Publisher: Routledge
Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK

Civil Wars
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/fciv20

Scarcity-Induced Domestic Conflict: Examining the Interactive Effects of Environmental Scarcity and 'Ethnic' Population Pressures

Cigdem V. Sirin [a]
[a] University of Texas, El Paso, USA

Version of record first published: 24 Jun 2011

To cite this article: Cigdem V. Sirin (2011): Scarcity-Induced Domestic Conflict: Examining the Interactive Effects of Environmental Scarcity and 'Ethnic' Population Pressures, Civil Wars, 13:2, 122-140

To link to this article: http://dx.doi.org/10.1080/13698249.2011.576141

Scarcity-Induced Domestic Conflict: Examining the Interactive Effects of Environmental Scarcity and 'Ethnic' Population Pressures

CIGDEM V. SIRIN

This study argues that environmental scarcity is more likely to result in civil conflict in countries that experience 'ethnic' population pressures (i.e. where the size of the largest minority group is close to parity with the majority group). I refer to this argument as the 'parity-threat' approach to the study of scarcity-induced domestic conflict. I empirically test my argument by analysing time-series cross-section data for the period 1979–2000 using four alternative environmental indicators: (1) ecological footprint, (2) biocapacity, (3) scarcity of ecological reserves and (4) water scarcity. The results demonstrate that environmental scarcity increases the probability of civil conflict when conditioned by 'ethnic' population pressures.

INTRODUCTION

Scholars have long explored the potential role that environmental scarcity may play in generating violent conflict. Although recent studies suggest that the linkage between environmental scarcity and civil conflict is mostly indirect and more complex than that previously theorised, the relationship between environmental scarcity and conflict has rarely been subjected to stringent empirical examination, particularly regarding the interaction of environmental scarcity with other conflict-inducing factors. Given the dearth of empirical studies to date, a systematic exploration of the major factors that may magnify or mitigate the impact of environmental scarcity is key to further mapping the causal route to the outbreak of scarcity-induced domestic conflict. In addition, while most studies in this area of research have focused on the demands and actions of minority groups, relatively less attention has been paid to the concomitant role of the majority group's perceptions and behaviour in instigating civil conflict.[1] In certain cases, the insecurity of both majority and minority groups residing in a country may result in an internal dispute, particularly if one group is large enough to create a perceived threat among the members of another group.

Building on and extending previous scholarship, this study constitutes one of the first large-*N* works that explores systematically the interactive effects of environmental scarcity and minority–majority group dynamics on the likelihood of civil conflict. I argue that environmental scarcity may lead to inter-group conflict, particularly when combined with a large minority population that is close to parity

Civil Wars, Vol.13, No.2 (June 2011), pp.122–140
ISSN 1369-8249 print/ISSN 1743-968X online
DOI: 10.1080/13698249.2011.576141

with the majority, generating what I term 'ethnic' population pressures.[2] More specifically, the incentives of a country's ethnic groups for sharing resources with each other may significantly diminish under conditions of environmental scarcity, particularly if such groups perceive access to resources as a zero-sum game. On the one hand, the majority group's appropriative demands may escalate to the point of aspiring to confiscate the minority groups' resource share. On the other hand, a minority group may decide to challenge the dominant status of the majority group in accessing scarce resources if its population size is large enough (i.e. close to parity with the majority group). I refer to this argument as the 'parity-threat' approach to the study of scarcity-induced domestic conflict.

I test this argument by analysing time-series cross-section data for the period 1979–2000 using four alternative environmental indicators: (1) ecological footprint, (2) biocapacity, (3) scarcity of ecological reserves and (4) water scarcity. Overall, the empirical results are in line with my theoretical expectations. As such, my findings provide a new contribution to the literature by demonstrating that environmental scarcity can in fact be a predictor of civil conflict when conditioned by 'ethnic' population pressures.

EXPLORING THE LINK BETWEEN SCARCITY AND CONFLICT

Research on scarcity-induced conflict is a developing field with growing scholarly interest, particularly since the end of the Cold War. An increasing number of studies have begun to explore the effects of environmental scarcity on intrastate as well as international conflict.[3] However, some of the key findings in the literature have thus far been inconclusive, leaving the door open for continued critical questioning of the causal relationship between environmental scarcity and conflict. Accordingly, scholars have called for stronger theoretical and empirical work to help advance the accumulation and integration of knowledge in this area of research.[4]

As Diehl puts it, the legitimacy of environmental security studies rests on whether robust empirical associations can be discerned between environmental scarcity and conflict.[5] However, the number of works that have subjected the relationship between environmental scarcity and conflict to large-scale empirical examination remains sparse. Indeed, the method of analysis in this area of research has consisted mainly of case studies and small-*N* qualitative research.[6] Among the few quantitative studies to date, empirical findings concerning the impact of environmental scarcity on the likelihood of conflict have been inconclusive due to mixed and insignificant findings.[7]

The presence of mixed and null empirical findings may be because the causal relationship between environmental scarcity and conflict is indirect and more complex than previously proposed.[8] For instance, based on his case study analyses of violent conflict, Gizewski states that, 'environmental scarcity rarely if ever, acts as the sole force leading to such strife'.[9] He further posits that scarcities of renewable resources interact with political, economic and social factors to generate a series of conflict-producing conditions. Following this logic, the role that resource shortages

play in producing violent conflict may be conditional upon the presence of other factors.

In short, the relationship between environmental scarcity and conflict seems theoretically and systematically underspecified. To more accurately outline the causal pathways to the outbreak of civil conflict, identifying the chief factors that may interact with environmental scarcity in a lead-up to conflict is necessary. Previously, de Soysa was among the first to interact resource scarcity with several demographic variables to test for any conditional effects on civil conflict.[10] The results of his study show that rural population density, conditioned by the scarcity of renewable resources, can have a positive and significant effect on conflict.[11] What remains, however, is to look beyond general population dynamics and focus more on the ethnic demographic structure of countries to investigate whether and to what extent environmental scarcity instigates civil conflict given particular ethnic compositions. As such, further exploration of the potential interactions between environmental scarcity and 'ethnic' population pressures in the study of domestic armed conflict is warranted.

'Ethnic' Population Pressures

A large amount of the literature that examines the link between population-driven environmental scarcities and conflict has produced inconsistent findings.[12] I argue that in identifying population pressures that may lead to scarcity-induced civil conflict, it is not sufficient to consider only general population measures. Rather, it is necessary to place a greater emphasis on population dynamics directly related to a country's ethnic composition. Indeed, environmental scarcity can affect different groups in a society at different intensity levels given that the distribution of resources may vary among such groups.[13]

As research on the political economy of natural disasters suggests, environmental scarcity may function as a catalyst for deepened social segmentation and intensified inter-group competition in ethnically diverse countries.[14] To illustrate, Martin's case study of an Ethiopian refugee camp demonstrates that scarcity-induced insecurities contribute to the amplification of perceived ethnic differences and inequalities, thereby increasing the likelihood of civil conflict.[15] Similarly, Ek and Karadawi observe that following the deepening of an economic recession, host communities increasingly perceived refugees in Sudan as a burden with the belief that relief agencies were prioritising refugees.[16] Likewise, Gurr asserts that discontent aroused by relative deprivation is a major trigger for collective violence.[17]

Several scholars suggest that accounting for the varying sizes of ethnic groups within a country is necessary for examining the outbreak of domestic conflict.[18] For example, Toft asserts that shifts in the distribution of ethnic group populations within a multinational state make civil war more likely.[19] Specifically, Toft finds that the probability of civil war increases as ethnic groups become similar in size.[20] In fact, her analyses show that the measure of a country's minority–majority group

ratio is one of the strongest and most consistent predictors of civil war.[21] Similarly, Roeder finds that the probability of an ethnopolitical conflict increases as an ethnic group's proportion of a country's total population rises.[22] In addition, Ellingsen finds that domestic conflict is more likely when the largest group in a country constitutes less than 80 per cent of the population.[23] On a parallel basis, Rabushka and Shepsle argue that the number of ethnic groups and their relative community size (in the form of balanced competition, a dominant majority, a dominant minority and/or fragmentation) may affect a country's political stability and prospects for peace.[24]

THEORETICAL FRAMEWORK

In view of previous arguments and findings, a more thorough investigation of the potential interactions between ethnicity-based population pressures and environmental scarcity is necessary to help increase our understanding of the indirect and complex link between environmental scarcity and civil conflict. Also important, the role of a majority group's perceptions and behaviour in instigating conflict warrants further investigation as most studies on domestic conflict focus primarily on the demands and actions of minority groups.[25] To address these issues, I develop what I term the 'parity-threat' approach to the study of scarcity-induced domestic conflict. The main argument of this approach is that environmental scarcity may lead to the outbreak of civil conflict when the size of the largest minority group is close to parity with the majority group. The theoretical basis of my 'parity-threat' approach is an integration of (a) social identity theory[26] and (b) the ethnic security dilemma theory[27] amid the simultaneous presence of environmental scarcity and 'ethnic' population pressures.

Social identity theory asserts that individuals aspire towards self-categorisation and higher self-esteem via membership in a collective body.[28] Once individuals become members of a group, they favour that group over other groups. This same logic applies directly to ethnic group membership. Therein, economic decline, inflation, changes in the professional-occupational structure, immigration and differences in population size among ethnic groups may contribute to changes in the strength of allegiances to one's own ethnic group, as well as one's attitude and behaviour towards other ethnic groups. In such circumstances, ethnic mobilisation may take place with the goal of acquiring and/or maintaining competitive advantages and resources while attempting to disparage and delegitimise the out-groups.[29]

As for the ethnic security dilemma theory, Saideman *et al.* propose that groups are more likely to act up when they are uncertain about their socio-economic and political position, as well as their prospects for the future.[30] A need for security motivates groups in divided societies to seek control over the state.[31] However, one group's attempts to control the state tend to reinforce the fears of others, thus generating the ethnic security dilemma.[32] Likewise, resource scarcity attributable to population pressures may lead to appropriative conflict as a struggle for subsistence and power.[33]

According to Toft, 'an ethnic group's relative population within a multinational state has implications for the control of that state in the same way that a state's industrial power has implications for who controls the international system'.[34] In the context of ethnically divided societies, a majority group is generally likely to have more control in government and have a more favourable share of a country's resources compared to minorities. Considering the potential interactive effects of environmental scarcity and the size of minority groups in a country, the ethnic security dilemma for the majority becomes twofold: political and economic-ecological. For the political dimension, the size of minority groups, particularly that of the largest minority group, is likely to pose a threat to the political power of a majority group, which may in turn affect their control over the distribution of scarce resources. From an economic-ecological perspective, a large minority population is likely to pose a heightened threat to the majority group in the presence of environmental scarcity as they compete for resource access and try to secure an adequate share of such resources. As Homer-Dixon asserts, a reduction in the quantity or quality of a resource shrinks the resource pie while larger populations divide the pie into even smaller slices for each individual.[35]

To illustrate how environmental scarcity and 'ethnic' population pressures may interact in a lead-up to civil conflict, one can look to the conflict between the Turkish and Kurdish ethnic groups in Turkey. As the largest minority group in the country, Kurds constitute approximately 20 per cent of the total population.[36] They largely reside in the eastern and southeastern areas of Turkey – a region that suffers from water scarcity, extreme soil erosion, drought and deforestation.[37] As a developing country with a large population, Turkey has also been experiencing problems of environmental sustainability in the presence of an inadequate ecological infrastructure, heavy industrialisation and rapid economic growth for the past few decades.[38] Within this context, several factors – such as discriminatory state policies and assimilation efforts – played a major role in the initiation of a violent Kurdish revolt in 1984, which was led by the Partiya Karkaren Kurdistan (PKK) guerrillas.[39] As part of their campaign, the PKK pointed to issues of resource deprivation as a means to ignite feelings of resentment, anger and grievances among the Kurdish population against the Turkish state.[40] In fact, existing inequalities regarding access to resources helped reinforce Kurdish nationalism, which the PKK then used in an effort to further mobilise the Kurdish masses to join their cause. However, the PKK also organised terrorist attacks on civilians, which alienated part of its support base and prompted a massive retaliation on the Turkish side. Thereafter, the Turkish state resorted to an overwhelming use of force in order to suppress the PKK and thus preserve the status quo in the political and economic realms, as well as with regards to the distribution of resources.[41] As such, one can argue that environmental scarcity coupled with 'ethnic' population pressures played a notable role in instigating civil conflict between the Turks and Kurds.

With these considerations in mind, I propose that the incentives for ethnic groups to share a country's resources with each other may rapidly diminish in the face of environmental scarcity. Under such circumstances, ethnic groups may

develop feelings of grievance and hostility towards one another, particularly since access to resources is often perceived as a zero-sum game in ethnically divided societies. Ultimately, the majority's appropriative demands may escalate to the point of aspiring to confiscate the minority groups' resource share, making civil conflict more likely. Meanwhile, a minority group may decide to challenge the dominant status of the majority group in accessing scarce resources if its population size is large enough (i.e. close to parity with the majority group). Accordingly, I hypothesise that *environmental scarcity is more likely to result in civil conflict when the size of the largest minority group is close to parity with that of the majority*.

DATA AND RESEARCH DESIGN

To test my core hypothesis, I combine time-series cross-section data on (1) environmental scarcity and (2) population estimates of ethnic groups in a country for the period from 1979 to 2000. Specifically, I merge the replication datasets from the studies by Theisen, Binningsbø *et al.* and Fearon and Laitin.[42]

One should note that the range of time-series cross-section data for environmental factors is limited. Although there have been studies that resort to proxy measures such as energy consumption for measuring environmental scarcity in order to obtain more observations across a wider time spectrum,[43] such measures are not direct operationalisations of environmental scarcity and, therefore, have not fully captured the link between environmental scarcity and civil conflict. In an effort to more directly capture environmental scarcity as an analytical concept, I have chosen to focus my analyses within the period 1979–2000 for which environmental data is more readily available with the largest range of countries possible and also with the least amount of missing observations. By using a relatively broader time period compared to most previous large-*N* studies on scarcity-induced conflict and by including post-Cold War years until the turn of the century, the risk of potential period effects is minimised.

Dependent Variable

The onset of civil conflict. Most scholars of scarcity-induced domestic conflict suggest that lower-intensity armed conflicts are the most likely forms of civil conflict to emerge from environmental degradation.[44] I adopt the measure for the onset of civil conflict from Theisen's dataset that contains data on civil armed conflicts with a threshold of 25 battle-related deaths per year as employed in the Uppsala/PRIO database.[45] Theisen gives a code of '1' if a new conflict breaks out in a given year and '0' for the ongoing years of that conflict.[46] His dataset also includes a dummy variable for any other conflicts that are ongoing in the country.[47] This coding approach allows one to include the onset of parallel conflicts within one country even when another civil conflict is in progress (as suggested by a number of scholars such as Fearon and Laitin, and Urdal).[48]

Independent Variables

Size of the largest minority group. I obtain the data on the size of the largest minority group in a given country from Fearon and Laitin's replication dataset, which includes a measure for the population share of the second largest group in a country as a percentage of the total population.[49] The data for this variable were compiled from various sources including the *CIA Factbook*, *Encyclopaedia Britannica* and the *Library of Congress Country Studies*.[50]

Measures of environmental scarcity. The proper operationalisation of the construct 'environmental scarcity' has been an issue of intense scholarly debate. In an earlier study on scarcity-induced conflict, Hauge and Ellingsen employed measures of water scarcity, deforestation and soil degradation to analyse the impact of environmental scarcity on civil wars for the period 1980–92 and on armed conflicts for the period 1989–92.[51] Building on Hauge and Ellingsen's study, Stalley created an *additive index* of environmental scarcity by combining these individual measures along with measures for fish catch and population density.[52] However, other scholars have found some of these variables highly problematic for measuring environmental scarcity. For instance, de Soysa argues that Hauge and Ellingsen's deforestation and soil degradation measures do not really capture environmental pressures and scarcity.[53] Specifically, de Soysa suggests that measuring deforestation without accounting for available forest stock may simply signify that a country is in the process of exploiting an already abundant resource.[54] He further argues that a poor country with bad governance, ill-defined property rights and a deficient agricultural infrastructure may experience conflict along with deforestation and/or soil degradation simultaneously without one necessarily causing the other.[55] Regarding the quality of environmental data previously used in this area of research, time series data on deforestation were in fact discontinued for being unreliable in assessing forest coverage whereas soil degradation has been criticised for overestimating the extent of soil degradation in Africa, as it concerns only the degradation of farmed land.[56]

More recently, Theisen improved and extended Hauge and Ellingsen's dataset to cover the period 1979–2001.[57] In addition, Binningsbø *et al.* recently released a dataset that includes highly innovative, broadly used and widely cited indicators of environmental sustainability – 'ecological footprint', 'biocapacity' and 'ecological reserve' – which they employed to study the link between environmental pressures and civil conflict.[58]

Given these latest developments in measuring environmental scarcity and the availability of the recently extended datasets, I employ four alternative environmental indicators for my study: (1) ecological footprint, (2) biocapacity, (3) scarcity of ecological reserves and (4) water scarcity. All these variables are measured on a per capita basis, log transformed to correct for skewness and centred.

Ecological footprint. This variable represents the demand on nature. Specifically, it measures how much biologically productive land and water area is required to produce

the resources consumed and to absorb the waste generated.[59] The ecological footprint consists of six main bioproductive areas (cropland, grazing land, forest area, fishing ground, built-up land and 'energy land'), which are transformed into a standardised unit – a 'global hectare' – to enable comparisons across time and space.[60]

Biocapacity. This variable represents the ecological supply. Specifically, it measures the 'maximum theoretical rate of resource supply that can be sustained on its (the nation's) territory under prevailing technology and management schemes'.[61] In order to convert actual hectares into comparable 'global hectares', the nation's bioproductive areas are multiplied by an equivalence factor for a given year and a yield factor for a given country and year.[62]

Scarcity of ecological reserves. This variable represents the difference between the ecological supply (i.e. biocapacity) and the demand of nature (i.e. ecological footprint).[63] As such, it is arguably the most salient proxy measure of environmental pressures.[64] In its original form, positive values of this measure indicate an ecological surplus, whereas negative values indicate a deficit. For the purposes of this study, in order to ease the interpretation of this measure as an indicator of environmental scarcity, I reversed the measure so that higher values correspond to a larger ecological deficit.

Water scarcity. I obtain the data on water scarcity from Theisen's replication dataset.[65] Theisen employs the United Nations Food and Agriculture Organization (FAO) estimates of water availability and reverses the measure to ease interpretation.[66] The measure is time-variant on a quinquennial basis.

Interactive variables. Since this study examines the conditional effects of environmental scarcity and 'ethnic' population pressures on civil conflict, I create four separate interaction terms by multiplying the size of the largest minority group with each of the four alternative environmental indicators (ecological footprint, biocapacity, ecological reserves and water scarcity).

Control Variables

In addition to my main independent variables, I control for the following factors that have been commonly employed in contemporary large-*N* studies of civil conflict: GDP per capita, population size, mountainous terrain, noncontiguous state, oil exporter, ethnic fractionalisation, regime type, ongoing conflict and peace years.

GDP per capita. As Hegre and Sambanis assert, income is perhaps the most important variable in models of civil conflict.[67] Almost every quantitative study of civil conflict includes a measure of income and scholars consistently find a negative relationship between income and the likelihood of civil conflict.[68] To control for this vital factor, I employ Gleditsch's GDP per capita data.[69]

Population size. Another important factor that has been included in most recent large-*N* studies on civil conflict is the size of a country's population. Numerous

studies find that civil conflicts are more likely to occur in populous countries.[70] Regarding scarcity-induced domestic conflict, several scholars argue that a large population places a higher demand on a country's resources, creating and/or exacerbating environmental scarcity by diminishing the ratio of resource distribution.[71] I obtain the data for population size from Theisen's replication dataset.[72]

Mountainous terrain and noncontiguous state. Fearon and Laitin suggest that mountainous and noncontiguous terrains increase the likelihood of rural guerrilla insurgency as they provide rebels with natural sanctuaries – an argument supported by a number of other studies.[73] Following their model specification, I include the variable 'mountainous terrain', which measures the percentage of mountainous terrain in a given country. I also include the variable 'noncontiguous state', which is a dummy variable that takes a value of '1' if a country has a territory with at least 10,000 inhabitants separated by at least 100 km of sea or land from the territory that contains the capital city. Both variables are adopted from Fearon and Laitin's replication dataset.[74]

Oil exporter. A number of scholars point out that oil-producing countries tend to have weak institutions, especially since the rulers of such countries often lack incentives to have well-structured bureaucratic systems to raise revenues given that oil exports already bring high income.[75] Oil revenues also raise the value of controlling state power. As such, scholars find that oil-exporting countries are more likely to experience civil conflict.[76] Furthermore, Theisen suggests that the inclusion of this variable may control for certain potential spurious effects between resource dependence and conflict.[77] Accordingly, I adopt this measure from Fearon and Laitin's replication dataset, which provides a dummy variable indicating whether a country's fuel exports exceed one-third of export revenues in a given year based on data from the World Bank.[78]

Ethnic fractionalisation. Ethnic fractionalisation is one of the most commonly controlled demographic attributes in the study of civil conflict.[79] I adopt the measure for this variable from Fearon and Laitin's dataset, which operationalises ethnic fractionalisation as the probability that two randomly drawn individuals in a country are from different ethnolinguistic groups.[80]

Regime type. A majority of studies on civil conflict control for the regime type of a country. To measure this variable, I use Polity IV's 21-point autocracy-democracy scale that ranges from −10 (most autocratic) to 10 (most democratic).[81]

Ongoing conflict. An already ongoing conflict in a country may impede the outbreak of another conflict for several reasons. As Urdal puts it, in a country that experiences an ongoing conflict, the government is more likely to increase surveillance of potential rebel elements and suppress subsequent rebel activity given an already mobilised military.[82] Furthermore, the negative effects of an ongoing conflict may

act as a deterrent to the initiation of another conflict and a country may actually have 'space' for only one conflict at a time.[83]

Peace years. Because I analyse time-series cross-section data with a binary dependent variable using ordinary probit, I control for peace years to avert the problem of temporal dependence as suggested by Beck *et al.*[84] Controlling for peace years is important not only for analytical purposes, but also for theoretical reasons. As previous conflict studies have consistently demonstrated, the longer a country is at peace, the more time that country has to build institutions for better conflict management as well as to distance itself from the recollections of any past conflict.[85]

Method

To test my conditional hypothesis, I employ multiplicative interaction models. Due to the dichotomous nature of the dependent variable, I use probit as my method of analysis. My unit of analysis is the country/year. Given my unidirectional hypothesis, I employ one-tailed tests. To minimise the potential for reverse causality and to account for real time lags, all four environmental indicators as well as the measures for regime type, population size and GDP per capita are lagged 1 year. I control for potential within-state heteroskedasticity by estimating robust standard errors clustered on country.

Following Brambor *et al.*'s suggestion, I include the constitutive terms of my two-way interactive variables in my models to avoid biased estimates and omitted variable bias.[86] That said, as Braumoeller points out, 'When a statistical equation incorporates a multiplicative term in an attempt to model interaction effects, the statistical significance of the lower-order coefficients is largely useless for the typical purposes of hypothesis testing'.[87] Accordingly, in order to avoid any erroneous conclusions, I only evaluate the coefficients concerning my two-way interaction variables and do not interpret the lower-order coefficients regarding the constitutive terms of the two-way interactions.

EMPIRICAL RESULTS

Table 1 reports coefficients for the probit analyses with robust-cluster standard errors in parentheses for four different models testing the two-way interaction between the size of the largest minority group and (a) ecological footprint (model 1), (b) biocapacity (model 2), (c) scarcity of ecological reserves (model 3) and (d) water scarcity (model 4). To calculate the correct marginal effects and standard errors for the interaction terms, the models were also estimated using the Stata command 'inteff' as developed by Norton *et al.*[88]

Overall, the results corroborate my expectations that environmental scarcity is more likely to result in civil conflict under 'ethnic' population pressures. Specifically, except for biocapacity, all other environmental indicators – ecological footprint, scarcity of ecological reserves and water scarcity – each demonstrates

TABLE 1
INTERACTIVE EFFECTS OF ENVIRONMENTAL SCARCITY AND 'ETHNIC' POPULATION PRESSURES ON THE PROBABILITY OF CIVIL CONFLICT ONSET

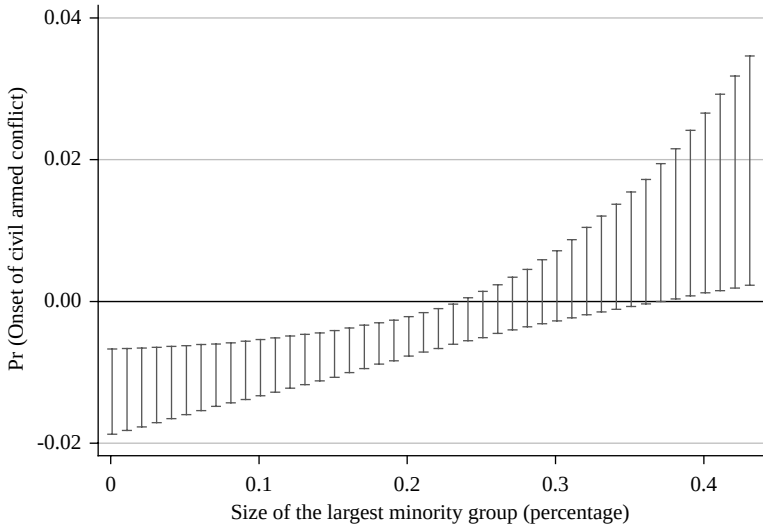
Variables	Model 1	Model 2	Model 3	Model 4
GDP per capita	−0.115*	−0.231***	−0.268***	−0.236***
	(0.088)	(0.073)	(0.077)	(0.067)
Population size	0.105**	0.099**	0.129***	0.123***
	(0.044)	(0.049)	(0.050)	(0.045)
Ethnic fractionalisation	0.520**	0.623**	0.444*	0.470**
	(0.268)	(0.303)	(0.281)	(0.281)
Oil exporter	0.393***	0.427***	0.406***	0.395***
	(0.149)	(0.156)	(0.158)	(0.148)
Noncontiguous state	0.443***	0.416***	0.374***	0.357***
	(0.156)	(0.146)	(0.143)	(0.137)
Mountainous terrain	0.051	0.054*	0.055*	0.076**
	(0.042)	(0.039)	(0.039)	(0.038)
Regime type	0.003	0.006	0.005	0.005
	(0.008)	(0.008)	(0.009)	(0.009)
Ongoing conflict	−0.246*	−0.255*	−0.255*	−0.280**
	(0.182)	(0.183)	(0.184)	(0.169)
Peace years	−0.006*	−0.008**	−0.009***	−0.011***
	(0.004)	(0.004)	(0.004)	(0.003)
Size of the largest minority group	−0.004	−0.172	−0.253	−0.198
	(0.622)	(0.660)	(0.649)	(0.610)
Ecological footprint	−0.639***			
	(0.202)			
Ecological footprint × size of the largest minority group	2.269***			
	(0.913)			
Biocapacity		−0.147		
		(0.136)		
Biocapacity × size of the largest minority group		0.025		
		(0.563)		
Scarcity of ecological reserves			−0.354	
			(0.372)	
Scarcity of ecological reserves × size of the largest minority group			2.884**	
			(1.625)	
Water scarcity				−0.094*
				(0.063)
Water scarcity × size of the largest minority group				0.580**
				(0.266)
Constant	−2.132***	−2.163***	−2.107***	−2.124***
	(0.133)	(0.142)	(0.133)	(0.126)
Log likelihood	−422.179	−424.014	−426.229	−456.652
Observations	2,821	2,821	2,821	3,016

Note: ***$p \leq 0.01$, **$p \leq 0.05$, *$p \leq 0.10$. Robust standard errors (clustered on country) in parentheses.

a significant positive effect ($p \leq 0.05$) on the likelihood of civil conflict onset when interacted with the size of the largest minority group.

Graphic representations of the interaction between the size of the largest minority group and the four alternative environmental indicators help illustrate and interpret the multiplicative effects of these factors on the likelihood of civil conflict onset.

FIGURE 1
CHANGE IN THE PREDICTED PROBABILITY OF CIVIL CONFLICT ONSET ACROSS POPULATION LEVELS OF THE LARGEST MINORITY GROUP WITH A ONE STANDARD DEVIATION INCREASE IN 'ECOLOGICAL FOOTPRINT'

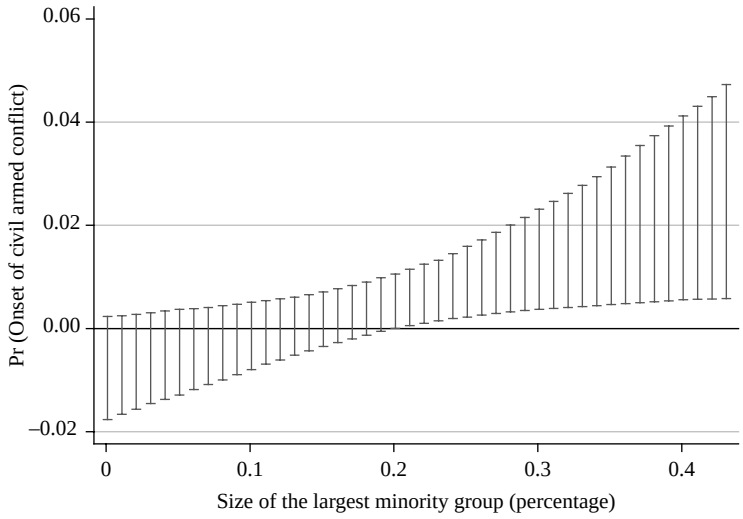


To generate the interaction graphs, I employ the 'Clarify' program in Stata.[89] Clarify estimates 1,000 parameters from my analytical model for different interaction scenarios by manipulating the main variables of interest (while the control variables are held at either their mean or another plausible or intuitive value) and calculates the change in the predicted probability of civil conflict onset using 95 per cent confidence intervals.

Figure 1 plots the changes in the predicted probability of civil conflict onset across population levels of the largest minority group given a one standard deviation increase in the ecological footprint. The graph shows that the ecological footprint has a reductive effect on the probability of civil conflict onset when the population level of the minority group is low. However, this reductive effect declines as the size of the largest minority group increases. Once the size of the largest minority group is about 23 per cent of the total population, the ecological footprint no longer has a significant reductive impact on the likelihood of civil conflict onset. Thereafter, in line with my theoretical expectations, when the size of the largest minority group reaches about 37 per cent of the total population (approximating parity with the size of the majority), a one standard deviation increase in the ecological footprint significantly escalates the probability of civil conflict onset.

To further interpret the interaction between the ecological footprint and the size of the largest minority group, one may consider the issues of wealth and economic growth along with environmental sustainability. In their study that focuses on the main effects of ecological footprint on civil conflict, Binningsbø *et al.* suggest that

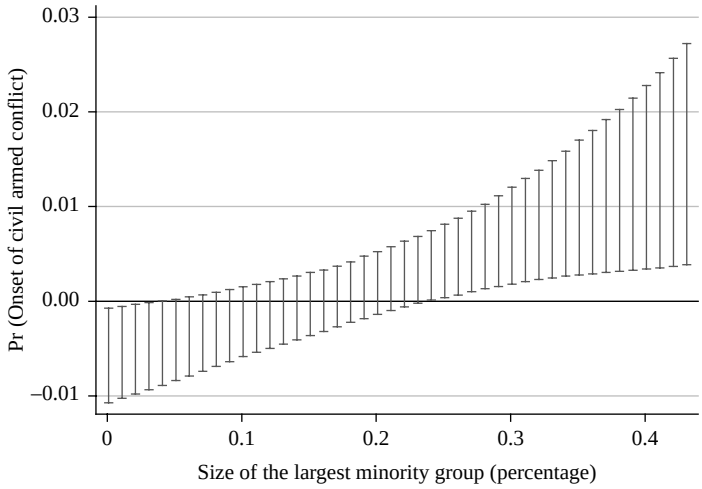
FIGURE 2
CHANGE IN THE PREDICTED PROBABILITY OF CIVIL CONFLICT ONSET ACROSS POPULATION LEVELS OF THE LARGEST MINORITY GROUP WITH A ONE STANDARD DEVIATION INCREASE IN THE SCARCITY OF ECOLOGICAL RESERVES



increasing consumption of the earth's resources per capita may reflect increasing rates of growth and development.[90] The more developed and wealthy a country becomes, the more there is to lose from violent conflict and thus the harder people may strive to avoid such turmoil.[91] As such, higher levels of ecological footprint may produce peace rather than conflict as Binningsbø *et al.* find.[92] However, in examining the conditional effects of ecological footprint, this study shows that the ecological footprint is negatively associated with the risk of civil conflict *only* in the absence of 'ethnic' population pressures. Otherwise, as 'ethnic' population pressures come into play, the effect of ecological footprint changes both in terms of its significance and direction. Specifically, as the size of the largest minority group increases, the conflict-reducing effect of ecological footprint becomes increasingly subdued and negated. Furthermore, once the largest minority group is close to parity with the majority, the effect of ecological footprint on the probability of civil conflict onset is completely reversed, transforming ecological footprint into a conflict-generating (rather than conflict-reducing) factor.

Figure 2 shows the changes in the predicted probability of civil conflict onset across population levels of the largest minority group given a one standard deviation increase in the scarcity of ecological reserves. As the graph shows, the probability of civil conflict onset escalates across higher population levels of the largest minority group as the scarcity of ecological reserves increases one standard deviation from the mean. More specifically, Figure 2 shows that the interactive effect attains

FIGURE 3
CHANGE IN THE PREDICTED PROBABILITY OF CIVIL CONFLICT ONSET ACROSS POPULATION LEVELS OF THE LARGEST MINORITY GROUP WITH A ONE STANDARD DEVIATION INCREASE IN WATER SCARCITY



statistical significance at the 0.05 level in cases where the size of the largest minority group stands at approximately 20 per cent of the total population and above.

Figure 3 illustrates the changes in the predicted probability of civil conflict onset across population levels of the largest minority group given a one standard deviation increase in water scarcity. Similar to the scarcity of ecological reserves, the graph shows that a one standard deviation increase in water scarcity leads to a higher likelihood of civil conflict onset across higher population levels of the largest minority group. The interactive effect becomes statistically significant at the 0.05 level in cases where the size of the largest minority group is around 25 per cent of the total population and above.

As for the control variables, the results are consistent across all four models. In line with earlier findings, GDP per capita, ongoing conflict and peace years all have a significantly negative effect on the onset of civil conflict, whereas population size, ethnic fractionalisation, 'oil exporter', noncontiguous state and mountainous terrain all have a significantly positive effect on the likelihood of civil conflict. Last, also in line with the most previous studies, the regime type variable does not have a statistically significant effect on civil conflict onset in any of the models.[93]

As a final note, I conducted several sensitivity analyses for robustness checks using alternative model specifications, variable operationalisations and analytical methods. These additional analyses generated findings that closely parallel my original results. I also ran several post-estimation diagnostics including a test for multicollinearity. Specifically, to detect for any multicollinearity issues in the data, I assessed each of the models with variance inflation factors (VIF). The mean VIF

values across different models are less than 2.5 and thus well below the VIF value of 10 that scholars consider to be the excess point.[94] Last, I also analysed the data by including cubic splines in the models as a means for additional temporal control as suggested by Beck *et al.*, which did not lead to any substantive changes in the results.[95] Overall, these additional analyses corroborate the general robustness of my findings.[96]

CONCLUSION

In this study, I have argued that environmental scarcity may lead to civil conflict, particularly when combined with 'ethnic' population pressures. More specifically, I posited that the incentives of a country's ethnic groups for sharing resources with each other may significantly diminish under conditions of environmental scarcity, particularly if such groups perceive access to resources as a zero-sum game. On the one hand, the majority group's appropriative demands may escalate to the point of aspiring to confiscate the minority groups' resource share. On the other hand, a minority group may decide to challenge the dominant status of the majority group in accessing scarce resources if its population size is large enough. Accordingly, I argued that environmental scarcity is more likely to result in civil conflict when the size of the largest minority group is close to parity with the majority group. I referred to this argument as the 'parity-threat' approach to the study of scarcity-induced domestic conflict.

I tested this argument by analysing time-series cross-section data for the period 1979–2000. The results of my analyses generally support my hypothesis concerning the interactive effects of environmental scarcity and 'ethnic' population pressures. Specifically, I find that the probability of civil armed conflict escalates across higher population levels of the largest minority group with increased levels of ecological footprint, scarcity of ecological reserves and water scarcity. As such, this study provides a new contribution to the literature by demonstrating that environmental scarcity can in fact be a predictor of civil conflict when conditioned by 'ethnic' population pressures.

In all, this study provides new insights regarding the dynamics within which environmental scarcity may instigate civil conflict. While this study used a relatively broad time period compared to most previous large-*N* works on scarcity-induced conflict, it is imperative (as new data becomes available) to further extend the time coverage as a means to increase the validity and reliability of the empirical findings produced through this line of research. In addition, while this study measured 'ethnic' population pressures as the size of the largest minority group in a country, another possible avenue of research would be to explore how ethnic population shifts (such as a growing minority population) interact with environmental scarcity in a lead-up to civil conflict. Last, one may examine the effects of environmental scarcity on the likelihood of civil conflict under certain institutional arrangements. For instance, scholars widely refer to electoral systems as primary political tools for managing inter-group relations – particularly in heterogeneous societies where scarcity is likely to intensify inter-group competition. As such, future work may take into consideration the type of electoral system in a country when theorising and

testing the conditional effects of environmental scarcity to further explore the potential dynamics of scarcity-induced domestic conflict, especially in newly democratising states. In sum, the conditional effects of environmental scarcity on intrastate conflict merit continued theoretical and empirical explorations, particularly vis-à-vis different social-economic and political contexts.

ACKNOWLEDGEMENT

The author would like to thank José D. Villalobos, Laron Williams and the anonymous reviewers for their instructive comments and suggestions.

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