The economic structure of a country and its role in climate-conflict nexus

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THE ECONOMIC STRUCTURE OF A COUNTRY AND ITS ROLE IN CLIMATE-CONFLICT NEXUS

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2 June 2020

Abstract

Climate-conflict literature has been growing intensively in the last decade. With a focus on African and Middle Eastern countries, various types of climate variables try to explain divergent natures of conflict. Many different mechanisms were shown as linking the two together. This study aimed to contribute to the literature by investigating the role of economic dependence on the agricultural sector in the relationship between social unrest and changing patterns of temperature and precipitation. It was asked, thus, to what extent does the economic structure of a country mediate the link between climate and social unrest, in the African continent? The large-N statistical analysis was conducted, including all the African countries, with a population of at least a million. Specifically, a negative binomial regression was run for the years from 1990 to 2007. The key finding suggested that the bigger the percentage of agricultural production in GDP is, the more the country is likely to suffer from temperature rise induced social unrest. This suggests that, because of climate change, economic reliance on the agricultural sector is dangerous for the political stability and even security in Africa. It calls for the importance of using planned adaptation techniques and educating the society on climate change and its effects.

Keywords: climate change, social unrest, agriculture, Africa

Contents

The economic structure of a country and its role in the climate-conflict nexus

The past decade was marked with an influx of scientific literature concerned with explaining the complex climate and conflict nexus. (see, e.g., Mach et al., 2019; Barnett & Adger, 2007; Hsiang & Burke, 2013; Salehyan, 2014) Different climate variables were investigated as dependent on the not less divergent scope of conflict types. The complexity of the topic lies not only within the broad scope of climate and conflict variables but within the broad scope of mechanisms that link the two as well. The political regime, state capacity, economic shifts, inequality, and technological development have all been repeatedly detected in the climate-conflict literature as mediating factors. This paper aims to look at yet another potential mediator, the namely economic structure of a country, and investigate to what extent does it mediate the link between climate and social unrest in the African continent.

Regardless of the lack of consensus on how, why, or whether the relationship is direct or dependent on other factors, there is an agreement in the literature on the fact that climate does influence conflict behavior. (Salehyan, 2014) Acknowledging the fact that conflict is dependent on other much more influential factors than climate, scholars collectively argue that climate is also important, even if to a smaller extent. Such confidence is based on multiple sources of evidence, that provide the increased likelihood of climate-related conflict, mostly in Africa and the Middle East. (Mach et al., 2019) Furthermore, the fact that climate change is a continuous process, the experts predict that its impact on conflict will substantially increase in the future. In sum, the scholarly agreement on the validity of this relationship and its salience for the future, together with the fact that the topic is complex and requires a great deal of further investigation, all lead to the conclusion that contributing to climate-conflict nexus literature is important.

Furthermore, understanding what the role of the economic structure of a country in the climate and conflict relationship is, could provide salient implications for agricultural countries of the world, especially those adversely affected by climate change in the lower latitude regions. (Mbow et al., 2019) One such region, the African continent, which is the main focus of this paper, is relying on agriculture as the “main engine for economic growth”, where more than half of the labor force of Africa is employed. (Barrios et al., 2008, p. 287) Despite the importance of it, the relative performance of this sector is poor, due to the weak institutions and policy failures. (Sachs & Warner, 1997) Other scholars include the pre-colonial slave trade, structures imposed by imperial powers, and the current international trading regime, as explanations for the unsuccessful agricultural performance in Africa. (Binswanger & Townshend, 2000). Therefore, climate change adverse effects are further enhancing the instability and unpredictability of the source of income agriculture provides for the plurality of the African population. The findings of this paper might further highlight the importance of finding plausible solutions for protecting African agriculture and thus, it's economy.

This study proceeds with exploring the relevant literature on climate-conflict nexus and identifying the disagreements and the gaps. Furthermore, theoretical motivations are presented that justify the hypotheses made. It was hypothesized that the countries, whose economies are more dependent on the agricultural sector, are more likely to suffer from climate-induced social unrest in the African continent. To test whether that is true, a large-N statistical analysis for all the African countries, that has a population of at least a million is performed. From 1990 to 2007, the results of negative binomial regression are presented. The research concludes with highlighting the limitations it has suffered from, together with societal implications and some general remarks.

Literature review

As has already been mentioned in the introduction, the climate-conflict literature has looked into how different types of climate variabilities affect divergent natures of conflict. Starting with the individual and personal violence, multiple studies have investigated how changes in climate, specifically, the increase in temperature and heat-related events, foster aggression both directly (Larrick et al., 2011) or indirectly, by making people spend more time outdoors and thus bringing “victims and offenders in closer proximity". (Mares, 2013, p. 769) Evidence that heat promotes aggressive violence, such as assaults and rape, as well as some forms of collective violence, such as protests and riots, has been encountered even in the literature from three decades ago. (Cohn, 1990) More relevant for this paper and also more extensively examined is the phenomenon of collective violence caused by climate change. In the existent literature, it ranges from (more or less) peaceful riots or protests and (mostly) intra-state armed disputes, such as civil war or one-sided violence against civilians. In sum, despite the divergent natures of conflict examined, collective violence is of most salience here.

As for the climate change, it is known to affect different countries or regions of the world disproportionally. Oftentimes economically, politically and technologically weaker countries suffer to a greater extent. Therefore, a great deal of research investigating climate-conflict relationship is aimed at explaining how climate, not alone but in conjunction with other factors, influences it. (Salehyan, 2014) One of the most important and commonly analyzed mediator is the regime type. With regards to the political regime, the non-democratic countries are more likely to experience armed conflict when economic conditions deteriorate, as compared to democracies. (Koubi et al., 2012) However, regarding the non-armed conflicts, democracies appeared to be more vulnerable to protests than autocracies, due to pursuing more favorable policies for the rural sector than the cities (Hendrix &

Haggard, 2015) or due to the cherished individual rights and freedoms, that provide opportunities to protest. (Bohmelt et al., 2013) In sum, the regime type of a country has been shown to impact the climate-conflict relationship significantly.

Other factors mediating the link, such as social disadvantage, geographic location, migration, or economic deterioration are also important in understanding the climate-conflict nexus. For example, Mares (2013) finds that social disadvantage mediated the link between unusually high temperatures and individual-level violence. Specifically, the study looks at the case of St. Louis, in Missouri, USA, and finds that the most socially disadvantaged neighborhoods suffer from climate-related violence to a greater extent than those higher in social wellbeing. Concerning the geographic location, it determines to what extent are the livelihoods in danger. The areas that are resource-dependent or environmentally and socially marginalized suffer from climate-induced conflict to a greater extent. (Barnett & Adger, 2007) Some regions are geographically unlucky to be experiencing climate-related extreme events more than others. As a response, populations within those areas might choose to migrate. Migration, then, can be perceived as another mediating factor between climate and conflict. Besides, as argued by Goldstone (2001), the social dynamics of host communities are important in cases where migration leads to violent conflict. Additionally, poverty, government capacity, economic deterioration, and logistics are often seen in the literature as plausible explanations for how climate change and conflict relate to each other in some areas but not others. (see, e.g., Barnett & Adger, 2007; Hsiang & Burke, 2013) It can thus be concluded that multiple factors mediate the connection between climate and conflict.

The mediator between climate and conflict of most salience for this research is agricultural productivity. According to the IPCC, climate change in terms of warming, changing precipitation patterns, greater frequency and intensity of some extreme events have adversely impacted food security and terrestrial ecosystems as well as contributed to desertification and land degradation in many regions. (see, e.g., Boko et al., 2007; Mbow et al., 2019; Niang et al., 2007) The lower-latitude regions are most negatively affected by climate change, specifically by making the crop yields decline. These patterns are predicted to continue with high confidence by the climatologists. Furthermore, climate change adverse effects on agricultural production lead to food price rises, negatively affecting the economic state of individuals and food security in general. Therefore, there is a consensus among the climatologists on the adverse effects climate change has and will continue to have on the agriculture of lower latitude regions.

Furthermore, there is a considerable degree of empirical support for the positive relationship between climate-induced food insecurity and different types of conflict, ranging from urban unrest to armed disputes. (see, e.g., Rezaeedaryakenari et al., 2017; Weinberg & Bakker, 2014) For instance, Razaeedaryakenari et al. (2017) found that food insecurity due to climate variability relates positively to rebel groups targeting civilians, especially the ones living in regions with a higher proportion of cultivated land. Such violence against civilians during periods of food crises emerges because rebel groups are highly dependent on food, in terms of recruiting and maintaining their members. Another study concerned with the food insecurity-conflict relationship is one of Weinberg and Bakker (2014). They found that there is a positive and significant relationship between rising food prices and social unrest across a broad scope of countries. The logic of this relationship is based on the assumption that individual wellbeing is most directly affected by the food prices, in comparison to other economic variables. Besides these two studies, many others are providing similar findings. (see, e.g., Barnett & Adger, 2007; Hendrix & Haggard, 2015) In conclusion, there is a great deal of evidence that lack of food due to climate variability can translate to various forms of violence.

The aforementioned and many other findings on climate-conflict link through agriculture, are mostly focused on rainfall patterns. Many of the scholars find that Africa is more likely to conflict in the dryer years. (see, e.g., Hendrix & Glaser, 2007; Miguel et al., 2004) Nevertheless, such a focus on precipitation is confusing and present uncertain results for the future likelihood of conflict, as argued by Burke et al. (2009). Climatology models on precipitation impacts on agriculture in Africa vary greatly among one another, presenting ambiguous predictions in both sign and magnitude. (Christensen et al., 2007) On the other hand, temperature's adverse effects on agricultural productivity are more certain, predictions on future temperature changes are more uniform, especially for the next few decades. Thus, some scholars started to look at the impact of temperature on African agriculture yields and economic output and found significant and negative relationships. (see, e.g., Dell et al., 2012a; Schlenker & Lobell, 2010) Additionally, it was found that the temperature-related negative effects on agriculture explain the migration from Mexico to the US, with migration being a potential driver for conflict. (Feng et al., 2010) More directly related to conflict, Zhang et al. (2011) found that war frequency is related to the cycles of temperature change in recent human history, while Burke et al. (2009) found similar results for the continent of Africa, which suggest that 1°C increase in temperature leads to "a 4.5% increase in civil war in the same year and a 0.9% increase in conflict incidence in the next year". (p. 20670) In response to some criticism about their models, Burke et al. (2010) revised their model and presented results confirming their previous findings. Nevertheless, some scholars suggest that temperature's effect on conflict is not necessarily related to agriculture. (see, e.g., Bollfrass & Shaver, 2014; Hsiang, 2010) Thus, there is a disagreement among the scholars whether temperature is as important for agriculture and conflict in Africa, as precipitation.

Besides the disagreements about climate variables, temperature-conflict literature is not as extensive as precipitation-conflict, in terms of agricultural productivity. Scholars examining temperature effects through agriculture are solely focused on armed unrest, thus the knowledge about lower-level violence is lacking. This is unfortunate since the temperature is showing its potential to be of importance too, through its adverse effects on African agriculture. (Boko et al., 2007) This is found in climatology models with high confidence, and in fact, higher than precipitation patterns. Therefore, this study aims to address these issues, by looking at the impact of both temperature and precipitation on specifically social unrest in the African continent. Furthermore, this study also aims to test the role of the economic structure of a country, with a specific focus on agriculture and its share in economic production. In other words, the mediating factor of interest is the dependence of economic production on the agricultural sector. Even though it was repeatedly seen in literature that agriculture is an important mediator between climate and conflict, the extent to which the country's reliance on agricultural production relates to this process is uncertain. Thus, this paper seeks to explore this uncertainty at least to some extent.

Theoretical motivation

The literature review overviewed the findings that confirm the likelihood of climate change to motivate conflict, specifically through decreasing agricultural productivity. Besides, there is a good reason to believe that agricultural regions, especially those geographically placed in lower latitude, such as Africa, South America, and Southern Asia, are more vulnerable to climate-induced conflict. Firstly, because they are more vulnerable to climate change in the first place. (Mbow et al., 2019) According to the IPCC, climate change has adverse effects on the agricultural production of lower latitude countries, in comparison with higher latitude ones, where agriculture was seen to have the opposite effect (i.e. increase agricultural productivity). On top of, and perhaps paradoxically, those countries that are geographically most vulnerable to climate change, are also the ones whose GDP is mostly dependent on agricultural production, according to the World Bank's data. (World Bank, 2018) Additionally, the wealthiest countries in the world are the same ones that are non-agricultural, and have more diverse economies, and are mostly located in Europe, North America, and Australia. (World Bank, 2018) This is not surprising, as multiple scholars have found correlations between economic diversity and economic stability and growth. (see, e.g., Dissart, 2003; Malizia & Ke, 1993; Pede, 2013; Wagner & Deller, 1998) According to Reilly (1996), richer countries of the world can almost certainly be eliminated as vulnerable in terms of hunger and malnutrition to climate change. The poorest, malnourished, and dependent on local production for food populations of the world are the most vulnerable and mostly located in Africa, Asia, and South America. (Reilly, 1996) Therefore, agricultural and less economically diverse lower latitude regions are more vulnerable to climate change.

Such vulnerability of those regions is further enhanced by a lack of mitigation techniques that could make the consequences of climate softer. Those regions of the world are lacking technological adaptation, and opportunities for farmers' children to switch to other industries. (see, e.g., Boko et al., 2007; Niang et al., 2014; Reilly, 1996) These points are related to wealth, as non-agricultural countries that are wealthier, are also more technologically developed and can afford advanced adaptive techniques. For instance, the Netherlands is famous for its efficient greenhouses that grow all kinds of fruits and vegetables, while the United Kingdom is planning to commercialize its strawberry harvester, which picks berries faster than humans. (King, 2017) In contrast, farmers in poor agricultural regions of the world have limited financial resources and adaptive technological opportunities for climate change, not to mention automatic harvesting. (see, e.g., Bryan et al., 2009; Mbow et al., 2014; Reilly, 1996) Bryan et al. (2009) find that a large percentage of Ethiopian and South African farmers did not adapt to climate changes, despite perceiving its negative impact. The study identifies multiple barriers to such adaptations, namely lack of access to credit, land, and information. (Bryan et al, 2009) Such technologically backward regions and farmers "may suffer significant disruption and financial loss for relatively small changes in crop yields and productivity." (Reilly, 1996, p. 251) In sum, lack of adaptation and mitigation techniques in Africa, makes its agriculture increasingly more vulnerable to climate variability.

Furthermore, the vulnerability of lower-latitude agricultural countries to climate change is not only perceived through food scarcity and malnutrition (Reilly, 1996), but also, in terms of education. Fuller et al. (2018) found that a decrease in the duration of school attendance over the past two decades, "was tightly linked to decreasing plantain yield (R^2 = 0.82)" in Central Africa. (p. 503) They argue that as agricultural productivity declines, rural households are making less revenue from it and thus parental investment in education-related expenses is decreasing. Thus, the children of farming families are more likely to be uneducated and encounter more obstacles in switching to alternative employment opportunities, which are, either way, lacking, in agricultural lands. (Reilly, 1996)

Furthermore, changing climate make farmers abandon agriculture and migrate to non-farming areas as an adaptation technique. Njock & Westlund, (2010) found that such a technique is common among the fishing communities in West and Central Africa. In turn, such workers dislocated due to climate change has little opportunities in comparison with workers in economically diverse regions. In sum, climate change is damaging the agricultural countries and their economies to a bigger extent than those that rely on other economic sectors and are more economically diverse.

As discussed in the previous paragraphs, agricultural countries are more vulnerable to climate change because they happen to be placed in more vulnerable areas geographically, also are less wealthy than non-agricultural countries at least in part due to the lack of economic diversity, thus cannot afford technologically advanced adaptation techniques that would prevent the adverse effects of climate change, and their farmers have fewer opportunities to move to other sectors, because of the absence of economic diversity and education. Nevertheless, the important question remains, how do the negative consequences of climate change translate to people taking upon collective action and protesting their governments. It is important to mention first, that the mechanisms explaining the link between climate and conflict, can be seen as the main drawback of the whole climate-conflict literature. (Hsiang & Burke, 2013) It is often many mechanisms in conjunction, rather than one determinant factor that can explain the link. Nevertheless, the following sections aim to make a convincing case, by merging multiple relevant theories.

Starting with the individual level, relative deprivation and income elasticity are the two common ways to explain why individuals are motivated to act upon their grievances. (Gurr, 1970) The theory of relative deprivation, issued by Gurr (1970), suggests that whenever long-term inequalities are present within the society or when the abrupt changes in economic conditions appear, people are likely to take action to receive what they think is attainable for them, due to other groups having it. As for Africa, it is already suffering from high levels of poverty and inequality. (see, e.g., Anyanwu, 2011; Gyimah-Brempong, 2002; Kayizzi-Mugerwa, 2001) With climate change further enhancing such inequalities, by affecting the agricultural sector, farmers might feel deprived, relative to a small minority working in other sectors, as they receive more income and can afford more food, or even education for their children. Similarly, some scholars argue that climate-induced crop failures in France were of importance in determining the timing of the French Revolution (Grove, 2006), while others found that unequally distributed land rights in Brazil were mediating the rainfall-affected land invasions. (Hidalgo et al., 2010) Furthermore, the theory of income elasticity presents an important addition to the theory. Knowing that African agricultural countries are in fact among the poorest in the world, it suggests that their societies spend most of their income on food. This makes them especially financially insecure during the episodes of food scarcity. (see, e.g., Arezki & Bruckner, 2011; Hendrix & Haggard, 2015; Lagi et al., 2011; Zhang et al., 2011) Thus, the poor African population, inequalities of which are further enhanced by climate variabilities, based on the aforementioned theories, are likely to take collective action.

Moreover, the misattribution theory helps explain why the public would take action against their governments, while the actor to blame in this scenario is climate change. (see, e.g., Achen & Bartels, 2004; Healy et al., 2010) In these studies, it has been demonstrated that even rational individuals tend to see incumbent leaders and pre-existing institutions accountable for random events. The public would even punish their leaders for the events beyond their control, through voting or protests. Similarly, people are likely to hold someone accountable for the negative climatic events, especially if they lack education, as in the case with Witch-hunting in rural Tanzania. (Miguel, 2005) Plus, the failure from the side of the government in providing an adequate response to food crises can further enhance the grievances of society and result in a higher likelihood of conflict. (Hendrix & Haggard, 2015) Blaming the government, in addition to individual grievances mentioned in the paragraph above, can explain at least the peaceful collective action. Social unrest, thus, is the focus of this paper. It includes peaceful demonstrations, strikes, and more violent riots. The term social unrest here thus suggests that the conflict is not necessarily non-violent but is indeed lower level and does not translate into armed conflicts. Furthermore, food-related protests are a common occurrence in the literature, in contrast to more violent armed-conflicts. (see, e.g., Arezki & Bruckner, 2011; Tilly, 1971) In sum, the theories of relative deprivation, income elasticity, and misattribution are used here to explain the climate-induced social unrest in agricultural countries in Africa, and make the following hypotheses:

H1: The larger the importance of agricultural production for the economy (GDP), the more a country in Africa is vulnerable to social unrest, induced by deviation in precipitation.

The same reasoning can be applied to the social unrest that is induced by temperature rise, and thus the second hypothesis follows:

H2: The larger the importance of agricultural production for the economy (GDP), the more a country in Africa is vulnerable to social unrest, induced by deviation in temperature.

Methodology

This paper is going to run a statistical large-N analysis, including all the countries of the African continent as cases. Using large-N over the small-N comparative analysis ensures that the selection bias does not occur, as all of the African countries, with a population of at least a million, will be included. Furthermore, such analysis allows for the statistical control and the findings of the paper will allow for more general implications. In the following paragraphs, the methodology is discussed in more detail, with all the variables, that are included in the model, provided, together with the justifications for doing so. Additionally, the estimation method is justified, and the results presented.

The focus of this research is on the African continent since it is one of the most vulnerable continents to climate change and variability. (Boko et al., 2007) The vulnerability of the region is not only geographical but aggregated by the interaction of multiple other elements, such as poverty, poor governance, limited access to capital, among others. As a result, low adaptive capacity is present. Even though some adaptation techniques have been developed in Africa and were seen to be successful, they will not be sufficient in the future. (Medany et al., 2006) Additionally, adaptation in Africa is highly dependent on addressing the root causes of poverty and vulnerability, rather than on the technology alone. (Niang et al., 2014) Thus, the vulnerability to climate change and the complexity of it in Africa presents a unique case for investigating the effects of climate change on conflict.

The data for the dependent variable is imported from the Social Conflict Analysis Database (SCAD) for Africa, which includes systematically tracked information on social conflict events from 1990 to 2015. (Salehyan et al., 2012) The dataset includes all African countries, with a population of more than 1 million. The advantage of this dataset, as compared to many others, that also track conflict in Africa is that its goal is to provide more detail on other than armed social conflicts. These non-armed social conflicts include (non-

)/organized demonstrations and more violent riots, as well as general and specific labor strikes. This research is using a year range of 1990 to 2007 due to the climate data being available up to then only. This dependent variable is coded as *Conflict Count* in the analysis.

As for the climate data, this study will look at both temperature and precipitation in Africa, because they are the most examined climatic variables in the literature and provides most evidence as being related to the conflict. (see, e.g., Burke et al., 2009, 2010; Rezaeedaryakenari et al., 2017; Weinberg & Bakker, 2014) These studies have all found a significant and positive relationship between the temperature rise and/or changing precipitation patterns and conflict, through agricultural disruption in Africa. The dataset for climate data used is borrowed from Dell et al. (2012b), which provides mean annual values for many countries. The dataset is called 'climate_panel.dta' by the authors. From this dataset, averages for African countries', for years 1990 to 2007, are used. I calculated the mean of averages of the years 1960 to 2007 and compare each annual mean to the mean of those 47 years, to create deviation variables for both temperature and precipitation. The deviation variable shows the extent to which temperature or precipitation has changed, in comparison to the norm, what is a better measure of climate variabilities than the annual mean alone. These variables were coded as *Annual temperature deviation* and *Annual precipitation deviation.*

The conditional variable, referred to as economic structure before, is going to be used from the World Bank database, called "Agriculture, forestry, and fishing, value added (% of GDP)". (World Bank, 2018) This variable shows the importance of the agricultural sector to the country's economic production. The inclusion of forestry and fishing is advantageous, as those sectors are also vulnerable to climatic changes and variabilities. Regarding the forestry sector, a higher temperature is related to pest and disease outbreaks, and shorter plants life-period in East Africa. (FAO, 2017) As for the fisheries industry, rising ocean temperatures are associated with decreases in maximum sizes of marine fishes, as well as decreasing maximum catch potential (MCP) in the tropics, the majority of the African continent. (Lam et al., 2016)

Furthermore, some other variables need to be controlled for to ensure the reliability of the findings. The control variables included are the most commonly investigated non-climate factors of conflict. The level of socioeconomic development has been shown to influence conflict in multiple studies (see, e.g., Collier and Hoeffler, 1998; Hegre et al., 2001; Hendrix and Salehyan, 2012; Koubi, et al., 2012; Weinberg & Bakker, 2014). Previous literature suggests two economic variables should be included in such research. First, *GDP per capita* is included, since lower incomes of the society suggests a higher proportion of it spent on food and thus higher vulnerability to food scarcity. (see, e.g., Collier and Hoeffler, 1998; Hegre et al., 2001) *GDP growth* is also included as it was shown that it has a pacifying effect on social unrest. (Hendrix and Salehyan, 2012) As an indicator of social welfare, *life expectancy* is included in the model. All the socioeconomic variables are taken from the World Bank data. (World Bank, 2018)

Furthermore, Hendrix and Haggard (2015) finds regime type to be the most important mediator between high food prices and social unrest. Their results suggest that democracies are most likely to experience social unrest, followed by anocracies and then autocracies. In contrast, Hengre et al. (2001) finds that democracy has a pacifying effect on domestic conflict. Their findings suggest that a quadratic relationship could be associated with decreased conflict because both democracies and autocracies have a pacifying effect, while anocracies have the opposite effect. (Treier & Jackman, 2008) Thus, both the *polity2* score and *polity2 (squared)* from the Polity IV dataset are included. (Marshall et al., 2016) Finally, the *population (total)* was taken from the World Bank data, as it is arguably one of the main predictors for conflict. (World Bank, 2018)

Knowing that the dependent variable of this research is conflict count, Poisson Regression, and its alternative, Negative Binomial Regression was chosen to be used. Even though for count dependent variable, Ordinary Least Squares (OLS) regression is often used, multiple scholars have highlighted the superiority of Poisson Regressions for relatively low-frequency events. (Osborne, 2017) In case the mean of the count outcome variable is lower than 10, OLS may produce biased results. (Coxe et al., 2009) In the case of conflict count used in this analysis, the arithmetic mean is approximately 6, thus Poisson regression and Negative Binomial Regression were chosen. In choosing between the two, the relative size of the mean and variance is important. In case the variance is bigger than the mean of the dependent variable, Negative Binomial Regression is a better option. This was the case with conflict count, however, both of the regressions were run, to also check which model is a better fit, using Akaike's Information Criterion (AIC) and Bayesian Information Criterion (BIC). Having performed both regressions, it was seen that AIC and BIC values are lower for the Negative Binomial Regression, which suggests a better model fit. Therefore, only the results of the Negative Binomial Regression are presented and analyzed in the following section of the paper.

Results

The results of the statistical analysis are presented in Table 1. A Negative Binomial regression was run to predict the number of social unrest from 1990 to 2007, based on the annual temperature deviation, and annual precipitation deviation. For every degree increase in deviation, 1.281 (95% CI, 1.061 to 1.546) times more social conflict occurred, a statistically significant result, $p = .010$. Regarding the annual precipitation deviation, a one-degree increase resulted in 1.057 (95% CI, 1.001 to 1.117) times more social conflict, also a statistically significant result, $p = .045$. The effect of precipitation suggests the positive relationship between precipitation and social unrest, which is not coinciding with the theory. However, the effect size is very small and the confidence interval suggests that the effect can deviate from almost a 0 change. Therefore, it is concluded that precipitation is a very uncertain predictor in this case. It can also be seen that the effect of temperature on social unrest is higher than the effect of precipitation and significant at a higher level. However, the effect of temperature on civil unrest here is not necessarily induced through a loss of agricultural productivity, since the mechanisms can also be related to psychological explanations for heat affecting anger, or other reasons, suggested by temperature-conflict scholars. (Bollfrass & Shaver, 2014) That is why I included the conditional variable of agricultural dependency in the second model, which is discussed later. Another result seen from the first model and important to mention is the influence of agriculture, forestry, and fisheries (% of GDP) alone for social unrest. 1 percentage increase in GDP share, resulted in 0.005 (95% CI, -0.011 to +0.001) decrease in social unrest, however, the effect is tiny and barely significant, $p = .111$.

Table 1

Outcome variable: count of social unrest

	Model 1	**Model 2**
(Intercept)	2.136*** (0.3419)	2.209*** (0.3445)
Annual temperature deviation	0.248*** (0.0960)	-0.091 (0.1771)
Annual precipitation deviation	0.056** (0.0278)	0.068 (0.0555)
Agriculture, forestry, and fisheries (% of GDP)	-0.005* (0.0031)	-0.10*** (0.0037)
Annual temperature deviation x Agriculture, forestry and fisheries (% of GDP)		0.016** (0.0068)
Annual precipitation deviation x Agriculture, forestry and fisheries (% of GDP)		0.000 (0.0017)
GDP Growth	-0.039*** (0.0073)	-0.040*** (0.0074)
Life expectancy	-0.017*** (0.0056)	-0.016*** (0.0056)
GDP per capita (divided by a million)	-0.003 (0.0026)	-0.002 (0.0026)
Population (total) (divided by a million)	0.028*** (0.0022)	0.028*** (0.0022)
Polity2	0.009 (0.0078)	0.007 (0.0078)
Polity2 (squared)	8.748E-6 (7.7882E-6)	6.195E-6 (7.8768E-6)
N	766	766
Number of countries	45	45
Log Likelihood	-2002.850	-1999.920

Note. Estimates are Negative Binomial Regression coefficients. *p<0.1, **p< 0.05, ***p<0.01.

Furthermore, the second model was run, with two interactions between annual temperature deviation (first) and annual precipitation deviation (second), with agriculture, forestry, and fisheries (% of GDP) included. For every one-unit increase in the first interaction, 1.016 (95% CI, 1.002 to 1.029) times more social conflict occurred, a statistically significant result, $p = 0.021$. Regarding the second interaction, there was no significant association between this variable and social unrest. At the same time, agriculture, forestry, and fisheries (% of GDP) variable has become significant at the highest level, after the inclusion of the interactions. One percentage increase of agriculture, forestry, and fisheries in GDP, resulted in 0.010 (95% CI, -0.017 to -0.003) decrease in social unrest. This suggests that agricultural countries, on average, experience less social unrest, than non-agricultural ones; in the case that the social unrest is not induced by the temperature rise or precipitation changes. Perhaps this outcome could be explained by the fact, that countries with a higher share of agriculture in their economic production, have a bigger population working in the agricultural sector and living in urban areas. Besides, as was suggested by several scholars, urban areas are more common places for social unrest to happen, in comparison with rural. (see, e.g., Bush, 2010; Wallensteen & Sollenberg, 2001)

After the inclusion of the two interactions, both temperature deviation and precipitation deviation predictors have become insignificant, which suggests that interaction effects are better predictors for this model. The temperature predictor has changed not only in the level of significance but also in the direction. However, due to them being not at all significant ($p>0.2$ and $p>0.6$, respectively), they will not be further interpreted. Moreover, the control variables, namely GDP growth, life expectancy, and population (total), all had as expected, and very significant ($p<0.01$) effects on social unrest. However, neither GDP per capita, nor any of the two polity variables were significant. Why these control variables were not significant in this case, is not self-evident. Nevertheless, perhaps the common theory that conflicts in certain countries often affect unrest in neighboring ones could explain these insignificant results. For instance, a research of 170 countries, found that it is not only the external events, such as food price increases or food scarcity, that explain widespread social unrest but also “internal processes of positive feedback and cascading effects in the form of contagion and social diffusion over spatially interdependent regions connected through social and mass communication networks.” (Braha, 2012, p. 1) This suggests that unrest in neighboring areas have a contagion effect, and the salience of issue within a country is not the most important predictor. Regarding Africa, it is a continent, where different regime types (democracies, hybrid, and autocracies) are bordering each other, as well as those of very different GDP per capita. This could perhaps explain why, regardless of the regime type or GDP per capita level, all the countries experience a substantial amount of social unrest.

Discussion

In sum, given the results, it could be concluded that temperature does indeed affect social unrest in Africa, even if the effect is not enormous. This result is not surprising, as multiple temperature-conflict scholars have found similar effects. (see, e.g., Bollfrass & Shaver, 2015; O'Loughlin et al., 2014) However, the scholars, finding this effect, oftentimes do not interpret it as due to agricultural productivity loss. This is where the conditional variable, economic dependence on the agricultural sector, becomes salient. The findings of a regression suggest that the null hypothesis, claiming there is no relationship between agricultural dependence and temperature-induced social unrest can be rejected. Thus, the alternative hypothesis (*H2*), suggesting that countries, with a higher percentage of agriculture in their GDP share, do suffer from the social unrest, that is induced by temperature rise, more. Again, the effect is not huge, but it is also not surprising, because, at the moment, many African farmers do have decent adaptation techniques in place. (Medany et al., 2016) For instance, farmers in Senegal and Burkina Faso are known to be using improved traditional fertilizing and pruning techniques, as well as there are multiple successful community-initiated projects in Madagascar and Zimbabwe. (Economic Commission for Africa, 2001) Nevertheless, experts are certain that with temperature rising further and other climate variabilities enhancing their effects on African agriculture, household-level initiatives will have an even smaller adaptive effect. (Thornton et al., 2006) It could be hypothesized further that with the climate change effects on African agriculture increasing, this interaction effect will increase in the future as well. Unfortunately, such a predicting analysis falls out of the scope of this research.

Regarding the precipitation variables, both the annual deviation, and interaction with agricultural share in GDP, the results appeared to be highly unexpected, in terms of what extant literature have found and theoretical explanations behind those findings. The null hypothesis, that there is no relationship between the importance of agriculture production for the economy and vulnerability of social unrest in Africa, induced by deviation in precipitation, could not be rejected. It is thus important to highlight some limitations this research has faced. First of all, the dataset used in this research only had the mean annual values. Even though the temperature and precipitation deviations for every year were computed, such climate variables are not ideal. It is known that temperature and precipitation are seasonal. Even though African seasons differ from those in the US or Europe, they can be classified as either dry or rainy. (Herrmann & Mohr, 2011) This is especially true for equatorial African countries, such as Uganda, Rwanda, Kenya, and the Democratic Republic of Congo, where the temperatures might deviate slightly thorough the year, but precipitation changes dramatically. Thus, using only annual mean temperature was not such a big limitation, as it was for precipitation data, which explains why precipitation-related effects were not in line with the theory. Therefore, having monthly or at least seasonal deviation in both temperature and, more importantly, precipitation would have made the results way more robust.

Furthermore, the data used is up to 2007, which is thirteen years before the time of conducting this analysis. In those thirteen years, the temperature and precipitation patterns were changing further, affecting the agriculture negatively to a greater extent. NOAA analyses confirmed that 2010 to 2019 was the hottest decade since the beginning of record-keeping. (NOAA, 2019) Unfortunately, this decade was not included in the analysis. Also, it was seen that the number of protests in the whole of Africa has increased since the mid-2000s, reaching a peak in recent years. (Arnould et al., 2016) Nevertheless, these obstacles were not solely inherent in the fact that instrumental climate data for the African continent is generally lacking, especially for the most recent years. (Gebrekirstos et al., 2013) There are indeed some well-known better databases that have monthly data for later than 2007, such as

NOAA, which present gridded data, however, not related to countries. This is not a huge obstacle for scholars able to analyze spatial data, using geographic information system (GIS) or some other related framework. That is why, the hypotheses in this research should be tested using more advanced statistical techniques and data, to make conclusive findings.

The other not less important improvement future research could provide, would be using other climate predictors, besides temperature and precipitation data. It was acknowledged that climate change effects on agriculture in Africa are complex, with all: temperature rise, precipitation levels, some extreme events, and the emergence of insects and diseases, affecting agricultural outcomes negatively. Precipitation and temperature have been examined quite extensively in the climate-conflict literature, however, extreme events and other climate-induced occurrences, that affect agriculture adversely as well are not investigated much. Therefore, future research should test the agricultural production role in climate-induced conflict, taking other climate-related predictors into account. An additional recommendation would be to use other than temperature and precipitation variables in investigating climate-conflict nexus, in general, not necessarily through agricultural productivity, as this less explored zone might propose some new insights. Finally, other countries or regions of the world, besides Africa, especially the other lower latitude places, such as Eastern Asia and South America, should be empirically tested, to see whether this model fits them too. See *Appendix* for SPSS syntax and output of the two models of negative binomial regression.

Regardless of the small effect of the interaction between agricultural sector importance and temperature deviation on social unrest, the significance of it allows for making the following societal implications. The finding suggests that climate change is indeed a problem of security for the African continent. To ensure Africa does not suffer drastically from climate-induced agricultural loss, and in turn, social unrest, planned future adaptation is a must, which includes better forecasting and early warning technologies, and better management. (Medany et al., 2006) Plus, the need for education and awareness spreading on climate change is also present. (Thornton et al., 2006) To promote adaptation, institutions and individuals must be educated on the issue. (Anabaraonye et al., 2018) Education in general was seen to be one of the most important determinants in farmer's choice to use adaptation techniques. (see, e.g., Adesina & Chianu, 2002; Deressa et al., 2009) Even though such implications have been repeatedly made by the scholars investigating unsuccessful agricultural performance in Africa, to protect the economy of the continent, this research has highlighted their importance further. Adaptation to climate change, in addition to protecting the population from poverty, malnourishment, and economic underdevelopment, might also enhance political stability and security.

Conclusion

This work has acknowledged the complexity of the climate-conflict nexus and the fact that no one mechanism can explain it. It aimed to contribute to the extant literature by exploring a very specific phenomenon, the relationship between temperature rise and precipitation and social unrest, through agricultural productivity loss in Africa. The main objective of the study was to understand what the role of the economic structure of a country is within this link. In other words, whether the countries, whose economic production is more dependent on agriculture, are experiencing more/less of the climate-induced social unrest. The theoretical motivations used, suggested that the more a country is reliant on agriculture for its economic production, the more likely it is to experience civil unrest due to climate change. The hypothesis of the paper was split into two, separating temperature and precipitation, and their effect on unrest. One of them was confirmed empirically, suggesting that the effect of an interaction between deviation in temperature and agriculture, forestry, and fisheries (% of GDP) was positive and significant. The precipitation, however, did not show significant effects on social unrest through agriculture. This can be attributed to one of the biggest limitations this paper has faced, lack of appropriate instrumental climate data.

Even though the effect of the relationship between temperature interaction with agriculture share in GDP and social unrest was not huge, it does not undermine the importance of the finding, as the problem of rising temperatures and low adaptive capacity in Africa is not fixed, but rather increasing. (Mbow et al., 2019) This finding highlights the importance of protecting African agriculture, and not only to promote economic growth but also to enhance political stability and security. The main implication for Africa, this research has given, is to develop a planned adaptation system, that could predict and prevent extreme events, and educate individuals and institutions on climate change. In addition to societal implications, some points to improve climate-conflict nexus literature were suggested. For future research, it is important to use more advanced statistical techniques that allow for interpreting gridded and non-political data. Also, other, than temperature and precipitation, variables of climate change would provide a useful additive value to the literature and explore even more potential ways in which climate can translate to conflict. Lastly, other lower latitude regions, whose agriculture also suffers from climate change, such as South America and Eastern Asia, should be investigated, to see whether economic dependence on agriculture also mediates the link. In sum, regardless of the complexity of the climate-conflict nexus, this research aimed to improve the scholarly understanding and present more clarity, by providing some insights into economic dependence on the agricultural sector.

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Appendix. Syntax and Output of SPSS

Model 1

SYNTAX

```
* Generalized Linear Models.
GENLIN countconflict_total WITH gdpgrowth life_expectancy polity2_squared polity2
agriculture_GDP devtem devpre population_divided GDP_per_capita_divided
/MODEL devtem agriculture_GDP gdpgrowth life_expectancy GDP_per_capita_divided
population_divided polity2 polity2_squared INTERCEPT=YES
DISTRIBUTION=NEGBIN(1) LINK=LOG
/CRITERIA METHOD=FISHER(1) SCALE=1 COVB=MODEL MAXITERATIONS=100
MAXSTEPHALVING=5 PCONVERGE=1E-006(ABSOLUTE) SINGULAR=1E-012
ANALYSISTYPE=3(WALD) CILEVEL=95 CITYPE=WALD LIKELIHOOD=FULL
/MISSING CLASSMISSING=EXCLUDE
/PRINT CPS DESCRIPTIVES MODELINFO FIT SUMMARY SOLUTION
(EXPONENTIATED).
```

OUTPUT

Model Information

Dependent Variable	Social Unrest
Probability Distribution	Negative binomial (1)
Link Function	Log

Case Processing Summary

	N	Percent
Included	766	94.8%
Excluded	42	5.2%
Total	808	100.0%

Continuous Variable Information

		N	Minimum	Maximum	Mean	Std. Deviation
Dependent Variable	Social Unrest	766	.00	84.00	5.8355	9.55502
Covariate	GDP Growth	766	-50.248067	35.2240783	3.62528063	5.70727008
	Life Expectancy	766	26.1720000	74.5580000	53.9701379	8.18260246
	Polity2 (squared)	766	.00	998001.00	3938.0862	62372.8988
	Polity 2	766	-999	10	-4.26	62.650
	Agriculture, Forestry and Fisheries (% of GDP)	766	1.82838052	79.0423625	25.9691195	14.8158423
	Temperature (deviation)	766	-1.43	1.79	.3314	.43228
	Precipitation (deviation)	766	-6.63	6.57	-.2741	1.44143
	population_divided	766	.82	146.34	17.7865	22.54127
	GDP_per_capita_divided	766	.00	552.01	.7217	19.94498

Goodness of Fit[a]

	Value	df	Value/df
Deviance	850.430	756	1.125
Scaled Deviance	850.430	756	
Pearson Chi-Square	786.919	756	1.041
Scaled Pearson Chi-Square	786.919	756	
Log Likelihood[b]	-2002.850		
Akaike's Information Criterion (AIC)	4025.701		
Finite Sample Corrected AIC (AICC)	4025.992		
Bayesian Information Criterion (BIC)	4072.112		
Consistent AIC (CAIC)	4082.112		

Dependent Variable: Social Unrest
Model: (Intercept), Temperature (deviation), Precipitation (deviation), Agriculture, Forestry and Fisheries (% of GDP), GDP Growth, Life Expectancy, GDP_per_capita_divided, population_divided, Polity 2, Polity2 (squared)

a. Information criteria are in smaller-is-better form.

b. The full log likelihood function is displayed and used in computing information criteria.

Omnibus Test[a]

Likelihood Ratio Chi-Square	df	Sig.
353.039	9	.000

Dependent Variable: Social Unrest
Model: (Intercept), Temperature (deviation), Precipitation (deviation), Agriculture, Forestry and Fisheries (% of GDP), GDP Growth, Life Expectancy, GDP_per_capita_divided, population_divided, Polity 2, Polity2 (squared)

a. Compares the fitted model against the intercept-only model.

Tests of Model Effects

Source	Type III Wald Chi-Square	df	Sig.
(Intercept)	39.039	1	.000
Temperature (deviation)	6.654	1	.010
Precipitation (deviation)	4.018	1	.045
Agriculture, Forestry and Fisheries (% of GDP)	2.547	1	.111
GDP Growth	28.806	1	.000
Life Expectancy	9.322	1	.002
GDP_per_capita_divided	1.170	1	.279
population_divided	168.412	1	.000
Polity 2	1.453	1	.228
Polity2 (squared)	1.262	1	.261

Dependent Variable: Social Unrest
Model: (Intercept), Temperature (deviation), Precipitation (deviation), Agriculture, Forestry and Fisheries (% of GDP), GDP Growth, Life Expectancy, GDP_per_capita_divided, population_divided, Polity 2, Polity2 (squared)

Parameter Estimates

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test			Exp(B)	95% Wald Confidence Interval for Exp(B)	
			Lower	Upper	Wald Chi-Square	df	Sig.		Lower	Upper
(Intercept)	2.136	.3419	1.466	2.806	39.039	1	.000	8.467	4.332	16.547
Temperature (deviation)	.248	.0960	.059	.436	6.654	1	.010	1.281	1.061	1.546
Precipitation (deviation)	.056	.0278	.001	.110	4.018	1	.045	1.057	1.001	1.117
Agriculture, Forestry and Fisheries (% of GDP)	-.005	.0031	-.011	.001	2.547	1	.111	.995	.989	1.001
GDP Growth	-.039	.0073	-.053	-.025	28.806	1	.000	.962	.948	.975
Life Expectancy	-.017	.0056	-.028	-.006	9.322	1	.002	.983	.972	.994
GDP_per_capita_divided	-.003	.0026	-.008	.002	1.170	1	.279	.997	.992	1.002
population_divided	.028	.0022	.024	.032	168.412	1	.000	1.028	1.024	1.033
Polity 2	.009	.0078	-.006	.025	1.453	1	.228	1.009	.994	1.025
Polity2 (squared)	8.748E-6	7.7882E-6	-6.517E-6	2.401E-5	1.262	1	.261	1.000	1.000	1.000
(Scale)	1[a]									
(Negative binomial)	1[a]									

Dependent Variable: Social Unrest
Model: (Intercept), Temperature (deviation), Precipitation (deviation), Agriculture, Forestry and Fisheries (% of GDP), GDP Growth, Life Expectancy, GDP_per_capita_divided, population_divided, Polity 2, Polity2 (squared)

a. Fixed at the displayed value.

Model 2.

Interaction between Agriculture, Forestry and Fisheries (% of GDP) and Temperature (deviation) included (coded as *agri_for_fish_GDPxdevtem*)

SYNTAX

```
* Generalized Linear Models.
GENLIN countconflict_total WITH gdpgrowth life_expectancy polity2_squared polity2
agriculture_GDP devtem devpre agri_for_fish_GDPxdevtem agri_for_fish_GDPxdevpre
population_divided GDP_per_capita_divided
/MODEL devtem agriculture_GDP agri_for_fish_GDPxdevtem gdpgrowth life_expectancy
GDP_per_capita_divided population_divided polity2 polity2_squared INTERCEPT=YES
DISTRIBUTION=NEGBIN(1) LINK=LOG
/CRITERIA METHOD=FISHER(1) SCALE=1 COVB=MODEL MAXITERATIONS=100
MAXSTEPHALVING=5 PCONVERGE=1E-006(ABSOLUTE) SINGULAR=1E-012
ANALYSISTYPE=3(WALD) CILEVEL=95 CITYPE=WALD LIKELIHOOD=FULL
/MISSING CLASSMISSING=EXCLUDE
/PRINT CPS DESCRIPTIVES MODELINFO FIT SUMMARY SOLUTION
(EXPONENTIATED).
```

OUTPUT

Model Information

Dependent Variable	Social Unrest
Probability Distribution	Negative binomial (1)
Link Function	Log

Case Processing Summary

	N	Percent
Included	766	94.8%
Excluded	42	5.2%
Total	808	100.0%

Continuous Variable Information

		N	Minimum	Maximum	Mean	Std. Deviation
Dependent Variable	Social Unrest	766	.00	84.00	5.8355	9.55502
Covariate	GDP Growth	766	-50.248067	35.2240783	3.62528063	5.70727008
	Life Expectancy	766	26.1720000	74.5580000	53.9701379	8.18260246
	Polity2 (squared)	766	.00	998001.00	3938.0862	62372.8988
	Polity 2	766	-999	10	-4.26	62.650
	Agriculture, Forestry and Fisheries (% of GDP)	766	1.82838052	79.0423625	25.9691195	14.8158423
	Temperature (deviation)	766	-1.43	1.79	.3314	.43228
	Precipitation (deviation)	766	-6.63	6.57	-.2741	1.44143
	Agriculture, Forestry and Fisheries (% of GDP) x Temperature (deviation)	766	-28.41	68.04	8.5806	12.30635
	agri_for_fish_GDPxdevpre	766	-437.47	221.55	-6.5914	43.50748
	population_divided	766	.82	146.34	17.7865	22.54127
	GDP_per_capita_divided	766	.00	552.01	.7217	19.94498

Goodness of Fit[a]

	Value	df	Value/df
Deviance	844.569	754	1.120
Scaled Deviance	844.569	754	
Pearson Chi-Square	787.226	754	1.044
Scaled Pearson Chi-Square	787.226	754	
Log Likelihood[b]	-1999.920		
Akaike's Information Criterion (AIC)	4023.840		
Finite Sample Corrected AIC (AICC)	4024.254		
Bayesian Information Criterion (BIC)	4079.534		
Consistent AIC (CAIC)	4091.534		

Dependent Variable: Social Unrest
Model: (Intercept), Temperature (deviation), Precipitation (deviation), Agriculture, Forestry and Fisheries (% of GDP), Agriculture, Forestry and Fisheries (% of GDP) x Temperature (deviation), agri_for_fish_GDPxdevpre, GDP Growth, Life Expectancy, GDP_per_capita_divided, population_divided, Polity 2, Polity2 (squared)

a. Information criteria are in smaller-is-better form.

b. The full log likelihood function is displayed and used in computing information criteria.

Omnibus Test[a]

Likelihood Ratio Chi-Square	df	Sig.
358.900	11	.000

Dependent Variable: Social Unrest
Model: (Intercept), Temperature (deviation), Precipitation (deviation), Agriculture, Forestry and Fisheries (% of GDP), Agriculture, Forestry and Fisheries (% of GDP) x Temperature (deviation), agri_for_fish_GDPxdevpre, GDP Growth, Life Expectancy, GDP_per_capita_divided, population_divided, Polity 2, Polity2 (squared)

a. Compares the fitted model against the intercept-only model.

Tests of Model Effects

Source	Type III		
	Wald Chi-Square	df	Sig.
(Intercept)	41.101	1	.000
Temperature (deviation)	.263	1	.608
Precipitation (deviation)	1.513	1	.219
Agriculture, Forestry and Fisheries (% of GDP)	7.276	1	.007
Agriculture, Forestry and Fisheries (% of GDP) x Temperature (deviation)	5.338	1	.021
agri_for_fish_GDPxdevpre	.056	1	.812
GDP Growth	30.077	1	.000
Life Expectancy	8.493	1	.004
GDP_per_capita_divided	.527	1	.468
population_divided	169.066	1	.000
Polity 2	.759	1	.384
Polity2 (squared)	.619	1	.432

Dependent Variable: Social Unrest
Model: (Intercept), Temperature (deviation), Precipitation (deviation), Agriculture, Forestry and Fisheries (% of GDP), Agriculture, Forestry and Fisheries (% of GDP) x Temperature (deviation), agri_for_fish_GDPxdevpre, GDP Growth, Life Expectancy, GDP_per_capita_divided, population_divided, Polity 2, Polity2 (squared)

Parameter Estimates

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test			Exp(B)	95% Wald Confidence Interval for Exp(B)	
			Lower	Upper	Wald Chi-Square	df	Sig.		Lower	Upper
(Intercept)	2.209	.3445	1.533	2.884	41.101	1	.000	9.103	4.634	17.881
Temperature (deviation)	-.091	.1771	-.438	.256	.263	1	.608	.913	.645	1.292
Precipitation (deviation)	.068	.0555	-.041	.177	1.513	1	.219	1.071	.960	1.194
Agriculture, Forestry and Fisheries (% of GDP)	-.010	.0037	-.017	-.003	7.276	1	.007	.990	.983	.997
Agriculture, Forestry and Fisheries (% of GDP) x Temperature (deviation)	.016	.0068	.002	.029	5.338	1	.021	1.016	1.002	1.029
agri_for_fish_GDPxdevpre	.000	.0017	-.004	.003	.056	1	.812	1.000	.996	1.003
GDP Growth	-.040	.0074	-.055	-.026	30.077	1	.000	.960	.947	.974
Life Expectancy	-.016	.0056	-.027	-.005	8.493	1	.004	.984	.973	.995
GDP_per_capita_divided	-.002	.0026	-.007	.003	.527	1	.468	.998	.993	1.003
population_divided	.028	.0022	.024	.032	169.066	1	.000	1.028	1.024	1.033
Polity 2	.007	.0078	-.009	.022	.759	1	.384	1.007	.992	1.022
Polity2 (squared)	6.195E-6	7.8768E-6	-9.243E-6	2.163E-5	.619	1	.432	1.000	1.000	1.000
(Scale)	1[a]									
(Negative binomial)	1[a]									

Dependent Variable: Social Unrest
Model: (Intercept), Temperature (deviation), Precipitation (deviation), Agriculture, Forestry and Fisheries (% of GDP), Agriculture, Forestry and Fisheries (% of GDP) x Temperature (deviation), agri_for_fish_GDPxdevpre, GDP Growth, Life Expectancy, GDP_per_capita_divided, population_divided, Polity 2, Polity2 (squared)

a. Fixed at the displayed value.