	-0.6011	0.2101	[-1.2257, 0.0236]
-11	0.7981	0.2448	[0.0702, 1.5259] *
-10	-0.5433	0.2228	[-1.2057, 0.1190]
-9	0.0194	0.2117	[-0.6100, 0.6489]
-8	-0.2926	0.2117	[-0.9220, 0.3368]
-7	-0.6852	0.3748	[-1.7993, 0.4289]
-6	0.4062	0.4083	[-0.8076, 1.6200]
-5	0.1135	0.3157	[-0.8249, 1.0519]
-4	-0.2004	0.3393	[-1.2090, 0.8082]
-3	-0.7163	0.5353	[-2.3076, 0.8750]
-2	0.9021	0.5254	[-0.6597, 2.4639]
-1	0.5214	0.3925	[-0.6454, 1.6882]
0	3.1006	0.4739	[1.6918, 4.5094] *
1	-0.1540	0.4806	[-1.5826, 1.2746]
2	24.7330	1.6669	[19.7779, 29.6880] *
3	59.2994	2.9738	[50.4595, 68.1393] *
4	34.2751	1.8320	[28.8291, 39.7211] *
5	-0.9492	0.8958	[-3.6120, 1.7136]
6	0.8052	0.5811	[-0.9221, 2.5324]
7	-1.2664	0.7476	[-3.4887, 0.9560]
8	-0.2133	0.2316	[-0.9019, 0.4753]
9	-0.3033	0.3804	[-1.4342, 0.8276]
10	-0.2559	0.2750	[-1.0735, 0.5617]
11	-0.0616	0.2331	[-0.7547, 0.6314]
12	-0.0766	0.2887	[-0.9348, 0.7817]
13	-0.3301	0.3485	[-1.3661, 0.7059]
14	-2.0622	0.9583	[-4.9108, 0.7864]
15	0.6507	0.1888	[0.0894, 1.2120] *

Note: The asterisk (*) indicates a confidence interval that does not include zero. The control group consists of units that have not yet been treated. There is one anticipation period to account for some of the setup time, and the estimation method uses doubly robust standard errors.

Table A.X: Event Study Dynamic Effects for Myanmar

Event Time	ATT Estimate	Std. Error	[95% Simult. Conf. Band]
Pooled	2.4133	0.5482	[1.3388, 3.4879] *
-29	0.2241	0.7028	[-1.914, 2.3623]
-28	-0.3966	0.8146	[-2.8746, 2.0815]
-27	-0.0431	0.5668	[-1.7674, 1.6812]
-26	-0.0905	0.6628	[-2.107, 1.9259]
-25	-0.375	0.6745	[-2.4269, 1.6769]
-24	-0.0833	0.5206	[-1.6669, 1.5003]
-23	0.0219	0.4291	[-1.2834, 1.3272]
-22	-0.4182	0.4054	[-1.6516, 0.8151]
-21	1.4208	1.3207	[-2.5967, 5.4384]
-20	0.3575	1.5323	[-4.3041, 5.019]
-19	-0.539	1.3482	[-4.6404, 3.5624]
-18	-0.7733	0.8825	[-3.4579, 1.9112]
-17	0.9153	0.8673	[-1.723, 3.5536]
-16	2.0922	2.1261	[-4.3755, 8.5599]
-15	-2.6164	2.0847	[-8.9582, 3.7253]
-14	-0.493	0.5158	[-2.0622, 1.0762]
-13	2.5071	1.9255	[-3.3505, 8.3647]
-12	-1.6413	1.7188	[-6.8702, 3.5876]
-11	0.9476	1.727	[-4.3061, 6.2014]
-10	-0.0297	1.7585	[-5.3792, 5.3198]
-9	-0.3059	1.1894	[-3.9242, 3.3124]
-8	0.0895	1.1807	[-3.5023, 3.6812]
-7	0.0527	0.9729	[-2.907, 3.0123]
-6	-1.4786	0.4574	[-2.8699, -0.0872] *
-5	0.8249	0.5976	[-0.9931, 2.643]
-4	2.6959	2.3886	[-4.5704, 9.9623]
-3	-4.4013	2.4828	[-11.9544, 3.1519]
-2	2.7352	0.6517	[0.7526, 4.7179] *
-1	-1.1988	0.6679	[-3.2307, 0.8331]
0	-2.695	0.7286	[-4.9116, -0.4785] *
1	-1.1939	0.7314	[-3.4191, 1.0312]
2	-1.6767	0.8276	[-4.1945, 0.841]
3	-0.206	0.7676	[-2.5412, 2.1291]
4	4.5167	0.9031	[1.7693, 7.264] *
5	19.1701	6.0342	[0.8132, 37.527] *
6	8.2361	1.1585	[4.7119, 11.7603] *
7	11.9784	1.4485	[7.5718, 16.385] *
8	9.9441	1.6023	[5.0697, 14.8185] *
9	7.6055	1.9693	[1.6146, 13.5964] *
10	5.1149	0.9079	[2.3529, 7.877] *
11	1.6025	0.7348	[-0.6329, 3.8379]
12	9.8396	1.046	[6.6574, 13.0218] *
13	3.7975	0.8521	[1.2054, 6.3896] *
14	1.0185	0.559	[-0.6821, 2.7192]
15	4.7041	3.9705	[-7.3745, 16.7827]
16	1.0052	1.4443	[-3.3886, 5.399]
17	-2.2297	1.6136	[-7.1386, 2.6791]
18	-1.877	1.1474	[-5.3675, 1.6136]
19	-2.0104	1.1506	[-5.5105, 1.4898]
20	-1.7634	1.8529	[-7.4002, 3.8733]
21	0.2449	0.7612	[-2.0708, 2.5606]
22	2.0417	0.7569	[-0.2609, 4.3443]
23	1.1875	0.6596	[-0.819, 3.194]
24	-1.125	0.9342	[-3.9669, 1.7169]
25	1.0213	0.7103	[-1.1394, 3.182]
26	-0.8511	1.4541	[-5.2745, 3.5724]
27	-0.7391	0.9527	[-3.6374, 2.1592]
28	-3.337	2.2931	[-10.3128, 3.6389]
29	-0.9239	1.2636	[-4.7681, 2.9202]

Note: The asterisk (*) indicates a confidence interval that does not include zero. The control group consists of units that have not yet been treated. There is one anticipation period to account for some of the setup time, and the estimation method uses doubly robust standard errors.

Table A.XI: Event Study Dynamic Effects for Pakistan

Event Time	Estimate	Std. Error	[95% Simult. Conf. Band]
Pooled	-19.5916	6.5411	[-32.412, -6.7712] *
-33	-2.8581	2.8096	[-11.1969, 5.4807]
-32	1.8258	2.8765	[-6.7117, 10.3633]
-31	1.6194	2.2818	[-5.1529, 8.3916]
-30	-3.5425	3.0468	[-12.5853, 5.5004]
-29	2.4706	3.5173	[-7.9687, 12.9099]
-28	0.3907	0.4492	[-0.9426, 1.7241]
-27	-0.1722	0.3537	[-1.2219, 0.8775]
-26	-0.7881	0.5972	[-2.5607, 0.9845]
-25	-0.7219	0.9148	[-3.4368, 1.9931]
-24	-1.7651	2.0362	[-7.8086, 4.2784]
-23	-1.9199	2.2253	[-8.5247, 4.6849]
-22	0.1187	2.4637	[-7.1935, 7.4308]
-21	1.4294	2.0133	[-4.5462, 7.4049]
-20	-3.0441	2.4951	[-10.4495, 4.3613]
-19	2.8554	3.0244	[-6.1211, 11.8318] *
-18	-1.1759	1.0071	[-4.1649, 1.8132]
-17	-0.0348	1.2235	[-3.6662, 3.5966]
-16	0.0681	1.0048	[-2.9143, 3.0505]
-15	-1.4949	1.4766	[-5.8773, 2.8876]
-14	-1.4896	1.9539	[-7.2888, 4.3096]
-13	0.4074	1.8408	[-5.0561, 5.8708]
-12	-3.1596	2.3233	[-10.055, 3.7359]
-11	0.7160	2.2407	[-5.9344, 7.3664]
-10	-0.7558	1.8215	[-6.1621, 4.6505]
-9	1.8029	1.6586	[-3.1199, 6.7256]
-8	-1.19	1.4025	[-5.3527, 2.9727]
-7	-2.3978	1.7084	[-7.4684, 2.6728]
-6	36.1540	3.7294	[25.0853, 47.2228] *
-5	-9.9934	4.4638	[-23.2421, 3.2552]
-4	9.0731	6.1961	[-9.3170, 27.4631]
-3	24.6799	23.6847	[-45.6164, 94.9761]
-2	-6.7789	23.3179	[-75.9864, 62.4286]
-1	20.7699	17.2360	[-30.3867, 71.9264]
0	69.1449	17.4044	[17.4887, 120.801] *
1	77.9539	18.7491	[22.3064, 133.6013] *
2	44.9202	17.5113	[-7.0535, 96.8939]
3	17.9960	15.0023	[-26.5310, 62.5229]
4	133.7324	18.6693	[78.3218, 189.1430] *
5	-17.3879	14.7575	[-61.1881, 26.4122]
6	55.1282	15.2326	[9.9178, 100.3386] *
7	9.7246	15.6372	[-36.6865, 56.1357]
8	23.4593	16.0103	[-24.0592, 70.9778]
9	14.5834	14.8703	[-29.5515, 58.7184]
10	2.5916	15.7079	[-44.0297, 49.2128]
11	-28.6327	15.0823	[-73.3970, 16.1317]
12	-19.4234	2.6615	[-27.3228, -11.5239] *
13	-20.1706	3.0005	[-29.0761, -11.2650] *
14	-13.3502	2.9639	[-22.1471, -4.5533] *
15	-26.7101	4.5925	[-40.3407, -13.0795] *
16	-48.6645	4.3513	[-61.5792, -35.7499] *
17	-64.4799	5.5121	[-80.8397, -48.1200] *
18	-68.7832	6.8481	[-89.1085, -48.4580] *
19	-54.9054	4.7691	[-69.0600, -40.7507] *
20	-40.7326	4.1803	[-53.1397, -28.3254] *
21	-39.2514	4.5538	[-52.7672, -25.7356] *
22	-41.9381	6.4310	[-61.0254, -22.8508] *
23	-60.4597	5.5267	[-76.8629, -44.0565] *
24	-56.1298	6.7852	[-76.2684, -35.9913] *
25	-100.4056	8.9057	[-126.8378, -73.9734] *
26	-86.0278	5.7997	[-103.2413, -68.8144] *
27	-119.4310	8.1853	[-143.7249, -95.1371] *
28	-129.0282	10.4557	[-160.0608, -97.9955] *
29	-12.5634	1.8708	[-18.1160, -7.0108] *
30	-8.0986	0.5629	[-9.7694, -6.4278] *

Note: The asterisks indicate statistically significant results at the 95% level. Standard errors are reported below the estimates.

Table A.XII: Event Study Dynamic Effects for Ethiopia

Event Time	ATT Estimate	Std. Error	[95% Simult. Conf. Band]
Pooled	12.5735	0.9138	[10.7824, 14.3646] *
-32	-0.3944	0.6735	[-2.5283, 1.7396]
-31	0.6056	0.6484	[-1.4486, 2.6599]
-30	0.0009	0.3615	[-1.1445, 1.1463]
-29	0.346	0.4074	[-0.9447, 1.6367]
-28	-0.011	0.3507	[-1.1222, 1.1002]
-27	0.3059	0.3508	[-0.8057, 1.4175]
-26	0.033	0.2471	[-0.7498, 0.8159]
-25	1.5173	0.3069	[0.545, 2.4896] *
-24	0.9388	0.1944	[0.3227, 1.5548] *
-23	-1.7412	0.209	[-2.4036, -1.0789] *
-22	0.4485	0.2629	[-0.3846, 1.2815]
-21	1.9817	0.2164	[1.2961, 2.6674] *
-20	-2.2586	0.2548	[-3.066, -1.4512] *
-19	-2.6265	0.2636	[-3.4617, -1.7914] *
-18	0.0679	0.2261	[-0.6485, 0.7843]
-17	0.0332	0.1901	[-0.569, 0.6355]
-16	-0.257	0.1669	[-0.7859, 0.272]
-15	0.0915	0.1705	[-0.4487, 0.6318]
-14	-0.0757	0.1866	[-0.6671, 0.5156]
-13	0.1464	0.1856	[-0.4416, 0.7344]
-12	-0.2286	0.1955	[-0.8479, 0.3908]
-11	0.3799	0.2288	[-0.345, 1.1048]
-10	-0.3787	0.2522	[-1.1776, 0.4203]
-9	-0.4985	0.2544	[-1.3046, 0.3077]
-8	-0.0374	0.2412	[-0.8017, 0.7269]
-7	-0.3776	0.2984	[-1.3231, 0.568]
-6	-0.099	0.318	[-1.1066, 0.9086]
-5	0.3298	0.3009	[-0.6237, 1.2833]
-4	-0.2678	0.3066	[-1.2392, 0.7035]
-3	0.7548	0.3172	[-0.2502, 1.7599]
-2	-1.3201	0.3414	[-2.4018, -0.2385] *
-1	0.3691	0.4225	[-0.9697, 1.7079]
0	0.142	0.4272	[-1.2116, 1.4956]
1	1.8892	0.494	[0.3239, 3.4545] *
2	14.6317	1.0296	[11.3696, 17.8938] *
3	24.935	1.9021	[18.9083, 30.9616] *
4	14.0867	1.1404	[10.4736, 17.6999] *
5	0.5713	0.5532	[-1.1814, 2.324]
6	0.9475	0.297	[0.0063, 1.8886] *
7	-0.9153	0.3888	[-2.1472, 0.3166]
8	-0.4745	0.3402	[-1.5523, 0.6033]
9	-0.4238	0.4055	[-1.7084, 0.8608]
10	1.7267	0.6436	[-0.3125, 3.7659]
11	53.2802	3.4793	[42.2564, 64.3039] *
12	103.0547	8.4916	[76.1499, 129.9595] *
13	65.9345	5.1037	[49.7641, 82.1048] *
14	-1.4649	0.5681	[-3.265, 0.3352]
15	1.6471	0.3611	[0.503, 2.7912] *
16	0.8222	1.0913	[-2.6355, 4.2799]
17	-5.9774	1.7355	[-11.4761, -0.4788] *
18	-8.8271	1.9786	[-15.0961, -2.558] *
19	-3.5564	0.9202	[-6.472, -0.6408] *
20	2.015	0.2579	[1.1979, 2.8322] *

Note: The asterisk (*) indicates a confidence interval that does not include zero. The control group consists of units that have not yet been treated. There is one anticipation period to account for some of the setup time, and the estimation method uses doubly robust standard errors.

Table A.XIII: Event Study Dynamic Effects for Mali

Event Time	ATT Estimate	Std. Error	[95% Simult. Conf. Band]
Pooled	-1.9812	0.1893	[-2.3523, -1.6101] *
-32	-0.1953	0.0629	[-0.3832, -0.0074] *
-31	0.0888	0.0707	[-0.1224, 0.2999]
-30	-0.0237	0.0618	[-0.2081, 0.1608]
-29	0.1006	0.0543	[-0.0616, 0.2627]
-28	-0.4556	0.1529	[-0.9122, 0.0009]
-27	0.4438	0.1574	[-0.0264, 0.9140]
-26	0.0414	0.0238	[-0.0296, 0.1124]
-25	-0.0296	0.0196	[-0.0882, 0.0290]
-24	-0.0178	0.0418	[-0.1427, 0.1072]
-23	0.0237	0.0391	[-0.0931, 0.1404]
-22	0.0237	0.0153	[-0.0219, 0.0692]
-21	0.0000	NA	[NA, NA]
-20	-0.0774	0.0570	[-0.2477, 0.0930]
-19	0.0774	0.0489	[-0.0685, 0.2233]
-18	-0.0833	0.0566	[-0.2524, 0.0858]
-17	0.0595	0.0593	[-0.1174, 0.2365]
-16	0.0238	0.0183	[-0.0308, 0.0784]
-15	-0.1786	0.0734	[-0.3979, 0.0407]
-14	-0.0774	0.1275	[-0.4583, 0.3035]
-13	0.1488	0.0678	[-0.0536, 0.3512]
-12	-0.0708	0.0393	[-0.1883, 0.0466]
-11	0.0206	0.0454	[-0.1150, 0.1562]
-10	-0.2559	0.0930	[-0.5336, 0.0218]
-9	-0.2920	0.2078	[-0.9126, 0.3287]
-8	0.2633	0.1914	[-0.3082, 0.8348]
-7	0.0374	0.1171	[-0.3123, 0.3871]
-6	0.0802	0.0967	[-0.2086, 0.3691]
-5	-0.5981	0.1680	[-1.0998, -0.0965] *
-4	-1.0357	0.4067	[-2.2504, 0.1791]
-3	-0.6876	0.7450	[-2.9125, 1.5374]
-2	-0.3661	0.8554	[-2.9206, 2.1883]
-1	-0.2619	0.9355	[-3.0557, 2.5319]
0	-1.1694	1.0204	[-4.2168, 1.8780]
1	-2.0923	1.1792	[-5.6138, 1.4293]
2	2.9169	0.6881	[0.8620, 4.9718] *
3	-0.0237	0.0295	[-0.1117, 0.0644]
4	0.0000	NA	[NA, NA]
5	-0.1775	0.1131	[-0.5152, 0.1601]
6	-0.2544	0.0659	[-0.4512, -0.0577] *
7	-0.1065	0.0351	[-0.2113, -0.0017] *
8	-0.0533	0.0259	[-0.1305, 0.0239]
9	-0.1006	0.0543	[-0.2629, 0.0617]
10	-0.5858	0.1564	[-1.0529, -0.1187] *
11	-1.2663	0.3432	[-2.2913, -0.2413] *
12	-0.2899	0.0798	[-0.5284, -0.0515] *
13	-0.6568	0.1479	[-1.0986, -0.2150] *
14	-0.5385	0.1404	[-0.9576, -0.1193] *
15	-1.6982	0.2827	[-2.5425, -0.8540] *
16	-3.7396	0.7027	[-5.8381, -1.6412] *
17	-5.1302	1.2812	[-8.9563, -1.3040] *
18	-5.8817	1.1632	[-9.3554, -2.4079] *
19	-6.4405	1.3831	[-10.5710, -2.3099] *
20	-8.1786	1.6793	[-13.1936, -3.1636] *
21	-10.1012	2.0368	[-16.1839, -4.0185] *

Note: The asterisks indicate statistically significant results at the 95% level. Standard errors are reported below the estimates.

Table A.XIV: Event Study Dynamic Effects for Colombia

Event Time	ATT Estimate	Std. Error	[95% Simult. Conf. Band]
Pooled	-4.8055	0.9946	[-6.7549, -2.8562] *
-34	1.4143	0.2561	[0.6463, 2.1822] *
-33	-0.9857	0.3231	[-1.9547, -0.0167] *
-32	1.8929	0.3244	[0.92, 2.8657] *
-31	-2.25	0.2531	[-3.0091, -1.4909] *
-30	0.7571	0.1745	[0.2338, 1.2805] *
-29	1.0214	0.2251	[0.3463, 1.6966] *
-28	-1.7143	0.3172	[-2.6658, -0.7628] *
-27	2.7286	0.3844	[1.5756, 3.8815] *
-26	-0.9286	0.3616	[-2.013, 0.1559]
-25	-0.9952	1.1849	[-4.549, 2.5586]
-24	0.246	1.5401	[-4.3733, 4.8652]
-23	0.0812	1.2598	[-3.6972, 3.8596]
-22	0.9305	1.09	[-2.3388, 4.1998]
-21	-4.9097	1.3774	[-9.0407, -0.7786] *
-20	1.0268	1.2328	[-2.6707, 4.7242]
-19	0.9899	0.712	[-1.1456, 3.1254]
-18	2.6295	0.4116	[1.3951, 3.864] *
-17	-0.0917	1.0367	[-3.2011, 3.0177]
-16	0.3821	0.937	[-2.428, 3.1923]
-15	21.3333	7.0463	[0.1997, 42.4669] *
-14	2.6659	9.0759	[-24.5547, 29.8866]
-13	20.2935	11.2175	[-13.3503, 53.9374]
-12	-5.6215	10.2906	[-36.4854, 25.2424]
-11	-4.5478	2.91	[-13.2756, 4.18]
-10	-9.2297	2.4172	[-16.4794, -1.98] *
-9	3.2961	1.1909	[-0.2756, 6.8677]
-8	-9.4267	1.6069	[-14.246, -4.6073] *
-7	-2.3297	0.5112	[-3.8628, -0.7966] *
-6	0.3868	0.5954	[-1.3989, 2.1724]
-5	1.9985	0.7547	[-0.2652, 4.2621]
-4	0.9256	0.6174	[-0.9261, 2.7773]
-3	-1.1765	0.2768	[-2.0067, -0.3463] *
-2	2.3788	0.6371	[0.4679, 4.2896] *
-1	4.2479	0.5399	[2.6287, 5.8672] *
0	16.973	1.461	[12.5912, 21.3547] *
1	21.2124	2.7335	[13.014, 29.4109] *
2	16.8608	3.3669	[6.7627, 26.9589] *
3	1.4991	2.3849	[-5.6538, 8.652]
4	0.2997	1.3306	[-3.6912, 4.2906]
5	-1.5152	1.0204	[-4.5756, 1.5452]
6	-6.1134	0.8258	[-8.5902, -3.6365] *
7	-5.3849	1.4083	[-9.6087, -1.1612] *
8	-2.6641	2.8947	[-11.3459, 6.0177]
9	-6.7307	0.8863	[-9.389, -4.0724] *
10	-11.5149	1.2183	[-15.1687, -7.861] *
11	-10.4685	1.1961	[-14.0559, -6.881] *
12	-14.3214	1.3567	[-18.3905, -10.2524] *
13	-12.3543	1.6278	[-17.2364, -7.4722] *
14	-13.0025	1.6268	[-17.8818, -8.1232] *
15	-10.0444	1.7402	[-15.2638, -4.8251] *
16	-14.837	1.6282	[-19.7205, -9.9536] *
17	-10.8	1.7242	[-15.9713, -5.6287] *
18	-12.0346	1.5508	[-16.6858, -7.3833] *
19	-12.6716	1.7008	[-17.7727, -7.5705] *
20	-11.4938	1.6566	[-16.4625, -6.5252] *
21	-11.6204	1.6106	[-16.4509, -6.7899] *
22	-5.7436	2.2142	[-12.3846, 0.8973]
23	0.9142	1.0086	[-2.1109, 3.9393]
24	-4.5821	0.2939	[-5.4637, -3.7005] *

Note: The asterisk (*) indicates a confidence interval that does not include zero. Standard errors are reported below the estimates.

Appendix C Country List of Model Convergence

Table A.XV below shows the countries in the analyses which were included in the main text, which converged but showed null results, and those that failed to converge for a variety of reasons listed in the robustness section in the main text.

Table A.XV: Countries with Results Summary

Main Text	Null Results	Failed to Converge
Philippines	Egypt	Afghanistan
Myanmar	Indonesia	Algeria
Pakistan	Iran	Bangladesh
Ethiopia	Morocco	Benin
Sudan	Peru	Burkina Faso
Mali	United Republic of Tanzania	Burundi
Venezuela		Central African Republic
Colombia		Chad
		Comoros
		Djibouti
		El Salvador
		Eritrea
		Guatemala
		Guinea
		Guinea-Bissau
		Haiti
		Iraq
		Jordan
		Kyrgyzstan
		Laos
		Lebanon
		Lesotho
		Liberia
		Libya
		Mauritania
		Mozambique
		Nepal
		Nicaragua
		Niger
		Panama
		Paraguay
		Republic of the Congo
		Rwanda
		Senegal
		Sierra Leone
		Somalia
		South Africa
		South Sudan
		Sri Lanka
		Syria
		Tajikistan
		Togo
		Tunisia
		Uganda
		Uzbekistan
		Malaysia
		Cambodia
		Thailand
		Ivory Coast
		Angola
		Kenya
		Democratic Republic of the Congo
		Cameroon
		Nigeria

Appendix D Alternate Specifications for Country DID Models

Table A.XVI below shows the alternate specification comparisons at the country level including those shown in the main text (Figures 6-13), those which drop the anticipation period, and those that use the“Never Treated” units as the control group. Consistency in sign and significance can be observed for the simple pooled ATT comparison across nearly all models.

Table A.XVI: Robustness Checks at Country Level

		Pooled ATT	Std. Error	[95% Conf. Int.]
Philippines	Main Text	-1.0069	0.1947	[-1.3886, -0.6253] *
	No Anticipation	0.2764	0.6667	[-1.0304, 1.5831]
	Never Treated Control Group	-1.0069	0.1954	[-1.3900, -0.6239] *
Myanmar	Main Text	2.4133	0.5482	[1.3388, 3.4879] *
	No Anticipation	1.6589	0.4952	[0.6883, 2.6295] *
	Never Treated Control Group	2.4438	0.5145	[1.4354, 3.4522] *
Pakistan	Main Text	-19.5916	6.5411	[-32.4120, -6.7712] *
	No Anticipation	-38.5696	6.0955	[-50.5166, -26.6225] *
	Never Treated Control Group	-19.5166	5.7639	[-30.8136, -8.2197] *
Ethiopia	Main Text	12.5735	0.9138	[10.7824, 14.3646] *
	No Anticipation	12.1185	0.8842	[10.3855, 13.8515] *
	Never Treated Control Group	12.5611	0.9325	[10.7335, 14.3887] *
Sudan	Main Text	7.3245	0.4515	[6.4395, 8.2095] *
	No Anticipation	7.0596	0.4680	[6.1424, 7.9768] *
	Never Treated Control Group	7.3211	0.4507	[6.4377, 8.2045] *
Mali	Main Text	-1.9812	0.1894	[-2.3525, -1.6099] *
	No Anticipation	-1.9454	0.1867	[-2.3113, -1.5795] *
	Never Treated Control Group	-1.9865	0.1801	[-2.3395, -1.6336] *
Venezuela	Main Text	-2.5088	0.3187	[-3.1334, -1.8841] *
	No Anticipation	-1.5961	0.3359	[-2.2544, -0.9377] *
	Never Treated Control Group	-2.5088	0.3319	[-3.1592, -1.8583] *
Colombia	Main Text	-4.8055	0.9946	[-6.7549, -2.8562] *
	No Anticipation	-7.6534	0.8435	[-9.3067, -6.0002] *
	Never Treated Control Group	-4.8020	0.9632	[-6.6898, -2.9142] *

Appendix E Grid Cell Size overlay

For a frame of reference with the unit sized manufactured for the analysis, please see Figure A.14 below which shows the world map of my 1.25 degree hexagonal spatial unit overlay.

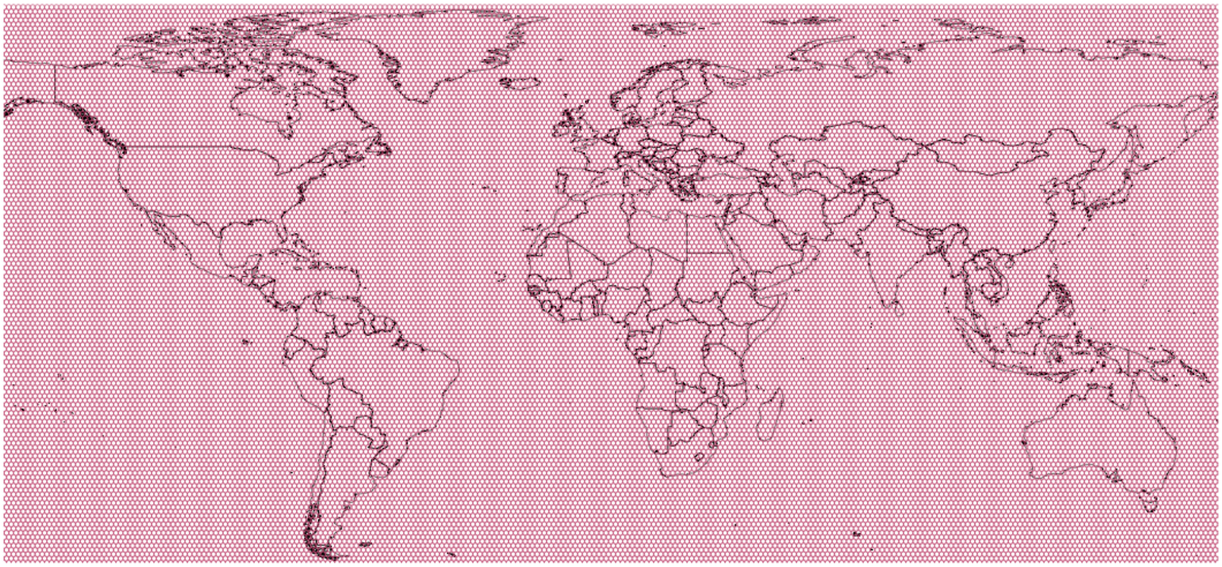

Figure A.14: 1.25 Hexagonal Unit Overlay of World Map. *This plot shows the global overlay of hexagonal units for reference of the size of units in each group.*