Climate Change, Power Transition Theory, and Civil Conflict

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Abstract

If Power Transition Theory applies to the international level, does it also explain the outbreak of violence at a domestic setting? Power Transition states that interstate conflict arises when actors have an opportunity (power parity between contenders) and a motive (the contenders are dissatisfied with the status quo). The authors extend this logic in a twofold way. First, they argue that the risk of *civil conflict* should increase when (potential) rebels' power approximates the power of the incumbent(s), and the rebels are dissatisfied with the status quo. Second, they introduce climatic changes therein as potential measures for rebels' motives because climatic changes can directly affect individuals' welfare. For testing the argument, the paper analyzes data on civil war onset for 1980-2004. While the empirical results provide some support for the validity of the opportunity component of power transition theory at a domestic level, they do not reveal evidence that climate induced dissatisfaction does affect civil conflict. This research establishes a more general application of power transition dynamics, which may have strong implications for the literature on climate change-civil conflict nexus.

Keywords: climate change, power transition theory, relative power, dissatisfaction, civil conflict.

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Introduction

The assessment reports of the Intergovernmental Panel on Climate Change (IPCC 2007), the Stern Review (2006), and many issue-specific studies demonstrate that climatic changes are a reality, and that those changes have far reaching effects on plants, animals, ecosystems, and humanity now and in the future. With increasing concerns about such global effects of climate change, a group of scholars referred to as neo-Malthusians[1] posits that climate change is a threat to international security because of its potential to increase resource scarcity (Homer-Dixon, 1999; Homer-Dixon and Blitt, 1998; Bächler et al., 1996).[2] In particular, Homer-Dixon (1999) argues that decreasing access to renewable resources increases frustration, which, in turn, creates grievances against the state, weakens the state, and increases the likelihood for instigating an insurrection.[3] Moreover, he claims that environmental scarcity is the cause for many of the recent conflicts such as the violence in South Africa, the insurgency in Assam, and the Zapatista rebellion in Chiapas (Homer-Dixon 1999; Percival and Homer-Dixon 1998; Homer-Dixon and Blitt 1994).

The neo-Malthusian argument is based on psychological and deprivation models that contend that grievances – the gap between individual expectations and achievement – would contribute to the willingness of people to instigate violence (Davies 1962; Gurr 1970). Gurr's (1970) well-known theory of relative deprivation depicts various types of collective violence as reactions to frustrations stemming from unfulfilled aspirations, mainly related to material well-being. However, at least until recently, the evidence supporting the deprivation

[1] Neo-Malthusian arguments, inspired by Thomas Malthus' proposition that population increases geometrically while food production only grows arithmetically, grew in the late 1960s and 1970s and were presented in the 1972 book *Limits of Growth* (Meadows et al., 1992).

[2] Several other researchers posit that natural resource abundance, rather than its scarcity contributes to civil conflict. In particular, they argue that a) resources may be used to finance rebels; b) the discovery of new resources may create conflict over their distribution; and c) natural recourse dependence may make economies more prone to downturns (Collier and Hoeffler 2004; Ross 2004; de Soysa 2002a; 2002b; Le Billion 2001).

[3] Other scholars, commonly referred to as cornucopians or resource optimists, do not share this pessimistic view. They acknowledge that environmental degradation may negatively affect human wellbeing. But they argue that humans can adapt to resource scarcity by using market mechanisms (pricing), technological innovation, and other means (Lomborg 2001; Simon 1998).

arguments has not been overwhelming.[4] Consequently most of the existing civil war literature argues that grievances are not sufficient to explain armed conflict and instead emphasizes the importance of factors that provide opportunities and resources for rebellion in predicting the onset of civil conflict. For example, large groups can draw on a larger pool of potential fighters and resources, and, thus, they are more able to challenge the government (Cederman et al. 2010). From a somewhat different perspective, several scholars emphasize that bad economic conditions provide the opportunity for rebellion either because the opportunity cost for rebellion is low (e.g., Collier and Hoeffler 2004) or because the government is both financially and administratively weak to prevent rebellion (e.g., Fearon and Laitin 2003). Although these arguments are appealing, still they are muted regarding the rebels' motives to challenge the government.

While most of the existing literature tends to emphasize either opportunity or grievances over the other as the main factor determining civil conflict, in this paper we synthesize these two broadly competing perspectives on collective violence – opportunity/resource mobilization models and psychological/deprivation models – and postulate that insurgents require both opportunity and willingness to challenge state power (Most and Starr 1989). For doing so, we rely on Power Transition Theory, which was initially developed to explain interstate war, by arguing that civil conflict is more likely to occur when rebels are powerful enough (opportunity) to challenge the government and dissatisfied enough (willingness) to do so. In other words, it is the interaction effect between them that presents the greatest risk of conflict. In addition, we argue that dissatisfaction could be a consequence of climate change since it directly affects individuals' well-being – particularly in societies where economic activity heavily depends on climatic conditions such as agriculture. Consequently, we expect that conflict is more likely when the power of (potential) rebels approximates or is roughly equal to governmental power *and* the rebels are dissatisfied with the climate induced

[4] For exceptions see Cederman et al. (2011), Cederman et al. (2009), and Østby et al. (2009).

conditions such as droughts, temperature increases, or precipitation variability, because these factors might have negative implications for agricultural productivity and food security, i.e., the well-being of (potential) rebels could be directly affected.

We test our argument on civil war onset data for 1980-2004. We employ a measure of climate change that captures dissatisfaction and, thus, it allows us to better identify the effects of climatic developments on the probability of civil conflict**.** This measure takes into account that choices regarding production structures (e.g. crop choices, methods of cultivation, etc.) tend to be climate specific, and are also adapted to persistent changes in climatic conditions. To the extent that such choices are optimal for a particular climate (precipitation, temperature) it should be deviations from the normal climate (climate variability) that matter for economic activity and, thus, for the level of satisfaction/dissatisfaction with the climate induced conditions. We find that climate induced dissatisfaction does not affect the likelihood of civil conflict. One possible explanation for this finding is that individuals' vulnerability and thus dissatisfaction with climatic changes depend not only on an individual's exposure to climate change but also on her adaptive capacity.

The next section reviews the literature and states the hypotheses to be tested. In the third section, we discuss the empirical approach and then present the results in the subsequent section. The final section summarizes the findings and discusses their policy implications.

Power Transition Theory, Climate Change, and Civil Conflict

Power Transition Theory in Civil Conflict: The Role of Power Parity

Power Transition Theory (PTT) holds that peace is most likely to be maintained in the international system when the dominant state has a clear preponderance of power. Accordingly, when one side enjoys a preponderance of power, the outcomes of potential conflicts are clear, and states will settle disputes before they actually might escalate to war. Power-preponderance thus suggests that when capabilities are roughly equal, the states

involved may both perceive a reasonable chance of winning, leading to an increased probability of disputes and escalation to war.

Although PTT intended to explain interstate conflict, its logic can also apply to and predict civil conflict. That is, civil conflict is more likely when rebels' power approximates the power of the government[5]. Empirical research has shown that the distribution of power among contending parties affects the likelihood of civil war in a similar fashion as in interstate wars. For example, Benson and Kugler (1998) in a sample of 26 countries for the 1985-1989 period find that relative parity between the government and opposition (measured as the capacity for fiscal extraction by government and opposition) leads to higher levels of violence. Ellingsen (2000) examines several determinants of civil war onset for 1946-1992. She shows that countries in which the population share of the dominant group is less than 80% experience civil wars more frequently than more homogeneous countries. Toft (2007) explicitly tests the logic of the PTT for domestic ethnic conflict. She develops four hypotheses regarding how conditions of parity, transition, and satisfaction should affect the likelihood of civil war between ethnic groups. Using data on 130 civil wars between 1940 and2000, Toft (2007) demonstrates that demographic population shifts increase the probability of civil conflict. In particular, she shows that as ethnic group sizes (measured as majority/minority group ratio) approach parity, the likelihood of civil war increases. Finally, Buhaug et al. (2008) and Cederman et al (2009) employ geographic information systems (GIS) to compute the power balance between politically excluded ethnic groups and dominant actors in terms of group sizes. They report that the dyadic power balance has a positive and significant effect on the likelihood of conflict; the probability of ethnic conflict increases as the peripheral group's relative size goes up vis-à-vis the government.

[5] It is worth noting that several other researchers have also identified parity as a precondition for civil conflict. Gurr (1970: 235), for example, states: "the likelihood of internal war increases as the ratio of dissident to regime coercive control approaches equality." Similarly Timansheff (1965: 156ff) argues that "revolution commonly breaks out when both parties have, or seem to have, a fair chance of victory."

Although power parity is a necessary condition for war to occur, it is not a sufficient one. For war to occur the PTT requires that the challenger is also dissatisfied with the status quo. Accordingly, it is a general dissatisfaction with its position in the system, and a desire to redraft the rules by which relations among nations work, that provoke a country to begin a war (Organski and Kugler 1980; Organski 1958). Applying this logic to the domestic setting, civil conflict is more likely when the rebels are dissatisfied with the status quo and, as a result, they seek to change the distribution of benefits within the state. We now address this in the following section.

Power Transition Theory in Civil Conflict: The Role of Environmental Dissatisfaction

Environmental problems such as floods, droughts, decertification as well as temperature increases, or precipitation variability can act as "stressors" that endanger individuals' well-being due to decreases in their personal income from production and/or lower chances for future employment. Accordingly, environmental stress should be more paramount in cases where people are directly dependent on the environment for their livelihood (i.e., agriculture) implying that environmental stress directly threatens their survival. In such cases, individuals might become increasingly discontented by the widening gap between their actual level of economic achievement and the level they feel they deserve. Moreover some groups are likely to be more dissatisfied (frustrated) than others because elites will use their power to maintain their standards of living despite the declining economic conditions. At some point, the dissatisfaction of these groups may cross a critical threshold, i.e., a 'threshold of dissatisfaction,' and they will seek to address their dissatisfaction by challenging the government. The reasons are that either they perceive that the government is responsible for their economic misery and/or they consider the government elites to be benefiting from an unfair distribution of economic goods in the society. Their revolt, thus, will aim at redrafting the rules by which the distribution of benefits should be determined.

Whereas case study analyses have provided anecdotal evidence that environmental degradation such as water scarcity, soil degradation, or deforestation have led to conflict in some parts of the world (Sahel area), econometric analyses, so far, have failed to generate conclusive evidence. A part of this variance in empirical evidence is certainly due to the use of different measures of environmental degradation, data problems, and different sample sizes and time periods.

Several authors investigated the effects of environmental degradation such as land degradation, freshwater scarcity, and deforestation on internal conflict. Hauge and Ellingsen (1998) find that all these environmental problems have direct, positive effects on the incidence of civil war. Raleigh and Urdal (2007) and Hendrix and Glaser (2007), on the other hand, find that only water scarcity significantly increases the likelihood of conflict. Theisen (2008) also reports that only a very high level of land degradation increases the risk of civil war.

Recent research examines how factors presumably related to climate change, such as rainfall and temperature patterns and anomalies affect the onset of civil conflict. Hendrix and Glaser (2007) examine the impact of short-term climatic changes (inter-annual variability in rainfall) on civil conflict onset in sub-Saharan Africa. They report that positive changes in rainfall significantly decrease the conflict risk in the following year. Similarly Miguel et al (2004) n a study of 41 African countries in 1981-1999 period, find that lower rainfall growth reduces economic growth and, indirectly, increases the probability of intrastate conflict. Brückner and Ciccone (2010) on the other hand do not find any significant effects of rainfall growth on civil war onset, and Ciccone (2011) reports that lower rainfall levels are associated with a lower probability of civil conflict. Koubi et al (2012) using a global sample also do not find any effect of climate variability on civil conflict. Finally Hendrix and Salehyan (2012) focus on Africa and find that of deviations from normal rainfall patterns (i.e., wetter and drier than normal conditions) are associated with both conflict and civil unrest (e.g., riots, strikes).

Zhang et al. (2007) using bivariate correlations over the period 1400-1900 reports that changes in average temperature were related to changes in agricultural production and the frequency of wars. Similarly, Burke et al. (2009) find that temperature increases in Africa between 1981 and 2002 have a significant, positive effect on the occurrence of civil war. Buhaug (2010) shows, however, that this result is not robust to alternative model specifications. His own analysis shows that climate variability, measured as inter-annual growth and deviation from annual mean precipitation and temperature, is a poor predictor of civil conflict**.** Similarly Theisen et al (2012) don't find any effect of drought on civil war.

The Synthesis

One of the reasons that the existing literature has been unable to produce conclusive results might be that most of the past research has focused on demonstrating that there exists a direct link between climatic conditions and conflict.[6] Consequently, conditional effects which stem from key factors such as the capacity to instigate a rebellion, economic development, and the political system have been ignored (e.g., Buhaug et al. 2010; Salehyan, 2008). An alternative, useful research strategy is to look for conditional effects that vary with the capacity of the rebels to revolt as it is suggested by PTT at an international level. PTT posits that for conflict to occur both power parity and dissatisfaction must be present. Consequently, we hypothesize that civil conflict is more likely when the rebels' power approximates the power of the government and the rebels are dissatisfied because of the prevailing climatic conditions.

Research Design

Data, Dependent Variable, and Method

For empirically testing our argument, we use data on civil war onset from UCDP/PRIO's Armed Conflict Dataset (see Gleditsch et al. 2002). These data define an armed civil conflict

[6] Miguel et al. (2004), Zhang et al. (2007), and Koubi et al. (2012) are notable exceptions.

as a contested incompatibility that concerns government and/or territory where the use of armed force between two parties, of which one is the government of the state, results in at least 25 battle-related deaths. We rely on the onset variable that specifies a nine-year intermittency threshold, i.e., a new conflict onset only occurs when a country under study did not have any civil conflict within the past nine years.

We employ the country-year as the unit of analysis and, ultimately, our data comprise 7,688 country-years for 1950-2004, while 171 (2.2%) of those cases actually saw the outbreak of civil conflict according to our definition. Since the dependent variable follows a dichotomous scale, we use logistic regression models with standard errors clustered on country to correct for the bias due to non-constant variances and for taking into account intra-group correlations. To model temporal dependence, we include the time elapsed since the last conflict as well as the squared and cubic terms (peaceyears, peaceyears^2, and peaceyears^3) in the models (Carter and Signorino 2010). This approach acknowledges that the likelihood of intrastate conflict onset may depend on dispute(s) that occurred in the years before.

Explanatory Variables

According to our theoretical framework, we require measures for (potential) rebels' power level relative to the incumbent(s) and for their degree of dissatisfaction. With regard to the former, we use variables from the Ethnic Power Relations (EPR) data set (see Wimmer, Cerderman, and Min 2009; Cederman, Wimmer, and Min 2010). These data contain information on included and excluded ethnic groups' size within a specific country. Although ethnic groups *per se* might not necessarily form rebel groups consistently representing a particular ethnic faction that, in turn, initiates conflict, previous research demonstrated, on one hand, the importance of ethnicity. For example, conflicts can break out over access to state power for a particular ethnic community (e.g., Brass 1991), secessions from existing states in order to establish a new state ruled in the name of a particular ethnic community (e.g., Hechter 2001) or to join another state controlled by ethnic kin (e.g., Weiner 1971), and

competition between new states over mixed territories inhabited by members of both ethnic core groups (e.g. Brubaker 1996). On the other hand, rebel organizations frequently recruit their fighters precisely from those ethnic groups. Consequently, superior numbers in ethnic groups increase the possibility to recruit fighters, mobilize economic resources to support political mobilization and armed rebellion, and provide an organizational infrastructure to sustain it (DeNardo 1985; see also Gurr 1993; 2000; Gurr and Moore 1997). Against this background, we operationalize power transition's opportunity component by the excluded groups' size relative to the size of the included group(s):

$$Power\ Parity = \frac{Size\ of\ Excluded\ Group(s)}{Size\ of\ Included\ Group(s)}$$

According to the EPR data, included/excluded ethnic groups are defined by ethnicity and their access to power. More specifically, excluded groups (largely) lack access to executive power, i.e., representation in the presidency, the cabinet and senior posts in the administration, including the army (see Wimmer, Cerderman, and Min 2009; Cederman, Wimmer, and Min 2010). Ethnic groups are also excluded if they are discriminated, powerless, or have regional or separatist autonomy. In turn, included ethnic groups have executive power, are not discriminated, and do not have to rely on sub-state regional or separatist autonomy. Ultimately, our operationalization allows us to capture the relative size of domestic excluded groups vis-à-vis those that are included and, thus, we obtain a relative power measure that we employ as a proxy for the opportunity component of our domestic version of the power transition theory.

With regard to the latter, i.e., the degree of dissatisfaction of the domestic actors, our theory suggests that environmental factors could signify the degree of actors' satisfaction, since environmental degradation may directly affect individuals' welfare. We approximate

dissatisfaction with measures of precipitation and temperature in order to estimate the impact of climate change on the probability of conflict onset. While many environmental variables such as water scarcity and soil erosion are directly affected by human behavior, climate variability is a large-scale phenomenon that is beyond human control at the local level and within the short to medium term. Using thus precipitation and temperature avoids the endogeneity problem that plagues much of the literature on the neo-Malthusian hypothesis.

Our climate variables are defined in terms of the deviation of the current level of precipitation and temperature from their past, long run level (defined as a 30 year moving average of past values). This measure takes into account the fact that choices of crops, methods of cultivation, and choices regarding other social and economic activities and structures could be affected by climatic conditions. To the extent that such choices are optimal for a particular climate (precipitation, temperature) it should be deviations from the normal climate (climate variability) that matter for economic activity. High rainfall levels in a region adapted to dry weather conditions could be as detrimental as low rainfall in regions adapted to wet conditions. This adaptation argument suggests that climate change is likely to have effects similar to those of climate variability if it occurs at a pace that is too fast to allow for suitable adjustment in production. We rely on data from Koubi et al. (2012).

We check the robustness of our results using the Standardized Precipitation Index (SPI6). SPI6 is a standardized probability index that measures variation in precipitation and indicates the monthly deviation from normal rainfall during the six preceding months. Negative values indicate a period of drought and positive values indicate wet conditions (McKee, Doesken, and Kleist 1993). This drought measure is a dummy variable that takes the value of 1 if at least three consecutive months have an SPI smaller than -1, which corresponds to weather conditions equivalent to a moderate drought or worse, and 0 otherwise. Again, we rely on the operationalizations in Koubi et al. (2012)

For fully capturing our theoretical model, we create interaction terms by multiplying *Power Parity* with each environmental factor, respectively. Eventually, we include those variables as well in our model estimations.

We also have to control for other variables that might affect the risk of civil conflict in order to avoid omitted biased estimates. We include variables that they have been found to be important for the onset of civil conflict in the existing literature. First, personal wealth or income signifies a key variable in existent studies of civil war onset, since poverty breeds conflict in the sense that domestic violence is frequently observed in poor countries. We use extended data that is based on Gleditsch (2002), while the final item is lagged and logged.

Second, civil conflict may be more likely in oil-producing countries, since "oil revenues raise the value of the prize of controlling state power" and oil-exporting countries tend to have weaker state apparatuses (Fearon and Laitin 2003: 81). We therefore include a binary variable receiving a value of 1 for countries in which oil constitutes more than one-third of export revenues.

Third, we include an indicator for democracy that is based upon the combined Polity score from the *Polity IV* dataset (Marshall and Jaggers 2004). Several studies have shown that inclusive rules that enable strong groups to participate in power alleviate social tensions and thus decrease the likelihood of civil conflict (Schneider and Wiesehomeier 2008). Democracy might be endogenous to conflict and, thus, we lag it by one year (Elbadawi and Sambanis 2002). Furthermore, we follow recent studies on the regime type on civil war onset (Gleditsch et al. 2009; Reynal-Querol 2002; Sambanis 2001; Hegre et al. 2001) that find that partly democratic countries are more prone to intrastate conflict than full democracies and full autocracies. For capturing this curvilinear effect, we also include a squared term of *Democracy* in our models.

Fourth, population is widely seen as an important determinant of civil conflict (e.g., North 1984; Fearon and Laitin 2003; Hegre and Sambanis 2006). For example, Fearon and Laitin

(2003) argue that a large population implies difficulties in controlling local level activity and increases the number of potential rebels that can be recruited by the insurgents. We use data from Gleditsch (2002). We use lagged and logged values.

Fifth, although there is disagreement in the literature on the relationship between the heterogeneity of a country's population and the country's propensity for intrastate conflict (e.g. Fearon and Laitin 2003; Cederman and Girardin 2007), we account for the possibility that ethnolinguistic fractionalization affects the potential for civil conflict. Elbadawi and Sambanis (2002), for instance, find that socially diverse societies may be at somewhat higher risk of civil conflict, whereas Fearon and Laitin (2003) do not find a statistically significant relationship. However, Theisen et al. (2012) find that climatic conditions are more likely to cause conflict in areas dominated by politically marginalized ethnic groups than in areas of ethnic group dominance. We use data from Fearon and Laitin (2003).

We also follow Fearon and Laitin (2003) who argue that mountainous countries are likely to experience a higher risk of civil conflict because rebels find it easier to hide in mountains and forests. We take a variable measuring rough terrain by the estimated percentage of mountainous terrain and using data from Fearon and Laitin (2003).

Finally, we include regional dummy variables, with Europe serving as the baseline category, to control for any regional variation in conflict onset. Table 1 provides the descriptive statistics of our variables.

---Table 1 about here---

Empirical Results

We estimate five models to demonstrate that our findings are robust. The first two models focus on a standard approach for explaining the onset of civil war, while Models 3-5 further include our operationalizations of power transition's opportunity and motives components.

---Table 2 about here---

We postulated that power transition theory can be applied to the domestic level and, thus, operationalized opportunity and motive with *Power Parity* and *a set of environmental factors*, respectively. However, according to our theoretical model, we must consider the simultaneous effect of both items, i.e., the constitutive terms of *Power Parity*, *the environmental factors*, and *Power Parity * environmental factors*. Since we cannot directly interpret the size, signs, and z-statistics of the components of a multiplicative specification (see Braumoeller 2004; Brambor, Clark, and Golder 2006), we calculate the marginal effects of *Power Parity* according to *the climatic variables* and the marginal effects of *the climatic variables* along the values of *Power Parity* to allow for a substantive interpretation (see Braumoeller 2004: 815ff). Figures 1 and 2 depict our findings.

---Figures 1 and 2 about here---

According to Table 2 and the figures, however, we do not obtain support for our hypothesis. More specifically, all items and their respective interactive terms are insignificant, which is summarized more thoroughly in Figures 1-2. As a result, neither do we observe a statistically significant impact of *Power Parity* on the onset of civil conflict, nor can we conclude that any of the environmental factors exerts a substantial influence conditional on the values of *Power Parity*. This finding is independent of the sample used. Hence, our analysis does not support the climate change-conflict pathway and it is also unlikely that environmental factors constitute a good proxy for power transition's motive component.

Finally with regard to our control variables, only *Population* and *Ethnic Fractionalization* depict consistent results across Models 1-5. The results for these two items are essentially in

line with the previous literature, i.e., countries with larger populations and higher ethnic fractionalizations face a higher risk of domestic conflict. *Oil* is constantly positively signed throughout our models, although statistically significant in Models 1-2 only. The same interpretation pertains to *Mountainous Terrain*. Hence, the substance of these variables depends on model specifications. We also find some evidence for the curvilinear relationship between regime type and conflict. While *Democracy* is positively signed, its squared term reveals a significantly negative sign in all models. Note, however, that this should be interpreted with caution, since *Democracy* is largely insignificant in four out of five models.

Robustness

To test the robustness of our findings, we also employed other econometric instruments that are not reported here. First, we re-sampled the observations with replacement using the non-parametric bootstrapped method. Second, in order to control for multicollinearity, we calculated the variables' cross-correlations and variation inflation factors. Third, due to the over-dispersion of zeros, our dependent variable receives a value of 1 only in about 2% of the observations. Regular logit models may then overestimate the probability and frequency of the "non-zero" events, and we thus use a rare-events logits (King and Zeng 2001a; 2001b). Fourth, Hendrix (2010) shows that *GDP per capita* might capture inherently different concepts. We therefore substituted *GDP per capita* for the relative political extraction measure from Arbetman and Kugler (1997) and the Political Risk Services Group's (PRSG) International Country Risk Guide (Howell 2011), respectively. The former measures the ability of a government to obtain resources from a population given their level of economic development. Efficient governments are able to meet or exceed their expected extractive capabilities; inefficient governments fail to reach their expected extraction levels. The latter data comprise one variable that – based upon expert assessments – measures the bureaucratic quality of a country on a 0-4 scale, where higher values stand for more effective bureaucratic capacities. Finally, a possibility for controlling for the persistent simultaneity between our

climatic variables and civil war onset, is the estimator proposed by Maddala (1983), which is designed to test a two-equation system with a dichotomous endogenous variable (see also Keshk 2003) and the two-step approach as employed by Koubi et al. (2012). However, all those robustness tests did neither differ significantly nor indicate that our main results reported here have to be interpreted with caution. The findings are available upon request.

Conclusion

Although the linkages between climate change and civil conflict have received a lot of attention both in qualitative and quantitative case studies, still this relationship remains unclear since the existing literature has not been able to establish the existence of a robust, systematic, causal relationship. In this paper we aim at improving on previous work in two ways: First, following the Power Transition logic we argue that the risk of *civil conflict* should increase when (potential) rebels' power approximates the power of the incumbent(s), and the rebels are dissatisfied with the status quo. Second, we introduce climatic changes therein as potential measures for rebels' motives because climatic changes can directly affect individuals' welfare.

While the empirical results provide some support for the validity of the opportunity component of power transition theory at a domestic level, they do not reveal evidence that climate induced dissatisfaction does affect civil conflict. This result is in line with Kvaløy et al (2012), who find on the basis of world-wide public opinion data that although there is widespread concern about global warming, still this concern is lower in countries that are expected to be more seriously affected, than in countries that are not expected to be seriously affected by climatic changes.

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Table 1. Descriptive Statistics, 1980-2004

	N	*Min*	*Std.Dev.*	*Min*	*Max*
Civil War Onset	7,688	0.022	0.147	0.00	1.00
Domestic Power Parity	5,009	1.138	4.587	0.00	49.00
GDP per capita	7,346	8.243	1.115	5.14	11.34
Precipitation	6,612	-9.805	179.086	-1,247.27	1,523.06
Temperature	6,612	0.106	0.483	-2.26	2.27
SPI 6	7,688	0.079	0.270	0.00	1.00
*Power Parity * Precipitation*	4,486	-10.699	1,248.534	-20,135.47	25,797.65
*Power Parity * Temperature*	4,486	0.091	1.591	-26.73	30.80
*Power Parity * SPI 6*	5,009	0.080	0.828	0.00	32.33
Oil	6,671	0.136	0.343	0.00	1.00
Democracy	6,649	-0.067	7.554	-10.00	10.00
Democracy^2	6,649	57.065	32.157	0.00	100.00
Population	7,529	8.682	1.898	2.81	14.07
Ethnic Fractionalization	6,671	0.387	0.282	0.001	0.93
Mountainous Terrain	6,671	2.122	1.425	0.00	4.56

Note: regional dummies and variables for temporal correction not shown due to space limitations.

Table 2. Power Transition Theory and Civil Conflict, 1980-2004

	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*
Domestic Power Parity			0.000	0.000	0.000
			(0.000)	(0.000)	(0.000)
Precipitation			-0.000		
			(0.000)		
Temperature				-0.002	
				(0.005)	
SPI 6					-0.014
					(0.011)
*Power Parity * Precipitation*			-0.000		
			(0.000)		
*Power Parity * Temperature*				0.000	
				(0.000)	
*Power Parity * SPI 6*					0.001
					(0.005)
GDP per capita	-0.006	-0.007			
	(0.002)***	(0.002)***			
Oil	0.012	0.009	0.010	0.010	0.008
	(0.004)***	(0.004)**	(0.007)	(0.007)	(0.006)
Democracy	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.001)*	(0.000)	(0.000)	(0.000)
Democracy^2	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Population	0.002	0.003	0.005	0.005	0.004
	(0.001)**	(0.001)**	(0.001)***	(0.002)***	(0.001)***
Ethnic Fractionalization	0.013	0.018	0.021	0.022	0.025
	(0.005)***	(0.006)***	(0.008)***	(0.008)***	(0.007)***
Mountainous Terrain	0.002	0.001	0.003	0.003	0.003
	(0.001)***	(0.001)	(0.002)	(0.002)	(0.002)
Middle East		0.009	0.016	0.017	0.012
		(0.007)	(0.012)	(0.012)	(0.011)
North Africa		0.006	0.016	0.017	0.016
		(0.006)	(0.011)	(0.011)	(0.011)
Sub-Saharan Africa		-0.005	0.011	0.012	0.007
		(0.006)	(0.008)	(0.008)	(0.007)
Latin America		0.003	0.006	0.006	0.004
		(0.006)	(0.009)	(0.009)	(0.008)
East Asia		-0.005	0.010	0.010	0.007
		(0.006)	(0.008)	(0.009)	(0.008)
West Asia		0.001	0.016	0.016	0.012
		(0.006)	(0.007)**	(0.008)**	(0.007)*
Peace Years	-0.002	-0.002	-0.002	-0.002	-0.002
	(0.001)**	(0.001)**	(0.001)*	(0.001)*	(0.001)**
Peace Years^2	0.000	0.000	0.000	0.000	0.000
	(0.000)**	(0.000)**	(0.000)*	(0.000)*	(0.000)**
Peace Years^3	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)**	(0.000)**	(0.000)*	(0.000)*	(0.000)**
Constant	-0.037	-0.030	-0.134	-0.134	-0.118
	(0.016)**	(0.022)	(0.022)***	(0.022)***	(0.019)***
N	6,453	6,345	4,337	4,337	4,781
Log Pseudolikelihood	-692.912	-687.762	-577.768	-578.566	-611.211
Wald χ^2	129.92***	157.88***	154.04***	137.45***	160.51***

Note: robust standard errors clustered on country in parentheses; * significant at 10%; ** significant at 5%; significant at 1% (two-tailed).

Figure 1. The Conditional Impact of Power Parity on Civil War Onset

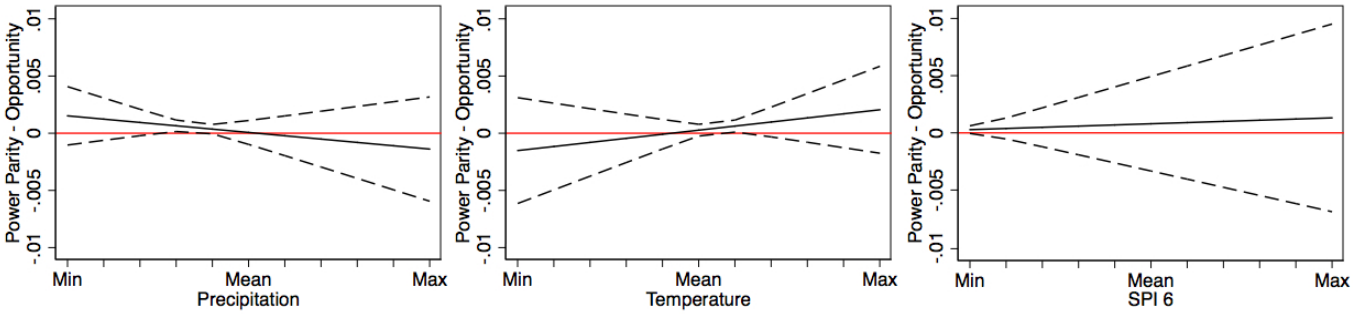

Figure 2. The Conditional Impact of Environmental Factors on Civil War Onset