Climate Change and Civil Unrest: Evidence from the El Niño Southern Oscillation

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Abstract:

A growing body of research connects short-run deviations in temperature and precipitation with violence. Less well understood is the extent to which these studies are representative of the impacts of global climate change. We follow the approach of Hsiang, Meng, and Cane (2011, *Science*) in using the existing climactic forces of El Niño and La Niña to analyze the potential consequences of climate change. We show that these events are strongly associated with subsequent periods of elevated social unrest. The effects we document are especially pronounced for Latin America which is particularly vulnerable both to existing climactic cycles and to projected climate change. Climate forces strongly influence the onset and frequency of government crises and anti-government demonstrations in Latin America specifically, suggesting a critical need to further develop political and social infrastructure to cope with these evolving challenges.

JEL Codes: Q5, K4

Key Words: Climate, Unrest, El Niño

1. Introduction

Climate change is altering human and natural systems around the planet, with consequences ranging from warming atmospheric and oceanic temperatures, to reductions in snow and ice cover, to rising sea levels (IPCC, 2014). Understanding the economic and social consequences of anthropogenic influences is a first order concern for the 21st century and is instrumental for designing appropriate policy to mitigate any potential damages. Within economics, research has predominantly focused on estimating the impact of temperature and rainfall deviations on factors such as regime stability, civil conflict, interpersonal crime, and agricultural yields (for broad summaries see Burke *et al.*, 2015 and Dell *et al.*, 2014).[1]

In this manuscript, we follow the approach of Hsiang *et al.*, (2011) of studying the El Niño Southern Oscillation (ENSO), a climactic phenomenon in which the ocean's surface temperature becomes irregularly warm or cold as the climate rapidly cycles between El Niño and La Niña events. We show that climate forces have a strong causal impact on unrest activity. El Niño periods (usually characterized by warmer and drier than average climates) are associated with increases in the incidence and intensity of civil strife, while the opposing cycle of La Niña (associated with cooler and wetter than average climates) dramatically mitigates unrest activity. In order to identify a causal association, we show that robust impacts of climate are only observable among the subset of teleconnected countries – those linked to the climactic pattern of ENSO and thus susceptible to El Niño and La Niña episodes. Furthermore, the relationship we observe is particularly strong in Latin America, and the climate cycle appears to affect different types of unrest in the region, than in the rest of the world as a whole. Climate forces strongly influence the onset and frequency of government crises and anti-government demonstrations in Latin America specifically, suggesting a critical need to further develop political and social infrastructure to cope with these evolving challenges.

[1] Similar research outside of economics has sought to estimate the potential risks posed by the presence of elevated levels atmospheric CO2, CH4, and NO2, or by rising sea levels (IPCC, 2014).

With the notable exception of Hsiang *et al.*, (2011), the vast majority of previous studies have focused on analyzing the impact of short-run deviations from longer-term average values, such as temperature and rainfall shocks (e.g. Miguel et al., 2004; Burke et al., 2009; Ranson 2014).[2] While of direct interest in their own right, these estimates may fail to generalize – in the sense that they may not accurately capture the impact of climate change on a global scale for numerous reasons. First, shorter-term weather shocks may be more unpredictable than global warming simply because climate change, even at unprecedented rates, is observed over the span of years as opposed to days or months. Second, individuals may perceive changes to the global climate as permanent rather than transitory deviations to their weather and ecosystem.

These distinctions are crucially important. An analogous body of economic research has shown that agents react very differently to shocks perceived to be transitory as opposed to those taken as permanent (Attanasio and Weber, 2010), as well as in response to anticipated shocks as opposed to those which were unexpected (Hsieh, 2003). Furthermore, because climate change is generated through actions occurring around the globe, mitigation and adaptation may necessitate the use of coordinated policy responses as opposed to unilateral or even regional actions.

While we follow the approach of Hsiang *et al.*, (2011) of studying the El Niño Southern Oscillation (ENSO), we do not impose any restrictions on the climactic data to attempt to isolate the role of temperature, as in their analysis. Instead, we acknowledge the existence of multiple potential ENSO influences on teleconnected countries, many of which may be complementary in nature. These events have been shown to influence air and sea temperature, humidity, air pressure, and wind patterns, and are associated with a history of extreme drought and flood conditions with devastating consequences for affected countries. Our results are thus more clearly interpreted as a study of how the myriad impacts of El Niño and La Niña

[2] Longer-term climate fluctuations has also been shown to influence historical regime transitions (see Burke *et al.*, 2015).

events aggregately influence unrest on the basis of their presence and strength and not an analysis seeking to isolate the specific role of a single underlying meteorological factor.

In addition to any inference that can be drawn for global climate change, an accurate understanding of the direct consequences of El Niño and La Niña is of interest as well. Existing research suggests that the ENSO cycle may be amplified by current and future anthropogenic influences on the planet. For example, Cai *et al.,* (2014) suggests that the process of global climate change may as much as double the incidence of extreme El Niño events. A clearer understanding of these cycles is particularly important for Latin America, as the region is far more vulnerable to these cycles than the global community as a whole.

Within the research on weather, climate, and conflict, analysis of social unrest is a relatively understudied fraction of this literature (Burke *et al.*, 2015 provides a summary of the literature). Several historical studies exist. For example, examining Latin America specifically, Dell (2012) shows insurgent uprisings during the Mexican Revolution were more common in areas of Mexico which experienced droughts in the early 20th century. In historical analysis, Chaney (2013) finds that excessive Nile flooding was associated with Egyptian revolts and with regime changes in favor of religious leaders, while Kung and Ma (2014) and Jia (2014) show that droughts triggered peasant uprisings in China.

We highlight Latin America both because we observe the largest effects for this region and because there are theoretical reasons to do so. First, social and political instability in the region, by some measures, is already elevated in comparison to other regions of the world. In this way, climactic forces may simply be catalyzing an already churning cauldron. Second, Latin American in particular may have a higher level of vulnerability to these particular climactic events. Of the 18 Latin American countries in our sample, 15 of them are classified as teleconnected by Hsiang *et al.*, (2011). Figure 1 depicts the set of countries which are teleconnected –

linked to the climactic pattern of ENSO and thus particularly susceptible to El Niño and La Niña.[3] It is clear that most of Latin America is at risk. Finally, the Intergovernmental Panel on Climate Change (IPCC) projections for future warming include large increases in temperature and changes in precipitation in Latin America and while several existing studies have examined weather and climate impacts in Africa and on the developed world, research examining these events in Latin America is less common (e.g. Miguel *et al.*, 2004; Burke *et al.*, 2009; Maystadt and Ecker, 2014).

The remainder of this paper is organized as follows. Section 2 explains the data used in the analysis. Section 3 details our empirical strategy and lays out the main results. Section 4 presents a set of robustness checks and Section 5 concludes.

2. Data

Climate Data

We combine data from several sources for our analysis. As a measure of climate change, we examine the El Niño Southern Oscillation (ENSO), a phenomenon in which the ocean's surface temperature becomes irregularly warm or cold as the climate cycles (generally over the span of a few years) between El Niño and La Niña events (as detailed in Hsiang *et al.*, 2011). These fluctuations are associated with heterogeneous changes in air currents, temperature, and humidity spanning large parts of the globe.

The National Oceanic and Atmospheric Association (NOAA)'s Center for Climate Prediction (CPC) publishes a monthly index designed to both classify the presence and capture the strength of these events, known as the Oceanic Niño Index (ONI). The ONI calculates a trend in sea surface temperature anomalies using values from the Nino 3.4 region (which includes a wide band of water in the mid-Pacific Ocean - pictured in Figure 2) and averages these readings over the three month

[3] Figure 1 is a replication of figure 1a from Hsiang et al., 2011.

period ending with the current month.[4]

Figure 3 plots the monthly ONI index for the period 1950 to the present to illustrate the frequency of El Niño and La Niña temperature anomalies. According to NOAA classification, when the value of the ONI deviates from zero by +0.5°C (-0.5°C), that particular month is defined to be an El Niño (La Niña) period. Furthermore, having 5 consecutive months with an ONI reading above (below) the 0.5°C threshold constitutes an El Niño (La Niña) event. For periods where the absolute value of the ONI deviation is smaller than 0.5°C in size, the month is classified as belonging neither to an El Niño nor to a La Niña period.

An advantage of this index is that it has undergone corrections to maintain comparability over time despite changes to the global climate (see Smith *et al.*, 2007). In addition to calculating a three month smoothed average, the ONI is also adjusted to separate the ENSO fluctuations from longer-term warming trends. This pattern and the unadjusted annualized measure of temperature anomalies are presented in Appendix Figure 1. Without this correction, the overall process of Global Warming would seriously confound detectable variation due to the ENSO oscillation, although, as can be seen from the figure, El Niño and La Niña years still constitute visibly meaningful deviations from this overall trend.

From the ONI, we create five measures to characterize the climactic impacts of the ENSO: (1) la_nina – which we define as the number of months in the year with the ONI measure in the La Niña range, (2) el_nino – which we define as the number of months in the year with the ONI measure in the El Niño range, (3) oni_annual – the average ONI value during a given calendar year, (4) oni_late – the average ONI value during the period running from May-December (a period examined to account for the possible influence of the 'Spring Barrier' as discussed in Hsiang *et al.*, 2011) and (5) oni_tropical – the average ONI value during the previous tropical year which runs from May through April (as discussed in Hsiang *et al.*, 2011).

[4] This is a rectangular section which ranges from 5°N - 5°S and 170°W - 120°W (Hsiang and Meng, 2015).

We additionally analyze the ENSO-unrest relationship using the well-known Southern Oscillation Index (SOI). Although this index is no longer directly used by NOAA to classify El Niño and La Niña events, it is available for a longer period of time and has been employed in a number of previous studies. Both the SOI and ONI are highly correlated (e.g. 0.89 for the annual averages) and generally produce similar results, particularly for our global estimates.

Civil Unrest Data

Our civil unrest data are taken from the Cross-National Time Series (CNTS) dataset compiled by Banks *et al.*, (2014). This database compiles a count of the number of unrest events occurring within a country during a given year, subdividing unrest activity into specific types of events.[5] We focus on events that constitute collective action by the populace including strikes, guerrilla warfare, government crises, riots, revolutions, and anti-governmental demonstrations.[6] These events are selected to provide a representative measure of the overall level of unrest sentiment in the economy. We examine these events on a case by case basis, but because activities may be jointly determined such as demonstrations, revolutions, and government crises, we also construct a conflict index using the first principal component.[7]

Controls

In our empirical analysis, we include controls for demographic, political, and economic variables which may have an impact on civil unrest. We include the percentage of the population that is below 15, above 65, and female. In theory, larger

[5] The CNTS data is compiled using newspaper sources.
[6] From the original CNTS unrest data, this means we exclude government purges or successful assassinations. The variables and their definitions are listed in Appendix Table 1.
[7] We normalize the principle component so that it has a mean of zero and a standard deviation of 1.

shares of these groups should all have a negative effect on civil unrest.[8] We also control for the percentage of population living in urban areas. Because the cost of collective action is potentially lower in more densely populated areas, this measure may be expected to have a positive effect. We also control for the extent of "democracy" by including the polity 2 variable. This variable ranges from -10 to 10 with more positive (negative) values corresponding with more democratic (autocratic) regimes (Marshall and Jaggers, 2009). Finally, we control for the population and the GDP of the country (Maddison, 2009). A concern with the inclusion of GDP as a control is that this factor may also be influenced by ENSO – as economic wellbeing may reflect a key channel through which climate influences civil unrest (Burke *et al.*, 2015 makes a similar point for conflict). For this reason, we confirm our primary estimates with and without economic controls.

3. Analysis

Our sample includes an unbalanced panel of 135 countries between 1960 and 2008. We estimate the relationship between climate and civil unrest using the following panel regression specification:

$$CivilUnrest_{it} = \alpha + \beta(ENSO\ Measure)_{t-1} + \mathbf{X}_{it}\Gamma + \mathbf{\Omega}_i + \boldsymbol{\tau} + \varepsilon_{it} \quad (1)$$

where i indexes countries and t indexes years. *ENSO Measure* varies across specifications and is one of the five climate variables discussed in the previous section. These five variables vary through time but not by country. $\boldsymbol{X}_{it}$ represents a vector of time variant country controls, which we include to account for demographic, political, and economic factors that may affect civil unrest in a country. As detailed in Section 2, these controls include percent of the population under the age of 15, over the age of 65, urban, and female, log of the population, log of real

[8] Data on the percentage of the population under 15, over 65, female, and urban all come from the World Bank's World Development Indicators (2014).

GDP, and the polity 2 score. $\mathbf{\Omega}_i$ is a vector of country fixed effects and $\boldsymbol{\tau}$ is a linear time trend.

We include country fixed effects in the analysis to capture any time invariant country specific characteristics. Because the climate values vary temporally and are not unique to each country, we include a linear time trend instead of year fixed effects. We assume the residuals, ε_{it} , are clustered by country and correct the standard errors accordingly throughout the analysis. Our outcome measure of interest *CivilUnrest*, varies by specification. We initially examine the first principal component as a summary metric of unrest activity and then disaggregate by unrest type for clarity of exposition. When examining unrest events specifically, we code both a dummy variable for unrest activity of a given type, which we examine to study unrest onset, and then examine the count of events, which we treat as a measure of intensity.

3.1 Principal Component Civil Unrest Results

Table 2 presents the results of estimating equation (1) to look at the relationship between climate and the principal component unrest index. Each coefficient in Table 2 is the outcome of an individual estimation.[9] Column (1) presents the results when including all 135 countries in the sample. The first three rows show the results for different averages of the ONI index. The first row uses the annual average, the second row uses the May-Dec average, and the third row uses the tropical year (May-April) average. Each of these averages shows a positive and significant relationship with the civil unrest principal component suggesting that stronger, warmer ENSO periods are robustly associated with higher levels of civil unrest. The last two rows use the number of months in the previous year classified as either El Niño or La Niña (see explanation in section 2). As with the ONI average

[9] Appendix table 2 presents coefficient estimates for the full set of covariates using the ONI annual climate variable. Others specifications with control variables displayed are available on request.

metrics, we see that having experienced more prolonged periods of El Niño during the course of the previous year is associated with higher levels of civil unrest. Interestingly, having experienced more La Niña months in the previous year is associated with significantly lower levels of civil strife, on an order of magnitude similar in absolute value to those for El Niño.[10]

Columns (2) and (3) of Table 2 break down the sample into countries which are teleconnected and countries with are not - as discussed and classified in Hsiang et al. (2011). By construction, countries are defined as teleconnected because their weather is more heavily affected by the El Niño/La Niña patterns than countries which are not.[11] As can be seen from columns (2) and (3), it is the teleconnected countries which exhibit significant changes in unrest during warming and cooling periods - particularly for the first two specifications. This result is even more robustly clear for the SOI index based measures of ENSO (see Appendix Table 3).

Existence of an impact of this climactic cycle only on teleconnected countries and not on non-teleconnected countries provides strong support for the hypothesis that ENSO has a causal impact on unrest, one which operates through channels unique to impacted nations. Lack of results for non-teleconnected countries for instance makes it less likely that correlation between worldwide commodity prices and the climate could drive the results, suggesting instead political, social, and economic processes unique to the affected countries themselves. For simplicity of exposition, we focus on the teleconnected countries in the remaining analyses.

We now turn our attention to the two regions of the world which have the largest portion of teleconnected countries – Africa and Latin America. In Table 3 we re-estimate equation 1 for teleconnected nations outside of Africa and Latin America (column (1)) and then exclude one region at a time with column (2) showing the rest of the world excluding Latin America and column (3) showing the rest of the world

[10] Appendix Table 3 shows the results when using the Southern Oscillation index instead of the Oceanic Niño Index. The results using SOI are statistically stronger than the ONI results.
[11] Figure 1 depicts the countries in the world which are teleconnected.

excluding African. The last two columns show the results for the teleconnected countries in Latin America and Africa, respectively. The results in column (1) support the idea that these two regions are the most affected by these climate events. When they are excluded from the analysis, most of the estimated impacts are insignificant. Incorporating African countries back into the analysis (column 2) we start seeing some more significant results, while if instead we add Latin American countries and exclude African countries, the estimated coefficients have a larger magnitude and are also significant.

Perhaps the clearest way to see this is to examine each region specifically. Comparing the effect of the various climate measures on teleconnected countries in Latin America (column 4) and Africa (column 5), we see that the magnitudes and level of significance are greater in these contexts. Interestingly, the size and precision of these effects are largest for the subsample of Latin American countries, despite their smaller sample size. If we contrast the coefficients between column (4) and column (5), the coefficients for the Latin America sample are larger in magnitude and statistically different from those for the Africa, suggesting that Latin America specifically is most vulnerable to the effects of El Niño (rows 1 through 4) and La Niña (row 5) on civil unrest. As a robustness check, we examine the results using the Southern Oscillation Index instead of ENSO (results are presented in Appendix Table 4). This analysis provides even more evidence that the impact of climate on unrest is largest in Latin America specifically. For the rest of the analysis we focus on the effects of El Niño and La Niña on Latin America.

While the ONI index exhibits a large amount of variability, as can be seen in Figure 3, just being in the El Niño or La Niña range of the index does not technically mean that there is an El Niño or a La Niña event, which are classified based on the duration and intensity of these cycles. According to NOAA, when the value of the ONI deviates from zero by +0.5°C (-0.5°C), a particular month is considered as an El Niño (La Niña) period. Having 5 consecutive months of ONI above or below the

0.5°C threshold constitutes an El Niño or La Niña event respectively.

In Table 4 we use this classification to see if having a more significant and prolonged El Niño (La Niña) event in the previous year and in the previous tropical year has a larger effect on civil unrest. This is indeed the case. Strikingly, La Niña events in Latin America (shown in Panel B), are associated with very large declines (or roughly 20%) in the unrest principal component index. These effects are larger than those for the ONI measure directly. As column (2) makes clear, the estimated impacts for Latin America from ENSO events are both more robust and pronounced.

3.2 Civil Unrest Event Counts Results

So far we have examined the impact of El Niño and La Niña on unrest broadly, without precisely specifying the types of activities. We now run the analysis on the complete set of individual civil unrest events listed in Table 1. The results of this exercise are presented in Table 5 which uses the count of these events in a given year as the dependent variable in equation (1). Each row is a different dependent variable while each column reflects a different ENSO measurement.

For the teleconnected countries outside of Latin America in Panel A, the events that are most affected by El Niño and La Niña are guerilla warfare and strikes. The estimated effect sizes are meaningful. For example, the coefficient on guerrilla warfare in column (1) suggests that a one standard deviation increase in the ONI annual average in the previous year increases the number of guerilla warfare events by 0.03. As a percentage of the average number of guerilla warfare events in the sample, this implies a 15% increase in the extent of unrest. Interpreting columns (2) and (3), increasing the number of months in the El Niño (La Niña) range increases (decreases) the number of guerrilla warfare events by 0.02 (0.004) or around 8% (2%).

In Latin America (depicted in Panel B), both strikes and guerilla warfare are again impacted by these climate fluctuations. In addition to these two effects, we additional observe significant impacts of El Niño on government crises and of La Niña on government crises and riots. Focusing on the government crises coefficients in columns (4) – (6), an increase in the ONI annual average in the previous year by one standard deviation increases the number of government crises in Latin America by 0.08 (a 31% increase from the average number of government crises in the sample). Furthermore, each additional El Niño (La Niña) range month in the previous year causes the number of government crises increases (decreases) by 1.4% (0.7%) from the mean.

In Table 6 we return to the analysis of El Niño and La Niña events (as in Table 4) using the civil unrest event data. As before, guerilla warfare appears to be the most affected in the teleconnected countries outside of Latin America and government crises appear to be most affected in Latin America. As would be expected for the severity of these events, the estimated effects are quite large. Interpreting the statistically significant guerilla warfare results would suggest that having a El Niño even in the previous calendar year (column 1) or in the previous tropical year (column 3) increases the number of guerilla warfare events by 33% and 40% respectively. At the same time, a La Niña event in the previous tropical year reduces the number of guerrilla warfare events by 23.5% of the average number.

The results for the Latin American sample (in Panel B) are also consistent with the previous analysis. Again the effects are both larger for ENSO events and for Latin America specifically. Having an El Niño event in the previous year (column 5) or in the previous tropical year (column 7) increases the number of government crises by 77% and 48%, respectively, from the average number. Similarly, having a La Niña event in the previous calendar year (column 6) or in the previous tropical year (column 8) reduces the number of government crises by 52% and 68%, respectively.

4. Further Robustness Checks

One of the biggest criticisms regarding the CNTS civil unrest data is that the underlying data is compiled using newspaper accounts. This method could capture a higher fraction of events for countries which have better newspaper coverage due to the presence of more outlets and/or greater relative freedom of the media to report unrest occurrences. In theory, this could increase the count of events for countries with better coverage and underestimate the count of events in countries with poorer coverage; generating systematic measurement error.

In order to address this concern, we run the analysis using a modified set of unrest variables to mitigate measurement error. Instead of using the count of civil unrest events, we simply code a dummy for the occurrence of at least one event in the given country-year for each of the events. While this is not a perfect solution for the criticism, it does allow us to use the data as a signal of unrest while discounting multiple reported occurrence of unrest.

Table 7 presents the results of estimating equation (1) using the civil unrest event dummies as the dependent variable. Panel A depicts outcomes for the rest of the world and Panel B for Latin American countries. The coefficients of interest have an interpretation which is slightly different than those for the analogous count estimates from the previous section. This difference is due to the fact that with the dummy dependent variable, estimates now essentially measure the probability of a civil unrest event occurring in any teleconnected country during a given year as opposed to providing an estimate of the marginal change in event frequency (as shown in Tables 5 & 6 for comparison).

As can be seen from the table, the impact of climactic forces on unrest onset as opposed to intensity is broadly similar, but we do observe several interesting differences when we disaggregate by type of unrest. For instance, there are weaker results for guerrilla warfare onset than for guerrilla warfare frequency. Also from the results in Panel A, it appears that El Niño and La Niña influence the probability of riots occurring. A one standard deviation in the ONI annual average in the previous year increases the probability of a riot event occurring by 0.94 percentage points (or 6.5% of the average occurrence). On the other hand, one additional month of La

Niña ONI range in the previous year reduces the probability of a riot occurring by about 0.5 percentage points (or 4% of the average occurrence).

For the Latin American sample in Panel B, the results for government crises appear generally to match those for frequency. A one standard deviation increase in the ONI annual average in the previous year increases the probability of a government crises occurring by 3.3 percentage points (or 19% of the average occurrence). An increase of one more month being classified as El Niño (La Niña) in the previous year increases (decreases) the probability of a government crisis occurring by 1.2 percentage points (0.9 percentage points) or 7% (5%) of the average value. Interestingly, El Niño (La Niña) increases (decreases) the probability of an anti-government demonstration event occurring during a given year. The overall results in Table 7 suggest that El Niño and La Niña can influence the probability of civil unrest events happening.

We also replicate the exercise using indicators for the presence of civil unrest by type and focusing on the occurrence of an El Niño or La Niña events. The results of this exercise are shown in Table 8. In Panel A, the results for guerilla warfare are weaker than in the analogous Table 6 estimation. For the rest of the world, having a La Niña event in the previous calendar year or the previous tropical year reduces the probability of having a riot event by roughly 2 and 4 percentage points, respectively (or 12% and 29% of the average occurrence in the sample). For the Latin America sample in Panel B, the results on government crises are still strong suggesting that having an El Niño event in the previous calendar year or in the previous tropical year increases the probability of having a government crisis by 4 and 5 percentage points respectively (23% and 31% of the average occurrence in the sample) while having a La Niña event in the previous calendar or tropical year reduces the probability or having a government crisis by 5 and 12 percentage points respectively (31% and 61% of the average occurrence in the sample).

5. Conclusion

This paper studies the relationship between changes in the climate and the level of civil unrest across countries. We show that as would be expected for these forces to have a causal impact on unrest behavior, robust impacts of climate are only observable among the subset of teleconnected countries – those linked to the climactic pattern of ENSO and thus susceptible to El Niño and La Niña episodes. Furthermore, we show that larger and more prolonged ENSO events have even larger impacts on civil strife, with El Niño dramatically increasing unrest and La Niña mitigating average levels of unrest. This effect occurs both for unrest onset and for civil unrest frequency.

We also find evidence that the relationship between ENSO and civil unrest is both slightly different in nature and particularly strong for the subset of teleconnected countries in Latin America. These differences suggest that these populations may be more vulnerable to climactic forces such as global warming and the ENSO cycle, but also are informative about local institutions.

Our results suggest that El Niño and La Niña are far more likely to influence government crises and riots in Latin America. This vulnerability may be indicative both upon the relative impact of climactic forces, but also upon the set of existing institutions in the region. For instance, one solution may be to develop stronger political and social resiliency in Latin America. Ultimately, our analysis highlights a need for further study and suggests that the region may require a different set of policy responses and adaptations, particularly since a given change in the climate currently yields much larger and comparatively direr economic and social consequences in Latin America specifically.

References

Attanasio, O. P., and Weber, G. (2010). "Consumption and Saving: Models of Intertemporal Allocation and Their Implications for Public Policy." *Journal of Economic Literature*, 48(3), 693-751.

Banks, Arthur S., Wilson, Kenneth A. (2014). Cross-National Time-Series Data Archive. Databanks International. Jerusalem, Israel.

Burke, M., S.M. Hsiang, E. Miguel. (2015). "Climate and Conflict", forthcoming *Annual Review of Economics*.

Burke, Marshall B., Edward Miguel, Shanker Satyanath, John A. Dykema, and David B. Lobell. (2009). "Warming Increases the Risk of Civil War in Africa." *Proceedings of the National Academy of Sciences* 106 (49): 20670-20674

Burke, M., S.M. Hsiang, E. Miguel. (2015). "Climate and Conflict", forthcoming *Annual Review of Economics*.

Cai, Wenju, Simon Borlace, Matthieu Lengaigne, Peter Van Rensch, Mat Collins, Gabriel Vecchi, Axel Timmermann et al. (2014) "Increasing frequency of extreme El Niño events due to greenhouse warming." *Nature Climate Change*.

Chaney Eric (2013). Revolt on the Nile: Economic Shocks, Religion and Political Power. *Econometrica*. Vol. 81(5): 2033-2053.

Dell Melissa. (2012) "Path Dependence in Development: Evidence from the Mexican Revolution." *Working Paper*.

Fanjzylber, P., Lederman, D., Loayza, N., (1998). Determinants of Crime Rates in Latin America and the World: An Empirical Assessment World Bank Latin American and Caribbean Studies, Viewpoints, WA.

Hendrix, Cullen, and Idean Salehyan. (2010). After the rain: Rainfall variability, hydrometeoroogical disasters, and social conflict in Africa. *Working paper, University of North Texas*.

Hsiang, S. M., & Meng, K. C. (2015). Tropical Economics. *American Economic Review*, 105(5), 257-61.

Hsiang, Solomon M., Kyle C. Meng, and Mark A. Cane (2011). "Civil conflicts are associated with the global climate." *Nature* 476(7361): 438-441.

Hsieh, Chang-Tai (2003). "Do consumers react to anticipated income changes? Evidence from the Alaska permanent fund." *American Economic Review*, Vol. 93(1): 397-405.

IPCC, 2014: "Summary for Policymakers. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change" [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1-32

Jia, Ruixue. (2014) "Weather Shocks, Sweet Potatoes and Peasant Revolts in Historical China" *Economic Journal*, Vol. 124: 92-118

Kung , James Kai-sing, and Chicheng Ma (2014). "Can cultural norms reduce conflicts? Confucianism and peasant rebellions in Qing China," *Journal of Development Economics*, Vol 111: 132-149

Maddison, Angus. (2010). *Online Database: Statistics on World Population, GDP and Per Capita GDP, 1-2008 AD*. Retrieved 2010 December from http://www.ggdc.net/Maddison/

Marshall, M. G., and Jaggers, K. (2009). *Polity IV Project: Political Regime Characteristics and Transitions, 1800-2007*. Retrieved 2009 March from Integrated Network for Societal Conflict Research Data Page: http://www.systemicpeace.org/inscr/p4manualv2007.pdf

Maystadt, J. F., & Ecker, O. (2014). Extreme Weather and Civil War: Does Drought Fuel Conflict in Somalia through Livestock Price Shocks?. *American Journal of Agricultural Economics*, *96*(4), 1157-1182.

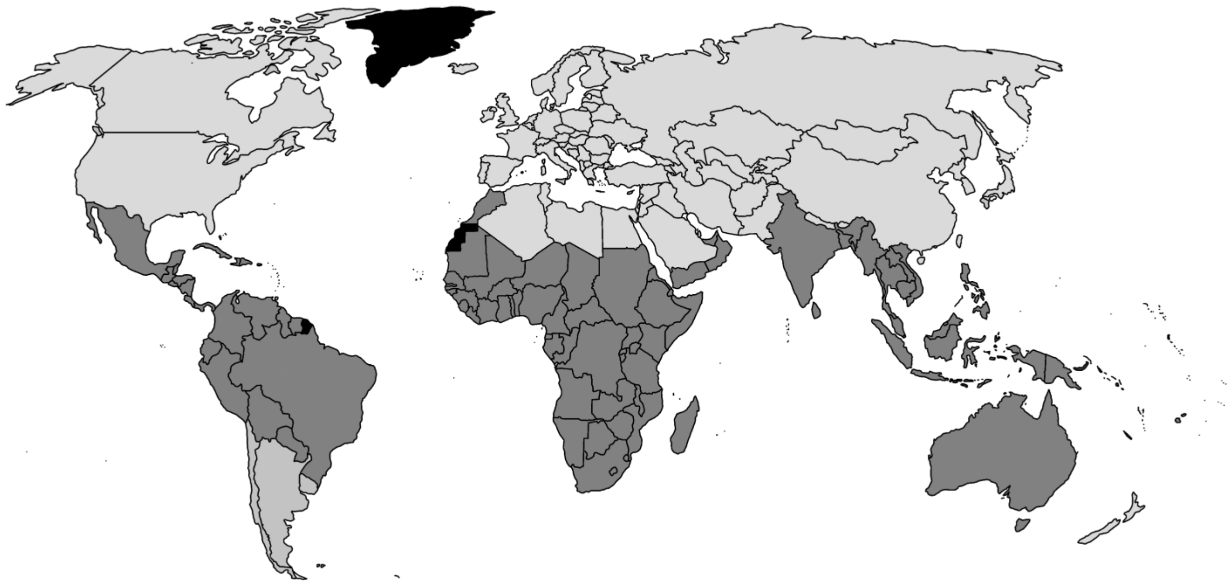
Miguel, E., Satyanath, S., & Sergenti, E. (2004). "Economic shocks and civil conflict: An instrumental variables approach." *Journal of political Economy*, 112(4), 725-753.

Ranson, M. (2014). "Crime, weather, and climate change." *Journal of environmental economics and management*, 67(3), 274-302.

Soares, Rodrigo R (2004). "Development, crime and punishment: accounting for the international differences in crime rates." *Journal of Development Economics* Vol. 73(1): 155-184.

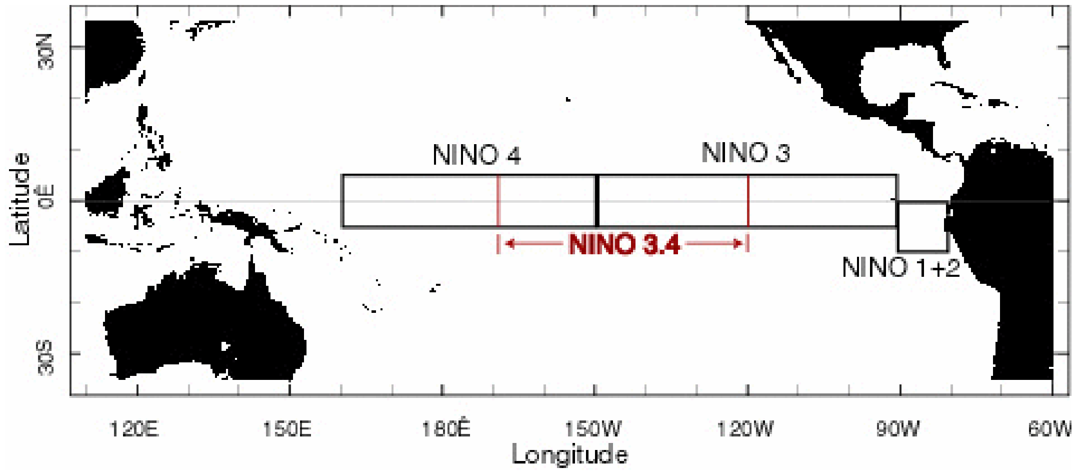
World Bank (2014). *World Development Indicators*. http://data.worldbank.org/data-catalog/world-development-indicators

Figure 1: Teleconnected Countries



Note: The countries in dark grey are the strongly teleconnected areas of the world. Those in black are excluded from the sample. Source: Hsiang et al. (2011).

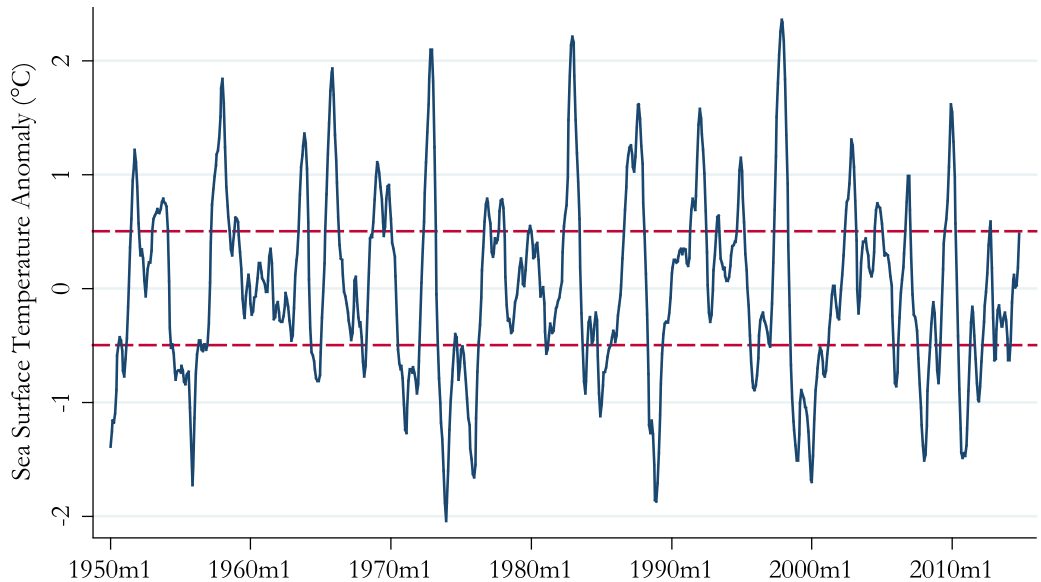
Figure 2: Niño 3.4 Region



Source: http://iri.columbia.edu/~blyon/Next_ENSO/NINO_Regions.jpg

Figure 3: Oceanic Niño Index

With El Niño (+0.5°C) and La Niña (-0.5°C) Thresholds



Source: National Weather Center, Center for Weather and Climate Prediction, ONI Index Accessed: Dec 2014.
Note: The ONI is a smoothed index calculated from sea surface temperatures in the Niño-3.4 region.

Table 1: Summary Statistics

Climate Measures	Mean	Std. Dev.
ONI Annual Average	0.017	(0.60)
ONI May-Dec. Average	0.033	(0.76)
ONI Tropical Year Average	0.023	(0.74)
Months with El Niño Deviations (+0.5°C)	3.042	(3.39)
Months with La Niña Deviations (+0.5°C)	3.139	(3.98)
El Niño Event in the Year	0.282	(0.45)
El Niño Event in the Tropical Year	0.328	(0.47)
La Niña Event in the Year	0.290	(0.45)
La Niña Event in the Tropical Year	0.336	(0.47)
Unrest Events	Mean	Std. Dev.
Principal Component Analysis of Unrest	0.000	(1.00)
Anti-Government Demonstrations	0.574	(1.91)
Government Crises	0.177	(0.53)
Guerilla Warfare	0.204	(0.70)
Revolutions	0.188	(0.49)
Riots	0.464	(1.91)
Strikes	0.140	(0.55)
Demographic Political and Economic Variables		
% of Population under 15	36.072	(9.98)
% of Population over 64	5.949	(4.20)
% of Population that is Female	49.938	(2.54)
% of Population in Urban Areas	48.850	(24.42)
Natural Log of Population	9.063	(1.51)
Natural Log of Real GDP	10.195	(1.94)
Polity 2 score	0.588	(7.58)

Notes: Full Sample Size (N = 5630)

Table 2: Effects of El Niño and La Niña on Civil Unrest

Dependent Variable: Civil Unrest Index	All Countries	TE Only	Not TE
	(1)	(2)	(3)
ONI Index (Annual Average $)_{t-1}$	0.048***	0.076***	0.019
	(0.017)	(0.026)	(0.024)
ONI Index (May-Dec. Average $)_{t-1}$	0.021**	0.041**	0.001
	(0.011)	(0.016)	(0.015)
ONI Index (Tropical Average $)_{t-1}$	0.032**	0.035*	0.029
	(0.015)	(0.019)	(0.022)
Months with El Niño Deviations (+0.5°C$)_{t-1}$	0.014***	0.015***	0.012***
	(0.003)	(0.005)	(0.004)
Months with La Niña Deviations (-0.5°C$)_{t-1}$	-0.009***	-0.012***	-0.007
	(0.003)	(0.004)	(0.005)
N	5,630	3,238	2,392

Notes: Full sample, 1960-2008. Each row and column is a different regression. All specifications include donor fixed effects, a time trend, and the full set of controls from equation (1). See text for the source and definition of all variables. All climate measures reflect measurements taken in either the previous calendar year or the previous tropical year (which effectively reflects a 6 month lag of the current calendar year). Standard errors are clustered at the country level and reported in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Latin America, ENSO, and Civil Unrest

	Rest of the world			Regions	
Dependent Variable: Civil Unrest Index	**Excl. Latin America & Africa**	**Excluding Latin America**	**Excluding Africa**	**Latin America**	**Africa**
	(1)	(2)	(3)	(4)	(5)
ONI Index (Annual Average $)_{t-1}$	0.058	0.058**	0.089**	0.140**	0.064*
	(0.055)	(0.029)	(0.040)	(0.062)	(0.037)
ONI Index (May-Dec. Average $)_{t-1}$	0.026	0.029*	0.047*	0.076**	0.035
	(0.032)	(0.017)	(0.025)	(0.033)	(0.022)
ONI Index (Tropical Average $)_{t-1}$	0.026	0.028	0.041	0.081	0.035
	(0.039)	(0.021)	(0.028)	(0.051)	(0.030)
Months with El Niño Deviations $(+0.5°C)_{t-1}$	0.021**	0.011*	0.025***	0.035**	-0.001
	(0.010)	(0.006)	(0.008)	(0.015)	(0.008)
Months with La Niña Deviations $(-0.5°C)_{t-1}$	0.001	-0.008**	-0.010*	-0.025**	-0.019***
	(0.007)	(0.004)	(0.006)	(0.010)	(0.005)
N	762	2,524	1,476	714	1,762

Notes: Teleconnected Countries Only, 1960-2008. Teleconnected status is described in the text and is as defined in Hsiang et al., (2011). Each row and column is a different regression. All specifications include donor fixed effects, a time trend, and the full set of controls from equation (1). See text for the source and definition of all variables. All climate measures reflect measurements taken in either the previous calendar year or the previous tropical year (which effectively reflects a 6 month lag of the current calendar year). Standard errors are clustered at the country level and reported in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Effects of El Niño and La Niña Events on Overall Civil Unrest

Dependent Variable: Civil Unrest Index	Rest of World	Latin America
	(1)	(2)
El Niño Event in the Previous Year	0.076**	0.185*
	(0.037)	(0.103)
La Niña Event in the Previous Year	-0.045	-0.208***
	(0.029)	(0.068)
El Niño Event in the Previous Tropical Year	0.027	0.097
	(0.032)	(0.087)
La Niña Event in the Previous Tropical Year	-0.043	-0.189**
	(0.039)	(0.084)
N	2,524	714

Notes: Teleconnected Countries Only, 1960-2008. Teleconnected status is described in the text and is as defined in Hsiang et al., (2011). Each row and column is a different regression. All specifications include donor fixed effects, a time trend, and the full set of controls from equation (1). See text for the source and definition of all variables. All climate measures reflect measurements taken in either the previous calendar year or the previous tropical year (which effectively reflects a 6 month lag of the current calendar year). Standard errors are clustered at the country level and reported in parenthesis. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 5: The Influence of Climate on Civil Unrest Frequency

Dependent Variable: Civil Unrest Event Counts

	Panel A: Rest of World			Panel B: Latin America		
	ONI Annual	El Niño Months	La Niña Months	ONI Annual	El Niño Months	La Niña Months
	(1)	(2)	(3)	(4)	(5)	(6)
Anti-Gov't Dems	0.006	0.000	0.001	0.060	0.018	-0.009
	(0.050)	(0.009)	(0.005)	(0.081)	(0.013)	(0.014)
Gov't Crises	0.009	0.003	-0.001	0.129***	0.034***	-0.018***
	(0.011)	(0.002)	(0.002)	(0.048)	(0.012)	(0.006)
Guerilla Warfare	0.050***	0.015***	-0.004**	0.068*	0.024**	-0.008
	(0.014)	(0.005)	(0.002)	(0.038)	(0.011)	(0.006)
Revolutions	0.010	-0.000	-0.003	0.003	0.004	-0.001
	(0.014)	(0.002)	(0.002)	(0.045)	(0.006)	(0.007)
Riots	0.044	0.001	-0.011	0.039	0.000	-0.020***
	(0.047)	(0.008)	(0.007)	(0.044)	(0.008)	(0.006)
Strikes	0.030**	0.004	-0.003**	0.069**	0.008	-0.014***
	(0.015)	(0.003)	(0.001)	(0.032)	(0.005)	(0.005)

Notes: Teleconnected Countries Only, 1960-2008. Teleconnected status is described in the text and is as defined in Hsiang et al., (2011). Each row and column is a different regression. All specifications include donor fixed effects, a time trend, and the full set of controls from equation (1). See text for the source and definition of all variables. All climate measures reflect measurements taken in either the previous calendar year or the previous tropical year (which effectively reflects a 6 month lag of the current calendar year). Standard errors are clustered at the country level and reported in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Effects of El Niño and La Niña Events on Civil Unrest Frequency

Dependent Variable: Civil Unrest Event Counts

	Panel A: Rest of World				Panel B: Latin America			
	Previous Year		Previous Tropical Year		Previous Year		Previous Tropical Year	
	El Niño Event	La Niña Event	El Niño Event	La Niña Event	El Niño Event	La Niña Event	El Niño Event	La Niña Event
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Anti-Gov't Dems	0.043	-0.002	-0.068*	0.004	0.126	-0.193**	-0.075	0.011
	(0.052)	(0.035)	(0.040)	(0.065)	(0.089)	(0.089)	(0.089)	(0.105)
Gov't Crises	0.016	0.008	0.014	-0.008	0.195***	-0.132***	0.122**	-0.171***
	(0.012)	(0.016)	(0.015)	(0.015)	(0.075)	(0.045)	(0.050)	(0.055)
Guerilla Warfare	0.067***	-0.016	0.081***	-0.047***	0.147*	-0.053	0.083	-0.099**
	(0.024)	(0.018)	(0.027)	(0.017)	(0.087)	(0.042)	(0.052)	(0.050)
Revolutions	0.009	-0.017	-0.011	-0.019	0.009	0.017	0.019	-0.051
	(0.019)	(0.019)	(0.018)	(0.020)	(0.048)	(0.051)	(0.061)	(0.054)
Riots	0.030	-0.095*	0.014	-0.034	-0.050	-0.155***	0.034	-0.112**
	(0.057)	(0.056)	(0.055)	(0.069)	(0.064)	(0.054)	(0.079)	(0.048)
Strikes	0.031	-0.025*	0.012	-0.013	0.038	-0.114***	0.011	-0.025
	(0.023)	(0.013)	(0.014)	(0.016)	(0.044)	(0.044)	(0.048)	(0.033)

Notes: Teleconnected Countries Only, 1960-2008. Teleconnected status is described in the text and is as defined in Hsiang et al., (2011). Each row and column is a different regression. All specifications include donor fixed effects, a time trend, and the full set of controls from equation (1). See text for the source and definition of all variables. All climate measures reflect measurements taken in either the previous calendar year or the previous tropical year (which effectively reflects a 6 month lag of the current calendar year). Standard errors are clustered at the country level and reported in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Table 7: The Influence of Climate on Civil Unrest Outbreaks

Depdendent Variable: Civil Unrest Indicator

	Panel A: Rest of World			Panel B: Latin America		
	ONI Annual	El Niño Months	La Niña Months	ONI Annual	El Niño Months	La Niña Months
	(1)	(2)	(3)	(4)	(5)	(6)
Anti-Gov't Dems	0.001	0.000	-0.001	0.062***	0.014***	-0.007**
	(0.010)	(0.002)	(0.002)	(0.023)	(0.005)	(0.003)
Gov't Crises	0.009	0.003*	-0.002	0.055***	0.012***	-0.009**
	(0.009)	(0.001)	(0.001)	(0.020)	(0.004)	(0.003)
Guerilla Warfare	0.013	0.003**	-0.001	-0.002	0.002	0.002
	(0.008)	(0.001)	(0.002)	(0.014)	(0.003)	(0.003)
Revolutions	0.008	-0.000	-0.003	-0.020	-0.002	0.002
	(0.011)	(0.002)	(0.002)	(0.031)	(0.004)	(0.005)
Riots	0.015**	-0.000	-0.005***	0.016	0.003	-0.006*
	(0.007)	(0.001)	(0.001)	(0.020)	(0.004)	(0.003)
Strikes	0.011	0.000	-0.002*	0.036*	0.005	-0.006*
	(0.007)	(0.001)	(0.001)	(0.019)	(0.003)	(0.003)

Notes: Teleconnected Countries Only, 1960-2008. Teleconnected status is described in the text and is as defined in Hsiang et al., (2011). Each row and column is a different regression. All specifications include donor fixed effects, a time trend, and the full set of controls from equation (1). See text for the source and definition of all variables. All climate measures reflect measurements taken in either the previous calendar year or the previous tropical year (which effectively reflects a 6 month lag of the current calendar year). Standard errors are clustered at the country level and reported in parenthesis. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 8: Effects of El Niño and La Niña Events on Civil Unrest Outbreaks

Depdendent Variable: Civil Unrest Indicator

	Panel A: Rest of World				Panel B: Latin America			
	Previous Year		Previous Tropical Year		Previous Year		Previous Tropical Year	
	El Niño Event	La Niña Event	El Niño Event	La Niña Event	El Niño Event	La Niña Event	El Niño Event	La Niña Event
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Anti-Gov't Dems	-0.001	-0.001	-0.012	-0.024*	0.102***	-0.083***	0.016	-0.036*
	(0.012)	(0.014)	(0.013)	(0.013)	(0.034)	(0.032)	(0.034)	(0.021)
Gov't Crises	0.013	0.003	0.013	-0.010	0.068***	-0.055**	0.054**	-0.116***
	(0.010)	(0.012)	(0.012)	(0.011)	(0.024)	(0.026)	(0.024)	(0.031)
Guerilla Warfare	0.012	-0.002	0.027**	-0.017	-0.005	0.028	0.055**	-0.030
	(0.011)	(0.012)	(0.012)	(0.014)	(0.019)	(0.027)	(0.026)	(0.022)
Revolutions	0.010	-0.016	-0.015	-0.014	0.001	0.033	0.009	-0.015
	(0.016)	(0.015)	(0.013)	(0.015)	(0.027)	(0.041)	(0.035)	(0.042)
Riots	0.002	-0.027**	0.014	-0.040***	0.002	-0.049**	0.040	-0.051*
	(0.011)	(0.013)	(0.013)	(0.011)	(0.035)	(0.023)	(0.030)	(0.029)
Strikes	0.004	-0.014*	-0.001	-0.003	0.016	-0.047**	0.001	-0.017
	(0.009)	(0.008)	(0.009)	(0.009)	(0.027)	(0.023)	(0.030)	(0.028)

Notes: Teleconnected Countries Only, 1960-2008. Teleconnected status is described in the text and is as defined in Hsiang et al., (2011). Each row and column is a different regression. All specifications include donor fixed effects, a time trend, and the full set of controls from equation (1). See text for the source and definition of all variables. All climate measures reflect measurements taken in either the previous calendar year or the previous tropical year (which effectively reflects a 6 month lag of the current calendar year). Standard errors are clustered at the country level and reported in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Appendix Table 1: Definitions of Instability Variables

Variables	Definitions
Anti-Government Demonstrations	“Any peaceful public gathering of at least 100 people for the primary purpose of displaying or voicing their opposition to government policies or authority, excluding demonstrations of a distinctly anti-foreign nature.”
Government Crises	“Any rapidly developing situation that threatens to bring the downfall of the present regime – excluding situations of revolt aimed at such overthrow.”
Guerilla Warfare	"Any armed activity, sabotage, or bombings carried on by independent bands of citizens or irregular forces and aimed at the overthrow of the present regime."
Revolutions	"Any illegal or forced change in the top government elite, any attempt at such a change, or any successful or unsuccessful armed rebellion whose aim is independence from the central government."
Riots	“Any violent demonstration or clash of more than 100 citizens involving the use of physical force.”
General Strikes	“Any strike of 1,000 or more industrial or service workers that involves more than one employer and that is aimed at national government policies or authority.”

Source: Cross National Time Series Data (Banks, 2011)

Appendix Table 2: Effects of El Niño and La Niña on Civil Unrest Index Results with all Covariates

Dependent Variable:	Conflict Index								
	All Countries			Teleconnected Countries			Not-Teleconnected Countries		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ONI Index (Annual. Average)$_t$	0.027*	0.032**		0.046**	0.053**		0.004	0.006	
	(0.015)	(0.015)		(0.023)	(0.023)		(0.021)	(0.021)	
ONI Index (Annual Average)$_{t-1}$	0.045**		0.048***	0.071***		0.076***	0.018		0.019
	(0.017)		(0.017)	(0.026)		(0.026)	(0.024)		(0.024)
% Urban Pop	0.007	0.007	0.007	-0.000	-0.000	-0.000	0.018*	0.018*	0.018*
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.010)	(0.010)	(0.010)
% of Population under 15	0.005	0.005	0.005	-0.011	-0.011	-0.011	0.016	0.016	0.016
	(0.008)	(0.008)	(0.008)	(0.011)	(0.011)	(0.011)	(0.016)	(0.016)	(0.016)
% of Population over 64	-0.082***	-0.082***	-0.082***	-0.149**	-0.148**	-0.147**	-0.062*	-0.062*	-0.062*
	(0.031)	(0.031)	(0.031)	(0.059)	(0.059)	(0.059)	(0.036)	(0.036)	(0.036)
% of Population that is Female	0.021	0.020	0.020	0.015	0.013	0.014	0.001	0.001	0.001
	(0.027)	(0.027)	(0.027)	(0.043)	(0.042)	(0.043)	(0.040)	(0.040)	(0.040)
Log of Population	0.079	0.083	0.082	0.044	0.056	0.052	-0.186	-0.185	-0.185
	(0.188)	(0.188)	(0.188)	(0.307)	(0.305)	(0.306)	(0.262)	(0.262)	(0.262)
Log GDP	-0.192***	-0.194***	-0.193***	-0.333***	-0.337***	-0.335***	-0.112	-0.113	-0.112
	(0.073)	(0.073)	(0.073)	(0.118)	(0.119)	(0.118)	(0.103)	(0.103)	(0.103)
Polity 2	0.002	0.002	0.002	-0.003	-0.002	-0.002	0.004	0.004	0.004
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.009)	(0.009)	(0.009)
N	5,630	5,630	5,630	3,238	3,238	3,238	2,392	2,392	2,392
R^2	0.024	0.023	0.023	0.020	0.017	0.019	0.036	0.036	0.036

Notes: Each row and column is a different regression. All specifications include donor fixed effects, a time trend, and the full set of controls from equation (1). See text for the source and definition of all variables. All climate measures reflect measurements taken in either the previous calendar year or the previous tropical year (which effectively reflects a 6 month lag of the current calendar year). Standard errors are clustered at the country level and reported in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Appendix 3: Effects of El Nino and La Nina on Civil Unrest Index Using Southern Oscillation Index Data

	All Countries	TE Only	Not TE
	(1)	(2)	(3)
SOI Index (Annual Average)$_{t-1}$	0.062***	0.111***	0.014
	(0.023)	(0.035)	(0.029)
SOI Index (May-Dec. Average)$_{t-1}$	0.026*	0.058***	-0.007
	(0.015)	(0.021)	(0.022)
SOI Index (Tropical Average)$_{t-1}$	0.038***	0.055**	0.022
	(0.015)	(0.023)	(0.018)
Months with El Niño Temperatures (+0.5°C)$_{t-1}$	0.014***	0.020***	0.007
	(0.004)	(0.006)	(0.005)
Months with La Niña Temperatures (-0.5°C)$_{t-1}$	-0.013***	-0.019***	-0.007
	(0.004)	(0.005)	(0.005)
N	5,630	3,238	2,392

Notes: Full sample, 1960-2008. Each row and column is a different regression. All specifications include donor fixed effects, a time trend, and the full set of controls from equation (1). See text for the source and definition of all variables. All climate measures reflect measurements taken in either the previous calendar year or the previous tropical year (which effectively reflects a 6 month lag of the current calendar year). Standard errors are clustered at the country level and reported in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Appendix Table 4: Latin America, ENSO, and Civil Unrest Index

Dependent Variable: Civil Unrest Index	Rest of the world			Regions	
	Excl. Latin America & Africa	**Excluding Latin America**	**Excluding Africa**	**Latin America**	**Africa**
	(1)	(2)	(3)	(4)	(5)
SOI Index (Annual Average)$_{t-1}$	0.106	0.092**	0.134**	0.165**	0.087**
	(0.088)	(0.043)	(0.058)	(0.067)	(0.041)
SOI Index (May-Dec. Average)$_{t-1}$	0.050	0.045*	0.071**	0.093**	0.040
	(0.051)	(0.025)	(0.035)	(0.039)	(0.025)
SOI Index (Tropical Average)$_{t-1}$	0.056	0.046	0.069*	0.089*	0.041
	(0.057)	(0.028)	(0.037)	(0.047)	(0.028)
Months with El Niño Deviations (+0.5°C)$_{t-1}$	0.019	0.017***	0.023**	0.030**	0.019**
	(0.012)	(0.006)	(0.009)	(0.013)	(0.008)
Months with La Niña Deviations (-0.5°C)$_{t-1}$	-0.016	-0.016**	-0.021**	-0.029**	-0.018**
	(0.013)	(0.006)	(0.009)	(0.012)	(0.008)
N	762	2,524	1,476	714	1,762

Notes: Teleconnected Countries Only, 1960-2008. Teleconnected status is described in the text and is as defined in Hsiang et al., (2011). Each row and column is a different regression. All specifications include donor fixed effects, a time trend, and the full set of controls from equation (1). See text for the source and definition of all variables. All climate measures reflect measurements taken in either the previous calendar year or the previous tropical year (which effectively reflects a 6 month lag of the current calendar year). Standard errors are clustered at the country level and reported in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Appendix Table 5: The Influence of Climate on Civil Unrest Event Counts on All Teleconected Countries Outside of Latin America

	Panel A: Rest of World			Panel B: Latin America		
	SOI Annual	El Niño Months	La Niña Months	SOI Annual	El Niño Months	La Niña Months
	(1)	(2)	(3)	(4)	(5)	(6)
Anti-Gov't Dems	0.055	0.007	-0.006	0.112	0.017	-0.018
	(0.050)	(0.008)	(0.008)	(0.089)	(0.016)	(0.016)
Gov't Crises	0.005	0.003	-0.003	0.104**	0.023**	-0.021**
	(0.013)	(0.002)	(0.002)	(0.048)	(0.009)	(0.009)
Guerilla Warfare	0.042***	0.012***	-0.009***	0.049	0.011	-0.009
	(0.015)	(0.004)	(0.003)	(0.041)	(0.009)	(0.008)
Revolutions	0.019	0.005*	-0.005*	0.040	0.006	-0.006
	(0.015)	(0.003)	(0.003)	(0.051)	(0.009)	(0.009)
Riots	0.088	0.008	-0.010	0.048	0.005	-0.009
	(0.070)	(0.009)	(0.010)	(0.049)	(0.009)	(0.008)
Strikes	0.049**	0.008**	-0.008**	0.104***	0.016**	-0.017***
	(0.024)	(0.004)	(0.004)	(0.040)	(0.007)	(0.006)

Notes: Teleconnected Countries Only, 1960-2008. Teleconnected status is described in the text and is as defined in Hsiang et al., (2011). Each row and column is a different regression. All specifications include donor fixed effects, a time trend, and the full set of controls from equation (1). See text for the source and definition of all variables. All climate measures reflect measurements taken in either the previous calendar year or the previous tropical year (which effectively reflects a 6 month lag of the current calendar year). Standard errors are clustered at the country level and reported in parenthesis. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.