Conflict and Development: the Type of Peace and Economic Growth in Post-Conflict Countries

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Abstract:

This paper investigates the relationship between growth and development through two main perspectives: the effect of ongoing conflict and the type of peace. Although conflict and development literature has a consensus that conflict depresses growth, the effect of peace type on growth has not been extensively analyzed. In this study, I have constructed a panel data set containing 28 countries and the period between 1998 and 2018. Through two-way fixed effect regressions, we suggest that ongoing conflict significantly depresses GDP growth, and in general, when peace is achieved through cooperation, I expect higher growth rates when compared to peace by victory. However, through various robustness checks, we found out that the significance and direction of this relationship change according to further exogenous controls. In order to explain these variations, I employed some machine learning methodologies, K-Means clustering, random forest and gradient boosting. Those methods also revealed different interpretations.

Keywords: Post-conflict, conflict resolution, economic development, fixed effect estimation, machine learning

JEL Classification Numbers: C23, C38, D74, F51, O11

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1   Introduction

Crime affects most developing nations. Frances Stewart (2005) reports that eight of the ten poorest nations experience instability civil wars, revolutions, and destruction. These issues have a huge societal cost and harm development, she claims. The causes and channels of disagreements might vary. In this research, I replicated the previous analysis in another software and added some analysis to explore the effects of conflict existence, scope, intensity, ending type, and processes on economic development.

Social conflict can range from peaceful protests, processes, and strikes to violent riots and civil war. I see political and institutional reasons, poor state institutions, elite power struggles, political exclusion, corruption, ethnic confusion, and rising poverty as causes of these conflicts. When I say economic development, I make inferences about the changes in economic activity based on values such as per capita GDP growth, income and welfare distribution, and GDP growth. Indeed, numerous factors affect countries' economic performance. I found comparable results in a 20-year study of 28 countries. Conflicts have evident instant effects. Social and economic systems are impacted by deaths, injuries, population changes, economic actor downturns and stops, and loss of trust in countries. I assumed the reduced economic activities during these processes were restored to normal following the conflicts. This study was meant to highlight the lags between these changes and the effects of ending and recurring conflicts.

The 28 countries studied share specific characteristics. First, these countries had internal conflicts between 1998 and 2018. Since my sample consisted of over 40 nations, I removed some due to GDP and other control variable data gaps. In the following sections, I analyzed the distribution, characteristics, and statistical values of these countries from different continents based on geographical regions.

It's important to analyze how conflicts in these countries vary over time to understand how to solve them, how far to go, and what to consider. I also looked at the economic impact of peace type, a missing subject in the literature, on ending conflicts. I hypothesize that countries perform better economically during peacetime. The theoretical background

section highlights the importance of this observation in conflict and development literature. In this section, I hope to validate this theory by analyzing nations that suffered civil unrest between 1998 and 2018. Panel data, time-fixed effect, and country-fixed effect regression analysis were used to measure these variables. my findings support my first hypothesis.

My second hypothesis fills the gap in economic development and performance depending on how the dispute is resolved: by actor cooperation or by group victory. I believed peace by cooperation would boost economic growth more than peace by victory. I tested my second hypothesis using new variables, which I detailed in the following sections and found significant in my previous analysis with a different software but nonsignificant here. I defined peace kind, peace five years, and agreement type variables in addition to the data sets I used. These characteristics tested my second theory and indicated new research avenues.

This paper used data from the 2022 research and I employed different software to replicate the results. I also used K-Means clustering to examine the intricate relationship between internal disputes, peace status, and economic metrics like GDP growth. This unsupervised learning technique, which is used to segment countries by looking at these variables, helps understand the inherent groupings in the data. I tried to create interpretable relationships beyond usual analyses.

Apart from these, estimation methods with different features, such as random forest and gradient boosting, were used. This methodology provides insight into the most influential feature types in predicting the outcome. Gradient boosting also performs well on complex datasets where relationships between variables are not straightforward.

If we talk about the general form of the article, in the second part, there is a literature review of previous scholarly work that studied the link between conflict and development. The third section explains how the data is obtained and how the sample is created. In the fourth section, my hypotheses are explained, and in the fifth section, the tests, analyses, and results are examined in detail. The summary of the results of the research and the discussion on the subject are presented in the conclusion.

2   Literature Review

The key question of my first hypothesis is: Do conflicts limit growth? Conflict cannot promote growth when viewed objectively. From a layered perspective, how long the conflict lasted, whether it ended with firmness or agreement, and whether it was a straight agreement or one with political provisions may affect the country's growth trend. There are different approaches and evaluations regarding this reflection in the literature.

The 2010 book "Consequences of Civil Conflict" examined how conflicts affected the "Millennium Development Goals," which include poverty, education, gender, mortality, and environmental sustainability in less-developed countries that experienced conflicts from 1965 to 2009. Conflict, fragility, and poor development outcomes are linked, according to analyses. Asia and Sub-Saharan Africa are the main developing countries with these issues.

"Evidence of the Relationship between Political Stability and National Economic Performance" (Polachek et al. 2010) examined how different kinds of conflicts affect GDP and per capita GDP growth. They used political science literature's interstate and intrastate conflict measures to determine how international and civil wars affect economic growth. Since the 1990s, empirical economic growth theory was used to achieve these results. Civil war reduces GDP growth by 0.01–0.13 percentage points, and high-intensity inter-state conflict by 0.18–2.77 percentage points, depending on severity.

"Conflict and Development" (Ray et al. 2017) examined economic development and social conflict. They refer to economic development, per capita income growth, and internal unrest, from peaceful protests, processions, and strikes to violent riots, civil wars, and social conflicts. Three common perceptions are carefully investigated in their review: That conflict declines with economic growth, is organized along economic differences rather than similarities, and is ethnically motivated, especially in developing countries. Ray and Esteban focused on conflict causes rather than effects.

Using a panel of 190 countries from 1970 to 2014, "The Global Economic Burden of Violent Conflict" (Bozzoli et al. 2018) estimated the average impact of different types of conflicts on ten-year GDP. Despite some evidence of faster post-conflict recovery and possible

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benefits for external participants, violent conflict causes net global losses that reduce the peace dividend long after peace is achieved.

These papers agree that conflict growth is negative. Interestingly, Bozzoli et al. estimated that the world would have been 33% wealthier without conflict from 1960 to 2014. Their methods for achieving results differ. Ray et al. (2017) studied inter-state conflicts and their causes. (Polachek et al. 2012) also noted inter-state conflicts, but they excluded years before 1990 for a more significant result. Starting from 1998, we excluded years that were not filled out to avoid comparison and countries with inter-state conflicts to eliminate external growth effects.

My second hypothesis is that peace type affects growth. We can analyze wars' endings and effects using the peace approach because we classify peace types as peace by victory and peace agreement and peace agreements as simplistic and comprehensive. Peace classifications and country selections vary.

War Endings: Do They Impact Post-Conflict Development? Francis Stewart's (2017) post-war study asks, "Are conflicts likely to recur with different types of war?" Does war ending affect development?". Analysis of the first question has changed over time: Depending on who won the war—government or rebels—a decisive victory led to a sustained peace environment (Fortna 2004; Quinn et al. 2007; Kreutz 2010). However, wars that end with peace agreements have a much lower conflict recurrence rate than the overall rate. To answer the second question, they used econometrics and paired case studies in sub-Saharan Africa, South Asia, and Latin America. The result was not decisive but as expected due to data deficiencies. Most winning countries have faster growth and lower infant mortality. Peace agreement countries share growth results better, spend more on social programs, and have lower inequality.

"Does Political Inclusion of Rebel Parties Promote Peace After Civil Conflict?" Marshall et al. (2016) examined the likelihood of civil wars and government–rebel group conflict after a settlement. Thus, Marshall and Ishiyama found that former rebel parties in the national government increase the likelihood of a lasting post-settlement peace. To be more specific,

allowing major rebel parties to participate in government is the key to post-conflict peace.

The literature generally agrees that who won the war affects post-conflict growth trends and that the duration of the peace depends on the pre-war sides in the post-war government. While these papers analyze peace agreements similarly, this paper divides them into simplistic and comprehensive agreements to add a different perspective.

This paper examines post-conflict growth in intrastate conflict countries. I wanted to find the most important conflict-growth link. I excluded countries that experienced interstate conflicts to avoid their external effects. The Institutional Quality Dataset helped me boost developmental indicators and support GDP growth. My key growth indicator settings and conceptualization of countries and conflicts gave the relevant literature a new perspective.

3   Sampling and Data Collection

Explaining how country conflicts affect economic activity is one of my main hypotheses. I wanted to use statistical data in the model I described in the previous section to measure this effect and strengthen my analysis. I chose countries with internal conflicts as my first common point. I studied countries with internal conflict from 1998-2018. These countries are in Table 2. Figure 1 shows that most of these 28 countries are in Africa. The rest are in South Asia, Asia Pacific, South America, the Caribbean, and the Middle East.

These low-income nations average 65,330 billion dollars in GDP. Guinea-Bissau has the lowest GDP, 0.651 billion dollars, and Nigeriea the highest, 492,075 billion. For economic activity analysis, I used GDP growth. I used World Bank World Development Indicators GDP estimates. I used a 0–1 active variable to indicate whether countries are at conflict in the given years. From the UCDP-PRIO dataset, this variable distinguishes peace and conflict periods by 25 fatalities per year (Gleditsch et al. 2002). To measure conflict intensity, the fatal variable counts deaths. I also measure conflict intensity (fatalities per 10,000 people) to improve measurement. Gleditsch et al. (2002) also aggregate fatality data from UCDP-PRIO conflict-event datasets.

From the International Country Risk Guide (ICRG) Researchers Dataset (2013), I calcu-

Figure 1: World Map with Countries in the Sample

lated bureaucratic quality, corruption, government stability, democratic accountability, and socioeconomic index using the World Development Index. In Table 1, the summary statistics of the panel's control, independent, and dependent variables are listed for analysis.

	Mean	Sd	Min	Max	Range	Se
GDP (in billion US&)	65.330	88.912	0.651	492.075	491.423	3.724
GDP_growth	4.40	8.52	-62.08	123.14	185.22	0.36
GDPpercap (in thousand US&)	1869.33	1704.06	260.35	8870.66	8610.31	71.38
Fatalities (annual)	998.71	5422.40	0.00	71352.00	71352.00	223.62
Conflict intensity	0.52	2.93	0.00	36.44	36.44	0.12
Active	0.47	0.50	0.00	1.00	1.00	0.02
Bureacratic quality	1.08	0.81	0.00	3.00	3.00	0.03
Govternment stability	8.30	1.68	3.17	11.25	8.08	0.07
Democratic accountability	2.89	1.40	0.00	6.00	6.00	0.06
Socio-economic	3.08	1.49	0.00	7.08	7.08	0.06
Corruption	1.83	0.69	0.00	4.00	4.00	0.03

Table 1: Summary statistics for the panel.

I examined the independent variables and control variable correlations in the model to en-sure analysis consistency. I excluded external and internal conflict variables, which are highly correlated and cause model deviations, based on Figure 2 values to avoid multicollinearity.

Internal conflict has the same exact correlation as external conflict with democratic account-ability (46%). External conflict is correlated with active and socioeconomic index variables by 30%. Internal conflict and active variables are negatively correlated at 53%. The afore-mentioned variables were excluded from my study to avoid data-sourced multicollinearity and precision loss, which weakens my regression model's statistical power.
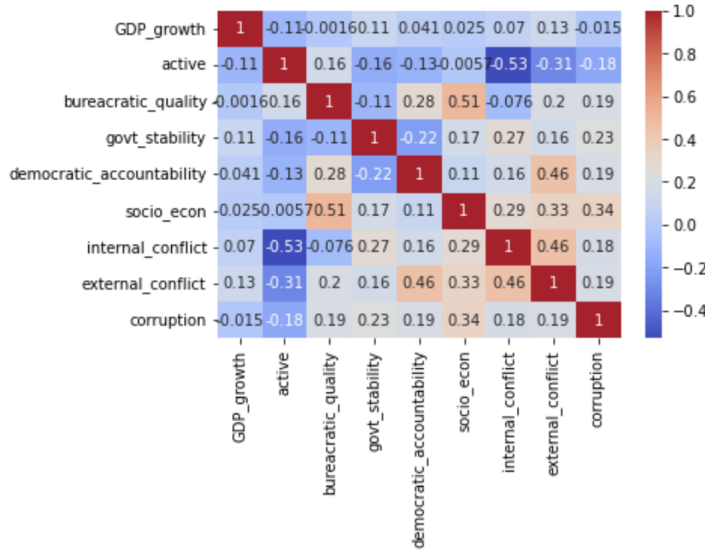

Figure 2: Correlation Matrix of Variables

This study uses UCDP PRIO and WDI data and other variables. My variable peace.by measures whether the conflict continues, whether peace has been achieved, and whether one side won or the parties reached an agreement. I defined peace.by as a dummy variable among subset groups of conflicting and peaceful countries. I used UCDP Peace Agreements Dataset data on all 1998–2018 peace agreements (Pettersson et al. 2019).

This involved checking active and agreement variables. If a peace agreement changed the active variable from 1 to 0, I said peace by agreement. If the active variable went from 1 to 0 without agreement, I probably concluded peace by victory. I processed these inferences into my dataset after country/conflict-specific confirmation. In years where the Active variable remained 1, ongoing conflict was marked.

During the analysis, I also observed GDP and GDP Growth, which I use to measure economic activity, with lags of 1, 2, and 3 years. I thought conflicts that affect total pro-

duction in internal dynamics of countries would last for years after they ended. Based on this assumption and these processes, I found the 2-year lag variable more accurate for my analysis. This issue will be detailed in the measurements and regression analyses below.

I added the five years after the year of peace to my analysis to test my model's robustness. For five years after peace is established, peace.fiveyrs is 1, but conflict years or peace episodes after its inception are 0.

Table 2: List of Countries and Their Conflicts

Country	Numb. of Conf.	Fatality	PA	PV	GDP Growth	Ag. Type
Algeria	1	10386	1	2	3,47	None
Angola	4	6130	0	2	5,56	Comprehensive
Bangladesh	2	304	0	2	5,94	None
Burkina Faso	1	110	0	0	5,80	None
Cameroon	1	2993	0	0	4,26	None
Colombia	2	13839	1	0	3,30	Both
Congo	3	4178	2	1	2,52	Comprehensive
DR Congo (Zaire)	2	21939	1	0	4,05	Both
Guinea	1	647	0	1	4,36	None
Guinea-Bissau	1	704	0	1	1,65	Simplistic
Haiti	1	207	0	1	1,96	None
Iraq	1	72628	0	0	7,40	None
Ivory Coast	2	930	1	1	3,32	Comprehensive
Liberia	1	2677	1	0	2,67	Comprehensive
Libya	2	6270	0	1	5,45	None
Mali	3	2762	0	2	5,03	Comprehensive
Mozambique	3	195	0	2	7,14	None
Myanmar (Burma)	1	5523	0	0	9,73	None
Niger	3	1109	0	2	5,00	None
Nigeria	3	17331	0	2	5,43	None
Peru	2	359	0	2	4,48	None
Philippines	1	12546	0	0	5,05	None
Sierra Leone	1	6872	1	0	5,38	Comprehensive
Somalia	2	21477	0	1	8,21	Comprehensive
Sudan	1	31411	0	0	2,39	Both
Syria	1	315816	0	0	-0,60	None
Uganda	1	5084	1	0	6,25	Both
Yemen (North Yemen)	1	22817	0	0	0,54	Comprehensive

Notes: This table includes the conflicts within the countries, their sizes, solutions, and the average growth amount of the country. In the first column, the names of the countries. In the second column, how many different conflicts took place, in the third column, the total number of deaths in these conflicts, in the fourth column, how peace was achieved by agreement. In the fifth column are the number of peace periods achieved by victory. In column 6, we show the average growth of countries' GDP over 20 years, and in column 7, we show the types of agreements made.

4 Hypotheses

4.1 Hypothesis 1: Ongoing conflict and growth

Hypothesis 1 *When there is an ongoing conflict, countries observe lower rates of economic growth in terms of GDP growth.*

I hypothesize that countries' economies perform better during peacetime. The theoretical background section highlights the importance of this observation in conflict and development literature. In this section, I expect to validate this hypothesis by analyzing countries that experienced civil conflict between 1998 and 2018.

Cross-country analyses comparing countries that have and have not experienced conflict in a given year using more heterogeneous samples have dominated this relationship. I only include countries that experienced civil or intrastate conflict between 1998 and 2018. Thus, due to sampling, my sample is more homogeneous and my analysis compares conflict and post-conflict (peace) periods. As countries recover from conflict, their economies should recover. I use GDP growth metrics to predict economic recovery and post-conflict development.

I created a two-way fixed effects model using panel data to test this relationship, as shown in Equation 1:

$$Growth_{i,t} = \beta_0 + \beta_1 Active_{i,t} + \sum_{k=2}^{n} \beta_k X_{k_{i,t}} + \epsilon_{i,t} \tag{1}$$

The dependent variable $Growth_{i,t}$ denotes yearly GDP growth in this model. $Active_{i,t}$ denotes whether a country experiences civil conflict in a given year. $Active_{i,t}$ is constructed as a dummy variable that takes 0 for peace periods and 1 for conflict periods. $X_{k_{i,t}}$ stands for various control variables explained in the previous section. Lastly, as I use panel data, I control for fixed effects in both countries (denoted by i) and years (denoted by t).

4.2 Hypothesis 2: Type of peace and growth

Hypothesis 2 *When a conflict is ended by the agreement or cooperation of different parties, countries observe greater economic growth rates in post-conflict periods compared to conflict resolution by the victory of one side.*

Peace shape affects economic growth and development. I hypothesize that inclusive political processes and dialogue reduce conflict relapse, increase economic system efficiency, and boost economic growth and development when conflicting parties reach an agreement to end the conflict. However, when a conflict is ended by total coercion and one side wins, important civil groups are excluded, resulting in inefficient participation of societal groups in economic activity, greater conflict relapse, and lower economic growth.

To determine if peace type significantly impacts post-conflict economic growth, I created a two-way fixed effects model using panel data (Equation 2):

$$Growth_{i,t} = \beta_0 + \beta_1 Peace\_by_{i,t} + \sum_{k=2}^{n} \beta_k X_{k_{i,t}} + \epsilon_{i,t} \tag{2}$$

Here, my main independent variable differs from the first equation. $Peace\_by_{i,t}$ classifies post-conflict peace periods into two categories: *peace by agreement* and *peace by victory.* $Peace\_by_{i,t}$ takes the value 0 when the conflict is ended by a version of cooperation of conflicting parties (a peace agreement), and 1 value when the conflict is ended by the decisive military victory of one side. As the dependent variable $Growth_{i,t}$ stays the same, the control variables $X_{k_{i,t}}$ are also the same. Moreover, I control fixed effects in both countries (denoted by i) and years (denoted by t). I will also employ different lags for my dependent variable on the grounds that the income effect of conflict resolution can come later in time.

5   Empirical Results

5.1   Results for ongoing conflict and growth

This section will empirically investigate the relationship between ongoing conflict and economic growth. Some descriptive statistics relating to my first hypothesis are given in Table 3.

Conflict	Growth	Bureaucracy	Govt Stability	Democracy	Corruption
Not active	2.62	0.97	8.56	3.06	1.95
Active	1.34	1.20	8.01	2.70	1.70

Table 3: The status of conflict, economic growth, and political control variables.

Economic growth and control variables (except bureaucratic quality) are lower during active conflict. The table indicates higher bureaucratic quality. However, when I compare mean bureaucratic quality scores between conflict and peace episodes, I get a p-value of 0.14 and fail to reject the null hypothesis that the two samples are equal.

Table 4 shows my first model's panel regression results. My dependent and independent variables are annual GDP growth and the "Active" conflict dummy. The two-way fixed effects method controls the regression model's country and time-fixed effects. According to the first bivariate model, ongoing conflict in a country is associated with a 4.3% lower GDP growth compared to peace periods. This relationship is highly significant at a 99% significance level. Stepping through the control variables, I see that the active conflict variable retains its significance and negative directional relationship.

Using Table 4's largest Model 6, I can support Hypothesis 1. This model predicts a 3.7% GDP reduction in countries with active conflict while controlling for key variables. Interestingly, with the Active variable, none of the control variables are highly significant in Model 6, even though they all have high GDP correlations.

Please note that my model compares conflict and post-conflict episodes. The Active coefficient is invalid for comparing conflict-ridden and developed countries and does not explain counterfactual scenarios like the estimated economic impact of conflict for countries that have never been in conflict.

Table 4: GDP growth and ongoing conflict. Two-way fixed effects model.

	Dependent variable:					
	GDP growth					
	(1)	(2)	(3)	(4)	(5)	(6)
Active	−4.359***	−4.309***	−3.902***	−3.788***	−3.709***	−3.744***
	(0.976)	(0.979)	(0.988)	(1.016)	(1.021)	(1.023)
Bureaucratic quality		−1.015	−0.736	−0.910	−1.140	−1.050
		(1.587)	(1.583)	(1.625)	(1.646)	(1.654)
Government stability			0.919*	0.900*	0.799*	0.798*
			(0.365)	(0.367)	(0.385)	(0.385)
Democratic accountability				0.215	0.171	0.163
				(0.449)	(0.451)	(0.452)
Socio-econonmic					0.516	0.486
					(0.588)	(0.591)
Corruption						0.417
						(0.756)
Observations	567	567	567	567	567	567
R^2	0.037	0.038	0.049	0.050	0.051	0.052

Note: *p<0.1; **p<0.05; ***p<0.01

5.2 Results for the type of peace and growth

5.2.1 Hypothesis and descriptive statistics

The second hypothesis examines how peace affects GDP per capita. I am interested in the type of peace (peace_by), a binary variable that describes peace episodes. The first model examined the active variable, which measured ongoing conflict or peace in a given year per country, with 567 country-year observations. However, since the second model examines the type of peace, I had to remove the conflict and pre-conflict years from my sample to focus on peace episodes and compare countries' growth trajectories that ended their civil wars differently. Thus, this refinement yields 185 country-year observations, 18 unique countries, and an unbalanced panel. Despite controlling for time and countries, the two-way fixed effects model (TWFE) still estimates my unbalanced panel data well (Wooldridge 2021).

Here, peace_by = 0 for cooperation episodes and 1 for victory episodes. Table 5 shows descriptive statistics for my second model.

	Peace	Growth	Bureaucracy	Govt Stability	Democracy	Corruption
By cooperation		2.33	0.62	8.97	3.27	2.07
By victory		3.32	1.27	7.22	3.21	1.84

Table 5: The type of peace, economic growth, and political control variables.

Generally, peace by cooperation leads to better government stability, democratic accountability, and corruption control. Despite my initial hypothesis, cooperative peace is associated with lower GDP per capita, my main variable of interest.

To improve robustness, I control for the first five years of peace episodes in my analysis. Some countries in my dataset have conflict in the first few years (say, 1998–2001), but the rest of the 18-year period (2001–2018) is peaceful. Such periods have long-term effects that can reduce conflict and manipulate my results. Also, I present my refined analysis for the first five years. Controlling for the first five years of peace reduces my sample to 99 country-year observations.

	Peace	Growth	Bureaucracy	Govt Stability	Democracy	Corruption
By cooperation		2.73	0.71	9.38	2.67	2.14
By victory		4.34	1.19	7.68	2.90	1.91

Table 6: The type of peace, economic growth, and political control variables for first 5 years of post-conflict episodes.

In Table 6, the first five years of refinement show similar characteristics. When the simple mean of growth rates for peace by cooperation and victory episodes are taken separately, peace by victory episodes have higher growth rates. These are not regression results because I do not control for other factors or time and state fixed effects. These simple observations can mislead.

A potential implication of descriptive statistics is the variation in *bureaucratic quality* between two types of episodes. Bureaucratic quality is significantly better in episodes of peace that are attained by the victory of one side; in other words, *peace by victory*. To explain this outcome, I can use the Coase Theorem and its implications for civil conflict

and conflict resolution. According to Daron Acemoğlu (2003), countries with more efficient institutions are less likely to experience civil or social conflicts. My suggestion is to use the *bureaucratic quality* variable to measure government efficiency. As a counterhypothesis, I could argue that more efficient government institutions increase the state's infrastructural power, which can help it suppress conflict. These stronger states can easily suppress opposition, so they don't need rebel groups to achieve peace through cooperation. Stronger states with better infrastructure are more likely to achieve peace by excluding other parties. The vast macroeconomics literature also shows that efficiency boosts growth (Angelopouloset al. 2017).

These theoretical mechanisms gave my panel regression models two expectations. First, Hypothesis 2 predicts higher peace growth rates from cooperation episodes. Second, due to the potential endogeneity of economic growth, peace type, and bureaucratic quality, I expect peace-by-victory episodes to have higher growth rates, not because peace type directly affects GDP growth but because countries that end conflicts through victory usually have more efficient institutions, which increases bureaucratic quality and post-conflict growth.

Two methods will help me understand how the peace type affects GDP growth. I will use Regression Discontinuity Analysis to assess the post-conflict reconstruction impact of various peace types and their enhancement of countries' economic status. Second, I will present panel regressions using control variables and fixed effects to understand how peace type affects GDP growth.

5.2.2   Regression Discontinuity Analysis

Regression Discontinuity Analysis (RDA) is a common statistical tool for assessing treatment effectiveness in experimental settings (Frey 2018). I do not use experimental data, but conflict endings and countries' post-conflict transitions can be treated. I created two variables: *time_to_event2* and *time_to_event3*.

The variable *time_to_event2* uses the conflict ending year as a cut-off for countries that transition to peace through cooperation. It then subtracts the cut-off year from the current

year to calculate the number of years until the conflict ends. This variable tracks countries for five to ten years before and after the cut-off to account for most of the data. The *time_to_event3* variable function similarly for countries that achieve peace through victory.
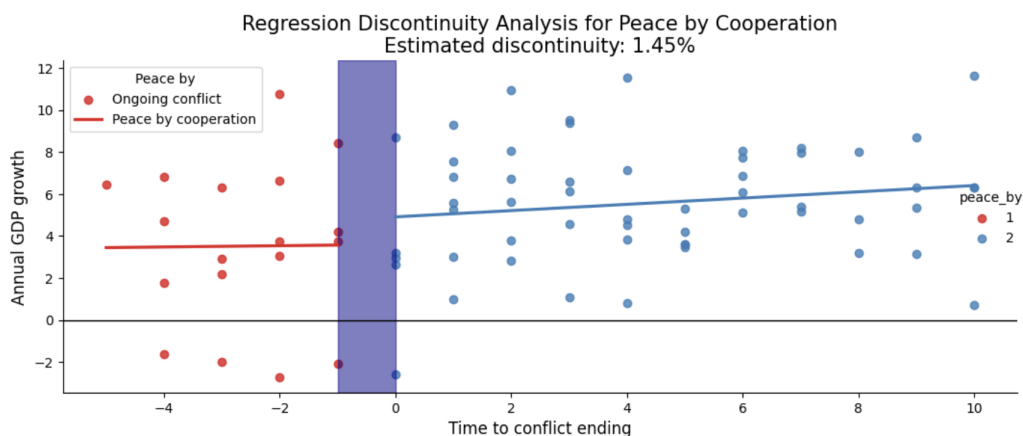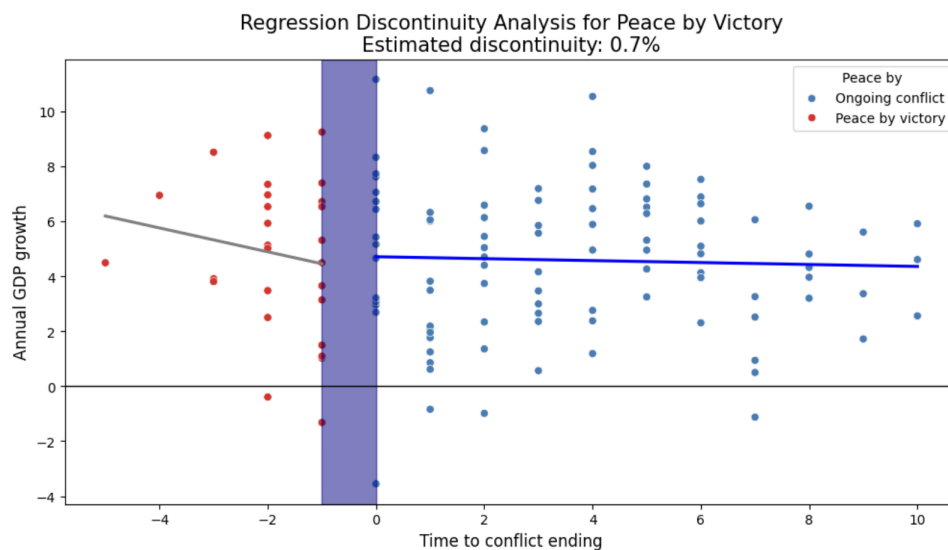

Figure 3: RDA for peace by cooperation

Figure 4: RDA for peace by victory

Figures 3 and 4 show that peace by victory and cooperation have positive treatment effects due to positively estimated discontinuities. Peace periods average higher growth and lower volatility.

During peace-by-cooperation periods, the discontinuity estimate is higher than during peace-by-victory. RDA results do not account for control variables or country-year fixed

effects. Therefore does not account for data endogeneity. I'll fix this with panel regressions in the next section. Covariates can be added to the RDA model and analyzed in an event study model using advanced methods.

5.2.3   Panel regressions

Table 7 shows the panel regression results for my second hypothesis, which examines economic growth and peace. Remember that the *peace_by* variable is 0 for cooperation episodes and 0 for victory episodes. As mentioned, my model controls time and state effects with TWFE.

I also use a two-year GDP growth lag. Since this refined sample for this model does not account for conflict years and conflict-time growth values, I found that a two-year lag best accounts for the lagged development effect of conflict resolution and post-conflict reconstruction through various tests and trials.

Table 7, model 1, shows a negative estimate of the simple bivariate peace type-lagged GDP growth relationship. Adding variables changes it, but they are not significant, so we cannot interpret it.

After adding control variables, the *peace_by* variable remains slightly significant and negative. In final model 6, the *Bureaucratic quality* control variable is the primary contributor to GDP growth. As bureaucratic quality rises, GDP growth should rise.

These findings do not strongly suggest that peace type strongly affects growth rate. However, confounding factors, particularly bureaucratic quality, play a larger role in explaining economic growth in this comparison.

This observation supports the counter-hypothesis that I discussed in the Hypothesis 2 section. In that section, I have found out that countries that wield more efficient bureaucratic institutions are more capable of ending conflicts through victory. Post-conflict countries grow faster due to bureaucratic quality and infrastructural power, not peace.

Table 7: **GDP growth (with two years lag) and the type of peace. Two-way fixed effects model**

			Dependent variable:			
			GDP growth (t+2)			
	(1)	(2)	(3)	(4)	(5)	(6)
Peace by	−0.806	0.095	0.029	0.065	−0.262	−0.365
	(1.738)	(1.823)	(1.832)	(1.843)	(1.876)	(1.896)
Bureaucratic quality		−6.485	−6.291	−6.280	−6.178	−5.880
		(4.138)	(4.166)	(4.180)	(4.183)	(4.250)
Government stability			0.204	0.197	0.056	0.068
			(0.400)	(0.402)	(0.429)	(0.431)
Democratic accountability				0.135	0.036	0.003
				(0.532)	(0.562)	(0.571)
Socio-economic					0.811	0.800
					(0.854)	(0.856)
Corruption						−0.496
						(1.139)
Observations	185	185	185	185	185	185
R^2	0.015	0.018	0.020	0.020	0.026	0.027

Note:	*p<0.1; **p<0.05; ***p<0.01

5.2.4 Robustness check 1: First five years

I use only the first five years of peace episodes to test my results against the short- and long-term effects of peace type. According to Stewart and Daga (2017), conflict's marginal impact decreases over time. They examine observations from the first decade of peace. Due to limited time coverage, I will look at the first five years to see if my panel regression results change.

Table 8 estimates the first five years of the reduced data set. Similar results to Table 7.

In Table 8, the first model estimates a similar negative relationship between economic growth and peace type, with short-term cooperative peace periods having higher growth

Table 8: GDP per capita growth (with two years lag) and the type of peace (first five years). Two-way fixed effects model.

					Dependent variable:	
				GDP growth (t+2)		
	(1)	(2)	(3)	(4)	(5)	(6)
Peace by	-2.430	3.025	2.864	2.785	2.075	2.861
	(1.998)	(2.266)	(2.279)	(2.280)	(2.312)	(2.387)
Bureaucratic quality		-20.465^{***}	-19.359^{***}	-20.050^{***}	-21.003^{***}	-21.880^{***}
		(5.187)	(5.360)	(5.404)	(5.395)	(5.417)
Government stability			0.365	0.381	0.177	0.175
			(0.431)	(0.431)	(0.450)	(0.448)
Democratic accountability				-0.512	-0.789	-0.708
				(0.511)	(0.541)	(0.543)
Socio-economic					1.211	1.064
					(0.839)	(0.843)
Corruption						1.473
						(1.187)
Observations	99	99	99	99	99	99
R^2	0.023	0.225	0.234	0.247	0.274	0.029

Note: *p<0.1; **p<0.05; ***p<0.01

rates. The relationship direction and magnitude are similar in the final model 6 with all control variables, but the peace type loses significance. This model's peace type and democratic accountability estimates are barely significant. In contrast to the previous model, bureaucratic accountability is not a significant variable.

Since the model has low explanatory power, the first five-year results are harder to interpret. This suggests that qualitative and within-case study methods could reveal other variables that affect growth in the early stages of post-conflict recovery.

Questions must be asked of the ruling party or parties. We must ask how other parties are integrated into government or civil society during peace-by-cooperation. Do the parties reach an agreement to end the conflict and find growth opportunities, or do they collude by distributing rents (which may involve precious natural resources and minerals)?

Rebel and government motives matter in peace by victory. Sometimes, terrorist groups incite civil war with radical ideologies. Whenever possible, governments avoid such groups. Thus, they legitimately suppress those groups with coercion. A dictatorship is another example. The dictatorship cares only about staying in power and not the public. A government that wins may also seek peace by ignoring a counterfactual scenario in which progressive rebel groups improve the economy.

Thus, those differentiations may explain why my model fails to explain GDP growth in the short term. However, collecting such detailed data from conflict-ridden countries is difficult and requires qualitative within-case studies to classify actor motives and peace and development methods.

5.2.5   Robustness check 2: Before and after 2008

Global economic growth and recession were impacted by the 2008 financial crisis. The crisis has also hit low-income countries despite most analyses focusing on developed and high-income countries (Sayeh 2012). Most of my sample is from Africa, so comparing development trajectories before and after the crisis is important.

The 2008 financial crisis lowered commodity prices, weakened external demand, and raised unemployment. The first two factors have hurt African economies, mostly due to falling export demand and prices (Ali 2009). Mostly Sub-Saharan Africa was isolated from global transmission. They maintained high growth post-crisis through reasonable policies. The global crisis still affected African nations with complex export relations (Stein 2016). Additionally, countries that experienced civil strife were more affected and adopted more inward-looking policies as exports of raw materials decreased (Sayeh 2012).

My sample includes countries with conflicts, so I expect lower post-crisis economic growth. Figure 5 shows my sample countries' average annual growth rates before and after the 2008 crisis. GDP growth increased pre-crisis, but post-crisis volatility and growth decreased. To account for this characteristic of my dependent variable, I split my panel data into two country-year episodes: 1998-2007 and 2008-2018.
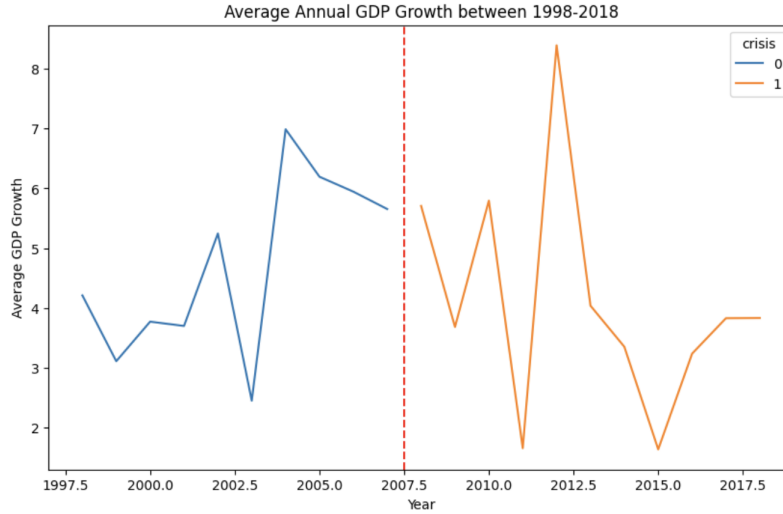
Figure 5: Pre- and post-2008 financial crisis growth levels for sampled countries.

No similar analysis on how financial crises affect peace types has been found in peace types and development literature. Further research can explain this indirectly. The 2022 analysis showed pre/post-crisis coefficients in different models. Countries' average growth rates don't differ much. After the crisis, volatility and decline increased. The robustness check tables are excluded because they are not analyzed this project.

6   K-Means Clustering

As seen in this study, there is a complex relationship between internal conflict, peace status, economic indicators, and the control variables used for the country. Before this section, I tried to examine this relationship in a robust form and compare the results. In addition, the K-means clustering method appears as another approach. This unsupervised learning technique is pretty effective for understanding inherent groupings varying from country to country, year to year in the data I used. This machine-learning technique allows us to observe patterns and relationships that might not be apparent through traditional analysis. Although two-way fixed effect models made with panel data helped to understand to some extent, our expectation here is a little different.

Here, our expectation from K-Means clustering is to understand countries with similar

conflict histories and similar economic activities through different groupings and to make interpretations on a group basis. By examining these clusters, I wanted to look at the relationship between different conflict and peace scenarios and economic outcomes.

First of all, I took a subset from the data by keeping the variables active conflict status, conflict intensity (fatality per thousand people), peace status, GDP growth (with 2-year lag). I normalized it so that all variables in the data had equal weight in the analysis. I used the elbow method to determine the optimal number of clusters. This technique involves plotting the within-cluster sum of squares (inertia) against the number of clusters and looking for an "elbow" point where the inertia begins to decrease at a slower rate. Then I applied K-means clustering for 3 and 4 clusters.
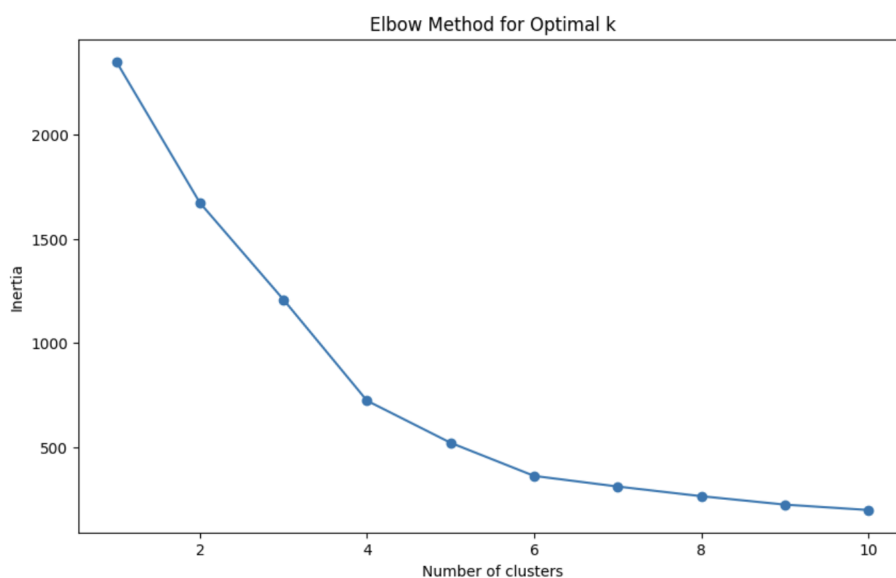
Figure 6: Elbow Graph

In the 3-way clustering model, there is low conflict intensity, low active conflict, high peace status, and average GDP growth in the 1st cluster. In the second cluster, while there is average GDP growth in the same way, there is moderate conflict intensity, high active conflict, and moderate peace status. The 3rd cluster, similar to the first cluster, contains low conflict intensity, low active conflict, low peace status, and above-average GDP growth, which differentiates it from the other two clusters. In the 4-cluster model, there is an additional cluster with significantly higher GDP growth rates, differing considerably from

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other clusters.

Clusters created with K-Means allow us to make a valuable inference. Accordingly, we generally observe average and stable economic growth in countries where peace prevails for long periods. It is possible to say that there is limited economic growth in countries experiencing frequent conflict. This reveals the negative impact of ongoing conflict on economic performance.

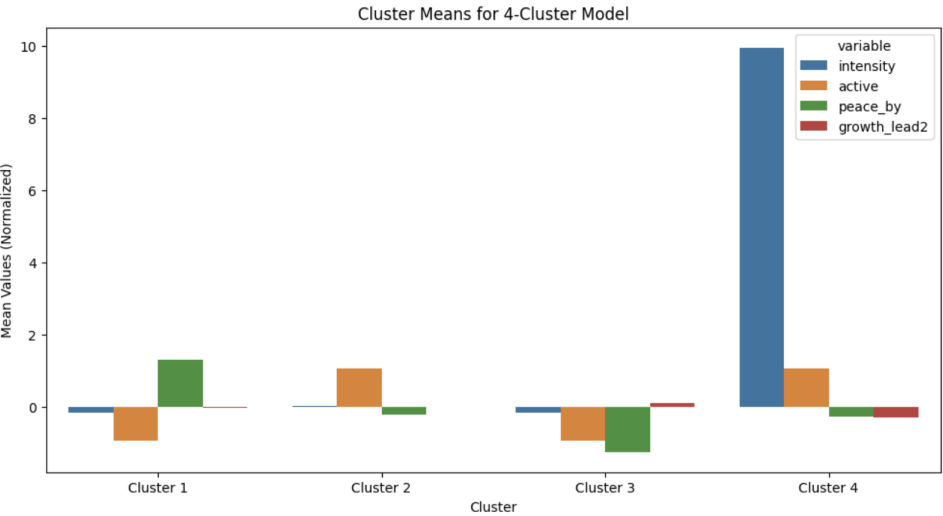Figure 7: Visualizing the mean values for the 3-cluster model

Figure 8: Visualizing the mean values for the 4-cluster model

Interestingly, in the post-conflict period, some countries show above-average economic

growth performance despite their low peace status. For this observation, which can be interpreted in the same way as the first five years estimation and RDD analysis of the post-conflict period, we can evaluate the impact of foreign investments coming to countries where the risk situation has disappeared and the reconstruction efforts after internal conflicts. This K-Means clustering analysis makes a significant contribution to understanding the relationship between conflict, peace, and economic development.

7 Random Forest and Gradient Boosting

In addition to the analyses described above, I performed random forest and gradient boosting estimations. This methodology provides an insight about the most influential features in predicting the outcome. Gradient boosting also performs well on complex datasets where relationships between variables are not straightforward. Although we advocate a direct relationship here, the relationship between variables can also be examined indirectly. I expect that observing the equivalent of these index values in my dataset, where country-specific dynamics are measured with indices, will contribute to the analysis. As it is known, these two approaches have a difference. Random forests build multiple independent decision trees in parallel; each tree in gradient boosting corrects the error of its predecessor. I had the opportunity to examine the nonlinear effects between features with this method, which I used to test whether we had an overfitting problem after the high R^2 value and 0.1% signature levels in the previous panel regressions and how robust our estimation was. Gradient boosting provides a very flexible optimization opportunity, and each tree it trains progresses by correcting the errors in the previous ones. Therefore, I can say that it will contribute.

As a result of the hyperparameter tuning process for the random forest, deeper trees (max_depth: 20) and moderate regularization (min_samples_leaf: 2, min_samples_split: 10) were preferred. The mean squared error was 69.429, and the R^2 value was 0.0103. When I tried to improve the estimation with extended parameters (min_samples_split: 12), although we observed some improvement, I could not increase the fit of the model to the data sufficiently.
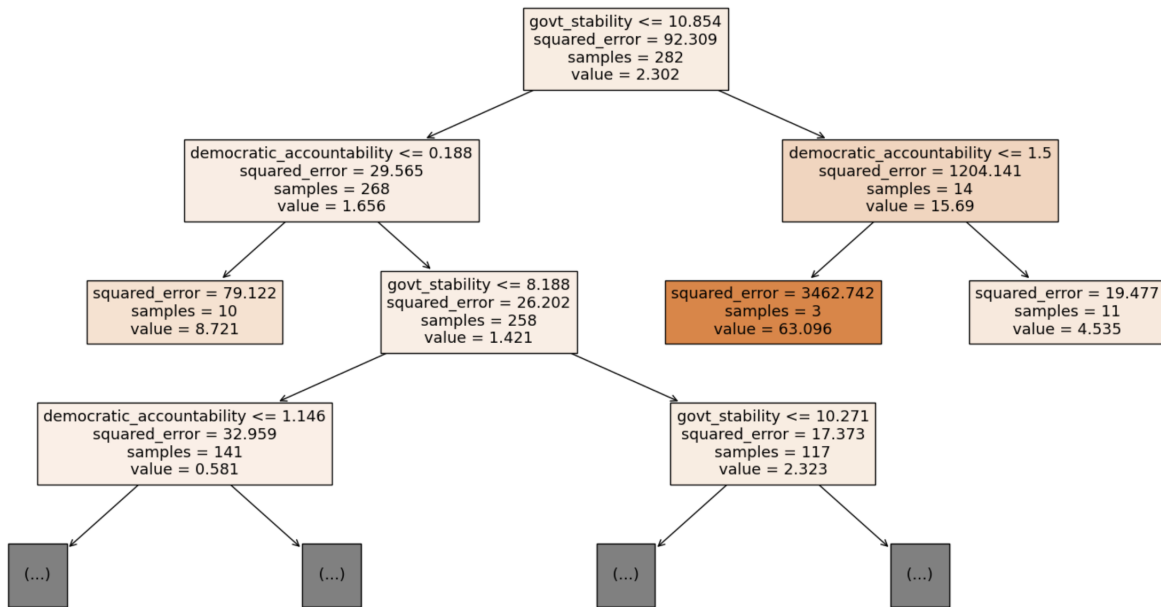
Figure 9: Selecting and visualizing a tree from the Random Forest model

Then, in the gradient boosting I did, a conservative learning rate (0.01) and shallower trees (max_depth: 3) were selected. With this model, I found MSE (66.8618) and R^2 Score (0.0469) Indicators a marginally better fit than the Random Forest model. In addition, it is possible to say that the predictive power of this model is still low.
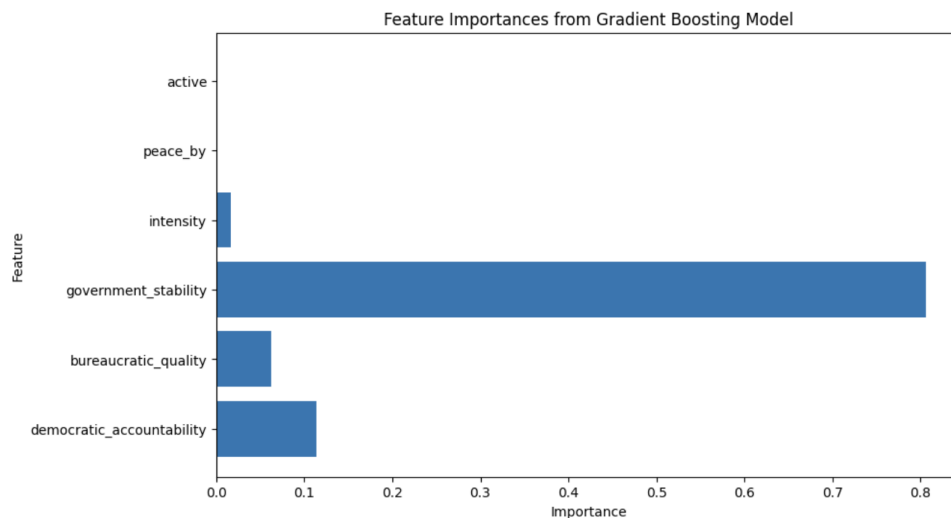

Figure 10: Bar chart for Gradient Boosting

The low R scores of the results indicate that the selected feature and model complexities

are not good enough and do not explain economic growth as well as expected. The reason for this is that it is difficult to estimate these variables, such as growth, which depends on many factors, with the parameters and explanatory variables used. It is an undeniable fact that there are many factors affecting the growth of countries. In addition, by developing these models and testing different variables, it becomes clear which features are important for policymakers. I look forward to trying different modeling techniques and developing the most descriptive parameters and features of these methods.

8   Discussion and Conclusion

Overall, my results give important implications for both of my hypotheses. Income growth is negatively correlated with active conflict, as shown in conflict and development literature. A country with active conflict is expected to have a 4.3% lower GDP growth.

Results for the second hypothesis are mixed. I hypothesized that if conflicting parties resolve their disputes through cooperation and achieve peace, post-conflict growth rates would be higher than if one side won the war. In the first model, which considered all country-year peace episodes, and the second, which considered the first five years, peace type negatively correlated with economic growth. After controlling for fixed effects and control variables, the main independent variable (peace type) was barely significant at the 10

These findings suggest that peace type may not be the most important factor in post-conflict growth. My 1998–2018 sample covers 20 years. I've seen dramatic global and macroeconomic shifts in countries' development patterns, especially before and after the 2008 global financial crisis. As an additional robustness check, I analyzed the period before and after this crisis and presented my results.

Pre-crisis growth was high for sampled countries, and my panel estimates matched my general results. My estimate for peace type reversed post-crisis, indicating higher growth for peace through victory episodes. The estimate was highly significant within the 0.5% confidence level. This suggests that controlling for external factors like financial crisis is

crucial for assessing peace by victory and peace by cooperation economic performance.

How internal conflict, peace status, economic indicators, and control variables interact in different countries is examined using K-means clustering and a robust approach. Traditional analysis may miss data groupings and patterns, but unsupervised learning does.

The K-Means clustering method groups countries with similar conflict histories and economic activities to understand them. The author analyzes these clusters to determine how conflict and peace affect economic outcomes. Normalizing active conflict status, conflict intensity, peace status, and GDP growth gives them equal weight in the study. The elbow method determines the optimal cluster count.

Clusters vary in conflict intensity, active conflict, peace status, and GDP growth. The study finds that countries with prolonged peace have average and stable economic growth, while those with frequent conflicts have low growth. Foreign investments and reconstruction may boost economic growth in some post-conflict countries.

The study also finds the most predictive features using random forest and gradient boosting estimations. These methods help complex datasets with variable relationships. Gradient boosting can fix previous tree errors and examine nonlinear feature effects, unlike random forests.

Results indicate a preference for deeper trees and moderate regularization in random forest hyperparameter tuning, but low R^2 values indicate insufficient complexity and feature selection for economic growth explanation. The study found that many factors make growth estimation difficult with the parameters and variables used. The research seeks to identify policymakers' key traits and test different modeling methods for greater descriptiveness.

I think this analysis fills a gap in conflict and development literature on post-conflict recovery and economic performance. The remaining research has covered conflict causes, resolution, and economic effects but has not examined what happens after a conflict, how countries achieve peace, or the economic effects. This paper examines how peace type affects post-conflict economic growth.

Although my models include important control variables and fixed effects, further explo-

ration of the effects of other exogenous variables on my model would increase the reliability. Most importantly, conflict resolution involves agents making decisions and acting based on their decision sets and potential payoffs. The motives and characteristics of actors can be analyzed using advanced game-theoretical models and econometric methods in future research.

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