A Maximum-Likelihood Search for Escalatory Ethnic Dominance*

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ABSTRACT

Efforts to empirically estimate a relationship between ethnic homogeneity and national stability raise debate in the areas of theory, data, and empirical method; this article focuses on empirical method. The author introduces maximum-likelihood search as a means to objectively identify the group-size thresholds at which ethnic groups might assert dominance and thereby destabilize a nation. The results provide new evidence to support the proposition that instability increases when a social majority becomes large enough, but not too large. The article emphasizes the uniqueness of empirical estimates.

JEL Classifications: C23; C25; Z10

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ABSTRACT

Efforts to empirically estimate a relationship between ethnic homogeneity and national stability raise debate in the areas of theory, data, and empirical method; this article focuses on empirical method. The author introduces maximum-likelihood search as a means to objectively identify the group-size thresholds at which ethnic groups might assert dominance and thereby destabilize a nation. The results provide new evidence to support the proposition that instability increases when a social majority becomes large enough, but not too large. The article emphasizes the uniqueness of empirical estimates.

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Keywords: instability analysis, conflict escalation, ethnic dominance, latent regime change.

1 Premise

Agent-based simulation offers a potential means to systematically combine voluminous empirical results into a single analytical framework to explore possible social responses to hypothetical geopolitical, environmental, or demographic changes. Simulations depend not only on raw data, but also on the theories and empirical findings of subject-matter experts. First, theory is required to simulate the preferences, decisions, and behaviors of social agents, such as individuals, organizations, social groups, or policy makers. Second, empirical findings can provide simulation parameters to quantify initial conditions, probability distributions, and tipping points.

For example, consider a simulation of social dynamics for a population with multiple ethnic groups. Experts suggest that the rise of a dominant social group can destabilize a nation or region and increase the likelihood of conflict. To simulate such dynamics, a simulation must capture the nature of dominance, as described by theory, within finite rules for individual and social choice. The simulation must also address questions of an empirical nature, such as: How powerful must a group be to assert dominance? How powerful must an oppressed group be to resist dominance? What are the measurable factors that define "power"?

One of the factors contributing to a group's "power" is its size. Therefore, researchers have looked at ethnic homogeneity as a possible factor contributing to conflict. This article re-examines efforts to estimate a relationship between stability and ethnic homogeneity in terms of group size. I specifically focus on studies that quantify those group-size proportions under which dominance might be asserted.

This article is arranged as follows. Section 2 reviews previous efforts to estimate *homogeneity regimes* in relation to conflict. Section 3 lists some testable hypotheses. Section 4 describes the research design and methodology used here. Section 5 provides the empirical findings. Section 6 explores questions of uniqueness in relation to the thresholds demarking ethnicity regimes. Section 7 remarks on the findings of this study and the implications for simulation.

2 Literature Review

Ethnicity and religious persuasion can provide individuals a sense of group identity and cohesion. Researchers have posited that such cohesion can provide an impetus for social and political discrimination and oppression of other groups, or solidarity against ruling authorities, both of which can destabilize a region and lead to conflict. Support for such propositions is sought by empirically estimating relationships between conflict and social homogeneity.

Various measures have been suggested as proxies for social homogeneity. One measure is fractionalization (see Mousseau 2001, Azam and Hoeffler 2002, Bernhard et al 2003, Sambanis 2004, Sørli et al 2005, Morgenstern et al 2005). Collier (2001) examines fractionalization and ethnic dominance, and finds that "fractionalization actually makes societies safer, while dominance increases the risk of conflict." This article explored ethnic dominance by examining the proportion of a population belonging to the largest ethnic group. In the context of theory, some proportions of group size are more likely to lead to conflict than others. The literature suggests we should consider three regimes with respect to social group size: (1) a *diverse* regime in which no group is proportionally large enough to assert dominance based strictly on its relative size, (2) an *intermediate* regime in which the largest social group is proportionally large enough to discriminate against the rest of the population, and (3) a *homogeneous* regime in which the dominant group is so large that minority groups become insignificant.

Collier (2000) and Collier and Hoeffler (2002) examine the issue from an economic perspective, suggesting that groups of sufficient size can assert dominance over minorities in an intermediate regime, but can also become so large that there is little to be gained by discriminating against minorities. They empirically test for the existence of an *intermediate* regime and find that the likelihood of civil war doubles when the largest ethnic group constitutes between 45% and 90% of the population.

Ellingsen (2002) provides a similar result. She argues that a dominant group can become so large that minorities become powerless and abandon efforts to resist the dominant group. Empirically, she tests for the existence of a *homogeneous* regime and finds that the likelihood of domestic conflict is halved when the largest ethnic, religious, or linguistic group constitutes more than 80% of the population.

Tir (2005) uses a quadratic regression to estimate an inverse-U relationship between ethnic diversity and armed conflict, suggesting that “the most conflict prone countries will be the ones with mid-levels of diversity.”

Sørli et al (2005) adopt the measure of ethnic dominance used by Collier and Hoeffler, but modify the coding to differentiate Sunni from Shia Muslims. Under the new coding, some countries that had been previously coded as intermediate regimes were now coded as diverse regimes. They find that the propositions supported by Collier and Hoeffler are still supported under the new coding.

All of these studies provide reasonably consistent results suggesting a U-shaped relationship between group size and stability. Tir’s quadratic model is analytically and anecdotally desirable because it estimates a smooth transition across regimes. However, the other models described above estimate discrete regimes denoting a finite set of possible states in which a nation can exist. This latter approach can be desirable for designing a simulation, because it simplifies how one defines the state of a nation with respect to social homogeneity. For this reason, and based on my premise for this analysis, I also take the approach of estimating discrete homogeneity regimes.

3 Hypothesis

The previous discussion of ethnic cohesion and dominance provide the following three testable hypotheses:

Hypothesis 1: An increase in the proportion of the largest ethnic group does not affect instability in an ethnically diverse regime.

Hypothesis 2: An increase in the proportion of the largest ethnic group increases instability in an ethnically intermediate regime.

Hypothesis 3: An increase in the proportion of the largest ethnic group decreases instability in an ethnically homogeneous regime.

4 Research Design and Methodology

I test the hypotheses above by statistically estimating instability as a function of ethnic group size. The data for this analysis were compiled by Sean O'Brien (2002), and are available at www.yale.edu/unsy/jcr/jcrdata.htm.

Part of the challenge is to identify the thresholds that distinguish ethnic homogeneity regimes. As discussed above, Collier, Hoeffler, and Sørli et al assumed thresholds of 45% and 90% for the partitioning of group size. In this analysis, I let the data determine the appropriate thresholds. This is accomplished by via maximum-likelihood search whereby thresholds are varied across successive estimates of the statistical model to determine which thresholds provide the highest log-likelihood.

4.1 Dependent Variable and Ordered Logit Regression

The model requires a dependent variable to proxy the likelihood of conflict. Researchers have studied factors contributing to various forms of intrastate conflict. Vanhanen (1999) shows a positive relationship between ethnic heterogeneity and domestic ethnic conflict. Collier and Hoeffler (2002) and Sørli et al (2005) examine ethnic fragmentation and group size as factors for the onset of civil war. Ellingsen (2000) studies ethnic, religious, and linguistic differences as factor of civil war, as provided by Singer and Small (1994), and domestic conflict, as provided by Wallensteen and Sollenberg (1999). Reynal-Querol (2002) also studies ethnic, religious, and linguistic differences as factors of civil war. Mousseau (2001) investigates political and economic conditions relative to ethnicity that are conducive to extreme political violence (see Taylor and Jodice 1983) as defined by the number of deaths from domestic political violence. Sambanis (2001) compares the causes associated with ethnic versus non-ethnic civil wars. Besançon (2005) examines the link between deprived identity groups and three types of intrastate conflict: ethnic conflicts, revolutions, and genocides.

Social identity has also been directly and indirectly linked to interstate conflicts. Most recently, Caprioli and Trumbore (2003) test a relationship between internal ethnic discrimination and a state's tendency to initiate hostilities in interstate conflicts. Besançon (2005) examines the link between identify-driven intrastate conflicts to interstate conflicts.

The studies listed above beg two empirical questions. First, is there a simple way to test for a relationship between ethnic homogeneity and *all* forms of conflict? Second, could one capture the fact that measurable destabilizing factors can destabilize a nation without tipping the nation into observable violent conflict? O'Brien (2002) addresses these questions by adopting a subjective proxy for instability based on the Conflict Simulation Model[2] (KOSIMO) data bank (see Pfetsch and Rohloff 2000), which allows for non-violent conflicts that have the potential to escalate into violent conflicts. From this data, O'Brien derives an instability index in which each country-year is mapped to one of four intensity levels. Conflicts are categorized according to an intensity index with the following four levels:

1. No conflict,
2. Crisis; mostly nonviolent,

[2] This data is maintained at the Heidelberg Institute on International Conflict Research (HIIK) at the Department of Political Science at the University of Heidelberg. The KOSIMO Manual is available at (www.hiik.de/en/manual.htm).

3. Severe crisis; sporadic, irregular use of force, `war-in-sight′ crisis,

4. War; systematic, collective use of force by regular troops.

From this categorization, O'Brien constructs a dependent variable of integer values ranging from 1 to 4 corresponding to the highest intensity level experienced by each country in each year.

Since the dependent variable is polytomous of ordinal rank, the statistical analyses in this article will be conducted using ordered logit regression[3] (with clustering[4]) in STATA 8.0 (see StataCorp 2003). Roeder (2003) uses ordered logit to estimate the effects of ethnopolitical factors on the intensity of observed conflict. Other applications of ordered logit regression in the conflict literature are found in Greig (2001), Saideman (2002), Terris and Maoz (2005), and Melander (2005).

The results will be presented as odds ratios, which represent the change in the odds due to a unit increase in the independent variable, where odds(x) = Pr(x)/[1-Pr(x)]. Brant (1990) and Borooah (2001) further describe the interpretation of odds ratios for ordered logit models. King and Zeng (2002) compare odds ratios to other quantities, noting that odds ratios have "the attractive feature of being invariant with respect to the values at which control variables are held constant." This feature is desirable for the model presented here, in which I present general cross-sectional conclusions about the influence

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[3] STATA 8.0 supports a fully documented algorithm for ordered logit regression, as described by Aitchison and Silvey (1957), Zavoina and McKelvey (1975), and McCullagh (1980). Borooah (2001) provides a detailed technical discussion, with examples, of the ordered logit algorithm employed in STATA. Ordered logit regression is executed using the ologit command described in the Stata Reference Manual.

[4] This analysis allows for both cross-country and within-country comparisons with respect to changes in the independent variables. The statistical criteria for testing the significance of such relationships are the standard errors associated with the odds ratios. If the country-year observations are not within-country independent, then the estimated standard errors will underestimate the true standard errors, possibly allowing us to conclude that factors are significant when they are not. We correct for this problem with a technique known as cluster sampling (Huber 1967, Rogers 1996), which provides robust estimates of the standard errors.

of social homogeneity amidst several control variables. The disadvantages of odds ratio relate to the ease and meaning of their interpretation. In this analysis, however, odds ratios are quantities of interest and lend themselves to meaningful interpretation.

In this analysis, in which the dependent variable has four levels of intensity, the *odds* denote the odds that instability will escalate from the *current* to the *next* level of intensity. The remainder of this paper uses the phrase "odds of escalation" to mean the "odds that instability will escalate to the next level of intensity." To clarify, recall that the model estimates the likelihood of escalation as the logit response to a linear combination of independent variables. Suppose that $k = \alpha + \beta \cdot x + \gamma \cdot y + \delta \cdot z$ is a linear combination of independent variables x, y, and z. The model selects coefficients α, β, γ, and δ to obtain the maximum-likelihood estimates of the logit response function

$$\Pr(escalation \mid x, y, z) = \frac{e^k}{1 + e^k} \qquad (1)$$

The estimated response to an increase in x, when x is incrementally increased by Δx, is described by the corresponding odds ratio

$$OR_{\Delta x} = \frac{Odds(escalation \mid (x + \Delta x), y, z)}{Odds(escalation \mid x, y, z)} = e^{\beta \cdot \Delta x} \qquad (2)$$

4.2 Independent Variable and Spline Methods

O'Brien provides a variable measuring the proportion of the population belonging to the largest ethnic group. Here, I segment the variable into ethnic regimes using spline methods. For example, suppose it is predetermined that there are two distinct regimes corresponding to the value of a continuous variable x, and that x_0 is a threshold (a.k.a.

spline knot) demarking a change from regime A to regime B, such that the segment $[x_{\min}, x_0]$ defines regime A and the segment $[x_0, x_{\max}]$ defines regime B.

In a statistical model, we would estimate regimes A and B using indicator variables and interaction terms (see Marsh and Cormier 2001). Specifically, we would introduce an indicator variable given by

$$d = \begin{Bmatrix} 0 & , x \le x_0 \ \text{(regime A)} \\ 1 & , x > x_0 \ \text{(regime B)} \end{Bmatrix}, \tag{3}$$

and an interaction term given by

$$d \cdot x = \begin{Bmatrix} 0 & , x \le x_0 \ \text{(regime A)} \\ x & , x > x_0 \ \text{(regime B)} \end{Bmatrix}. \tag{4}$$

We introduce these variables into the linear combination to obtain $k = \alpha + \phi d + \beta x + \theta dx + \gamma y + \delta z$, where

$$k = \begin{Bmatrix} \alpha + \beta x + \gamma y + \delta z & , x \le x_0 \ \text{(regime A)} \\ (\alpha + \phi) + (\beta + \theta) x + \gamma y + \delta z & , x > x_0 \ \text{(regime B)} \end{Bmatrix}. \tag{5}$$

Under this framework, the marginal effect of a Δx increase in the odds of escalation will differ depending on the regime, where the odds ratio in each regime is:

$$OR_{\Delta x} = \begin{Bmatrix} e^{\beta \cdot \Delta x} & , x \le x_0 \ \text{(regime A)} \\ e^{(\beta + \theta) \cdot \Delta x} & , x > x_0 \ \text{(regime B)} \end{Bmatrix}. \tag{6}$$

In practice, statistical packages will provide three *estimated* odds ratios, denoted $\overline{OR}$, corresponding to the three variables x, d, and $d{\cdot}x$. The expected response under regime A is obtained directly from the estimated odds ratio for Δx

$$E[OR_{\Delta x} \mid x \le x_0] = \overline{OR}_{\Delta x} = e^{\beta \cdot \Delta x} \tag{7}$$

but the expected response under regime B is obtained by the product of the odds ratios corresponding to variables x and $d{\cdot}x$

$$E[OR_{\Delta x} \mid x > x_0] = \overline{OR}_{\Delta x} \cdot \overline{OR}_{d \cdot \Delta x} = e^{\beta \cdot \Delta x} \cdot e^{\theta \cdot \Delta x} = e^{(\beta + \theta) \cdot \Delta x}. \tag{8}$$

Such calculations are implicit in the empirical results reported later in this article. Jaccard (2001) describes this methodology in greater detail.

Testing of hypotheses 1-3 requires modifications to model specifications used in previous studies. First, unlike previous studies, which estimate a shift in the odds of escalation under alternate regimes, this study estimates the rate of destabilization (with respect to increasing group size) under alternate regimes. To clarify, previous model specifications were equivalent to using an indicator term as described in equation (3) to compare the latent odds of conflict between regimes. I extend this approach by also using an interaction term as described in equation (4) to compare the marginal response to group size between regimes (see equation (6)).

Additionally, rather than distinguishing one regime from the other two, as did previous studies, I independently test for all three regimes. I first identify two thresholds. Then, assuming for the moment that the location of these thresholds is predetermined, I introduce two sets of indicator and interaction variables; the first set corresponds to the *intermediate* regime and the second set corresponds to the *homogeneous* regimes. This allows each of these regimes to be compared to the other, and independently compared against the baseline *diverse* regime. Formally, if we let x_{τ_1} denote the threshold between the diverse and intermediate regimes and let x_{τ_2} denote the threshold between the intermediate and homogeneous regimes, then the model estimates the following three marginal responses to unit changes in group size:

$$E[OR_{\Delta x}] = \begin{Bmatrix} e^{\beta \cdot \Delta x} & , x \le x_{\tau_1} & \text{(diverse regime)} \\ e^{(\beta+\theta) \cdot \Delta x} & , x_{\tau_1} < x \le x_{\tau_2} & \text{(intermediate regime)} \\ e^{(\beta+\theta+\rho) \cdot \Delta x} & , x_{\tau_2} < x & \text{(homogeneous regime)} \end{Bmatrix}. \quad (9)$$

In this case, a unit change is measured as a percentage change in the proportion of population belonging to the largest ethnic group. Figure 1 provides a visual representation of the hypothesized relationship between the odds of escalation and group size across the three regimes.

[Insert Figure 1 Here]

4.3 Control Variables

O'Brien provides two variables to control for economic fitness: per-capita GDP and trade openness. Per-capita GDP is measured in units of $1,000. Trade openness is measured as the ratio of the value of foreign trade to DGP, and is measured in units of 10 percentage points. These variables allow for two ancillary hypotheses, which are ubiquitous in the economic and state-strength literature:

Hypothesis 4: Increases in per-capita GDP will decrease the likelihood that instability will escalate to the next intensity level.

Hypothesis 5: Increases in trade openness will decrease the likelihood that instability will escalate to the next intensity level.

4.4 Estimating Regime Thresholds

Maximum-likelihood (ML) search provides a means to objectively identify the placement of thresholds for partitioning group-size regimes. This process is appropriate for this analysis, in which thresholds (knot locations) are unknown (Marsh and Cormier 2001). First, one assumes a range of possible values for regime thresholds. Second, one varies each threshold incrementally across its respective range, and estimates the ordered logit model for each set of thresholds. Third, one observes the log-likelihood for each model specification. The model that achieves the highest log-likelihood value is the ML model.[5]

To encompass Collier's assumptions for threshold placement, I search over the following range of values: $40\% \leq x_{\tau_1} < x_{\tau_2} \leq 95\%$. Additionally, I place a restriction on the size of the intermediate regime to be at least a 25% proportion of the population; that is, $(x_{\tau_2} - x_{\tau_1}) \geq$ 20%. This latter restriction is necessary to ensure that the algorithm identifies a model specification of analytical significance and theoretical relevance (McCloskey and Ziliak 1996). Under these search parameters, the algorithm searches across the interval by allowing each threshold to vary in 1% increments. This results in 961 possible pairs of thresholds, and therefore 961 model specifications.

5 Results

The ML search yielded global optima thresholds for the intermediate regime of 60% to 85% of the population. The results are listed in Table 2 as the global optima model. The ordered logit estimates corresponding to these thresholds are summarized in Table 1. The findings support all hypotheses.

[Insert Table 1 Here]

The odds ratio for group size is both analytically and statistically insignificant, suggesting there is no empirical relationship between group size and stability in ethnically diverse regimes. In intermediate regimes, a 1% increase in group size is

[5] Although not done here, one can adjust the standard errors of the estimated odds ratios to account for the fact that the thresholds are being estimated. To do so, one would add the number of thresholds (m_T) to the number of independent variables (m_V) to obtain the true number of estimated parameters, ($m_{Total} = m_V + m_T$). All standard errors would be adjusted (increased) accordingly by replacing the previous m_V with the adjusted m_{Total}. This exercise would increase the associated P-values and provide more robust hypothesis tests, but would not change the estimated odds ratios.

associated with a 16% increase in the odds of escalation. In homogeneous regimes, the cumulative product of odds ratios implies that a 1% increase in group size is associated with a 3% decrease in the odds of escalation. Figure 2 combines these results into a visual plot of the relationship between ethnic group size and the odds of escalation. These findings support hypotheses 1-3.

[Insert Figure 2 Here]

The hypotheses regarding economic influences also find support. A $1,000 increase in per-capita GDP is associated with a 6% reduction in the odds of escalation. Similarly, an expansion of trade openness that is proportional to 10% of national GDP is associated with a 20% reduction in the odds of escalation.

[Insert Table 2 Here]

6 The Topology of Likelihood

It is reassuring that the 85% upper threshold yielded by the ML search is consistent with thresholds used in previous studies: 80% used by Ellingsen and 90% used by Collier. In contrast, it is troubling that the 60% lower threshold yielded by the search is notably higher than the 45% threshold used previously by Collier, Sørli, et al. We cannot accept the robustness of the 60% lower threshold without analyzing its uniqueness. Figure 3 allows us to visually inspect the uniqueness of the (60%, 85%) thresholds by plotting the log-likelihood for the 961 model specifications corresponding to each possible pairs of thresholds.

The lower left plot orients the axes to inspect the sensitivity of log likelihood with respect to the upper threshold. The plot indicates that log likelihood is unimodal with respect to the upper threshold, and centered about 85%. Thus, the global ML estimate for the upper threshold is reasonably unique and corresponds to previously used thresholds.

The lower right plot orients the axes to inspect the sensitivity of log likelihood with respect to the lower threshold. The plot indicates that log likelihood is bimodal with respect to the lower threshold; the first mode exists about the globally optimal threshold of 60%, but a second mode exists in the range of 45-55%. A narrower ML search identified two local optima at the threshold pairs (52%, 84%) and (47%, 84%). The corresponding ordered logit results are reported as local optima (a) and (b) in Table 2. Model (a) provides weak evidence of a destabilizing intermediate regime, and model (b) provides no statistically significant evidence of such a regime. However, both models provide strong evidence of a stable homogeneous regime.

[Insert Figure 3 Here]

7 Remarks

This analysis demonstrates the value of search methods to identify model parameters and explore the uniqueness of those parameters.

This article introduces a comprehensive model that encompasses several hypotheses regarding the role of ethnic homogeneity as a stabilizing/destabilizing factor. Our finding that ethnic dominance arises and subsides at discernable thresholds supports arguments that ethnic dominance arises only when cohesive factors exist in certain proportions. For simulation, this finding supports a design plan in which initial algorithms will be based on the notion of cohesion. Under such a plan, initial designs will capture the analytic rigor of group dynamics, while subsequent designs will better incorporate subject-matter expertise and empirical details.

References

Azam, Jean-Paul, and Anke Hoeffler. 2002. "Violence Against Civilians in Civil Wars: Looting or Terror?" *Journal of Peace Research* 39 (July): 461-85.

Benson, Michelle, A. 2004. "Dyadic Hostility and the Ties That Bind: State-to-State versus State-to-System Security and Economic Relationships." *Journal of Peace Research* 41 (6): 659-76.

Bernhard, Michael, Christopher Reenock, and Timothy Nordstrom. 2003. "Economic Performance and Survival in New Democracies: Is There a Honeymoon Effect?" *Comparative Political Studies* 36 (May): 404-31.

Besançon, Marie L. 2005. "Relative Resources: Inequality in Ethnic Wars, Revolutions, and Genocides." *Journal of Peace Research* 42 (4): 393-415.

Borooah, Vani. 2001. *Logit and Probit: Ordered and Multinomial Models*. Sage University Papers Series on Quantitative Applications in the Social Sciences 07-138. Thousand Oaks CA: Sage.

Boslough, Mark, James Sprigg, George Backus, Mark Taylor, Laura McNamara, Kathryn Murphy, Leonard Malczynski, Joy Fujii, and Rhonda Reinert. 2004. *Climate Change Effects on International Stability: A White Paper*. SAND2004-5973. Albuquerque, NM: Sandia National Laboratories.

Brant, Rollin. 1990. "Assessing Proportionality in the Proportional Odds Model for Ordinal Logistic Regression." *Biometrics* 46 (December): 1171-8.

Caprioli, Mary, and Peter Trumbore. 2003. "Ethnic Discrimination and Interstate Violence: Testing the International Impact of Domestic Behavior." *Journal of Peace Research* 40 (1): 5-23.

Collier, Paul. 2000. "Economic Causes of Civil Conflict and their Implications for Policy." Working Paper of the World Bank Research Program to Study the Economics of Civil War, Crime and Violence.

__________. 2001. "Implications of Ethnic Diversity." *Economic Policy* 16 (April): 127-66.

__________, and Anke Hoeffler. 2002. "On the Incidence of Civil War in Africa." *Journal of Conflict Resolution* 46 (February): 13-28.

Ellingsen, Tanja. 2000. "Colorful Community or Ethnic Witches' Brew? Multiethnicity and Domestic Conflict During and After the Cold War." *Journal of Conflict Resolution* 44 (April): 228-49.

Fox, Jonathan. 2004. “Religion and State Failure: An Examination of the Extent and Magnitude of Religious Conflict from 1950 to 1996.” *International Political Science Review* 25 (January): 55-76.

Greig, Michael J. 2001. “Moments of Opportunity: Recognizing Conditions of Ripeness for International Mediation between Enduring Rivals.” *Journal of Conflict Resolution* 45 (December): 691-718.

Gurr, Ted. 1993. *Minorities at Risk: A Global View of Ethnopolitical Conflicts.* Washington DC: U.S. Institute of Peace Press.

Jaccard, James. 2001. *Interaction Effects in Logistic Regression.* Sage University Papers Series on Quantitative Applications in the Social Sciences 07-135. Thousand Oaks CA: Sage.

King, Gary and Langche Zeng. 2002. “Estimating Risk and Rate Levels, Ratios, and Differences in Case-Control Studies.” *Statistics in Medicine* 21 (May): 1409-27.

Marsh and Cormier. 2001. *Spline Regression Models*. Sage University Papers Series on Quantitative Applications in the Social Sciences 07-137. Thousand Oaks CA: Sage.

McCloskey, Deirdre N. and Stephen T. Ziliak. 1996. “The Standard Error of Regressions.” *Journal of Economic Literature* 34 (March): 97-114.

McCullagh, P. 1980. “Regression Models for Ordinal Data: with Discussion.” *Journal of the Royal Statistical Society* 42 (B): 109-42.

Melander, Erik. 2005. “Political Gender Equality and State Human Rights Abuse.” *Journal of Peace Research* 42 (March): 149-66.

Morgenstern, Scott, and Stephen M. Swindle. 2005. “Are Politics Local?: An Analysis of Voting Patterns in 23 Democracies.” *Comparative Political Studies* 38 (Marhc): 143-70.

Mousseau, Demet Yalcin. 2001. “Democratizing with Ethnic Divisions: A Source of Conflict?” *Journal of Peace Research* 38 (September): 547-67.

O’Brien, Sean P. 2002. “Anticipating the Good, the Bad, and the Ugly: An Early Warning Approach to Conflict and Instability Analysis.” *Journal of Conflict Resolution* 46 (December): 791-811.

Pfetsch, Frank R., and Christoph Rohloff. 2000. “KOSIMO: A Databank on Political Conflict.” *Journal of Peace Research* 37 (3): 379-90.

Reynal-Querol, Marta. 2002. “Ethnicity, Political Systems, and Civil Wars.” *Journal of Conflict Resolution* 46 (February): 29-54.

Roeder, Philip G. 2003. "Clash of Civilizations and Escalation of Domestic Ethnopolitical Conflicts." *Comparative Political Studies* 36 (June): 509-40.

Rogers, W. H. 1993. "Regression standard errors in Clustered Samples." *Stata Technical Bulletin* 13:19-23.

Saideman, Stephen M. 2002. "Discrimination in International Relations: Analyzing External Support for Ethnic Groups." *Journal of Peace Research* 39 (January): 27-50.

__________., David J. Lanoue, Micheal Campenni, and Samuel Stanton. 2002. "Democratization, Political Institutions, and Ethnic Conflict: A Pooled Time-Series Analysis, 1985-1998." *Comparative Political Studies* 35 (February): 103-29.

Sambanis, Nicholas. 2001. "Do Ethnic and Nonethnic Civil Wars Have the Same Causes? A Theoretical and Empirical Inquiry (Part 1)" *Journal of Conflict Resolution* 45 (June): 259-82.

Sambanis, Nicholas. 2004. "What is Civil War? Conceptual and Empirical Complexities of an Operational Definition." *Journal of Conflict Resolution* 48 (December): 814-58.

Silver, Brian D., and Kathleen M. Dowley. 2000. "Measuring Political Culture in Multiethnic Societies." *Comparative Political Studies* 33 (May): 517-50.

Sørli, Mirjam E., Nils Petter Gleditsch, and Håvard Strand. 2005. "Why Is There So Much Conflict in the Middle East?" *Journal of Conflict Resolution* 49 (February): 141-65.

StataCorp. 2003. *Stata Statistical Software: Release 8.0*. College Station, TX: Stata Corporation.

Taylor, Charles L., and David A. Jodice. 1983. *World Handbook of Political and Social Indicators*, 2nd ed. New Haven, CT: Yale University Press.

Terris, Leslie G., and Zeev Maoz. 2005. "Rational Mediation: A Theory and a Test." *Journal of Peace Research* 42 (September): 563-83.

Tir, Jaroslav. 2005. "Dividing Countries to Promote Peace: Prospects for Long-Term Success of Partitions." *Journal of Peace Research* 42 (5): 545-62.

Vanhanen, Tatu. 1999. "Domestic Ethnic Conflict and Ethnic Nepotism: A Comparitive Analysis." *Journal of Peace Research* 36 (1): 55-73.

Wallensteen, Peter, and Margareta Sollenberg. 1999. "Armed Conflict, 1989-98." *Journal of Peace Research* 36 (September):593-606.

Zavoina, W. and R. D. McKelvey. 1975. "A Statistical Model for the Analysis of Ordinal Level Dependent Variables." *Journal of Mathematical Sociology* 4: 103-20.

Figure 1. Hypothetical Effect of Ethnic Group Size

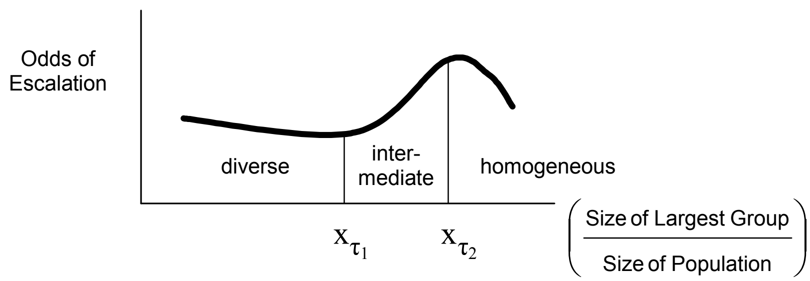

Table 1. Marginal Effects of Ethnic Group Size in the Global Optima Model

Hypothesis Tested	Regime Type	Population Segment	Effect of a 1% increase in proportion of population belonging to the largest ethnic group…
1	Diverse	0-59%	No change in odds of escalation.
2	Intermediate	60-84%	Over 16% increase in odds of escalation.
3	Homogeneous	85-100%	Over 3% decrease in odds of escalation.
Hypothesis Tested			**Effect of a $1,000 increase in Per-Capita DGP…**
4	-----	-----	Over 6% decrease in the odds of escalation.
Hypothesis Tested			**Effect of an expansion of trade openness that is proportional to 10% of national GDP…**
5	-----	-----	Nearly 20% decrease in the odds of escalation.

Table 2. Intensity of Instability: Ordered Logit Regression

	Global Optima		Local Optima (a)		Local Optima (b)	
Search results						
Lower threshold	60%		52%		47%	
Upper threshold	85%		84%		84%	
Hypothesis Variables*	*OR*	*p*	*OR*	*p*	*OR*	*p*
Group size	1.003	(.853)	1.017	(.558)	1.053	(.273)
Group size · Intermediate regime	1.167	(.002)	1.080	(.068)	1.025	(.658)
Group size · Homogeneous regime	0.829	(.002)	0.885	(.015)	0.900	(.022)
Per Capita GDP	0.937	(.000)	0.940	(.000)	0.940	(.000)
Trade Openness	0.804	(.000)	0.801	(.000)	0.802	(.000)
Ancillary Variables**	*Coef.*	*s.e.*	*Coef.*	*s.e.*	*Coef.*	*s.e.*
Intermediate regime (0-1 indicator)	-10.94	(3.5)	-5.58	(2.4)	-3.17	(2.4)
Homogeneous regime (0-1 indicator)	13.67	(5.0)	8.66	(4.1)	7.33	(4.1)
Cut 1	-.89	(0.9)	-.50	(1.1)	.58	(1.6)
Cut 2	-.37	(0.8)	.01	(1.0)	1.08	(1.6)
Cut 3	.99	(0.9)	1.38	(1.0)	2.46	(1.6)
Model Statistics						
No. observations	2619		2619		2619	
Log likelihood	-2321		-2330		-2324	
Wald χ^2	55.1		55.0		51.8	
Prob > χ^2	(.000)		(.000)		(.000)	

* Reports odds ratios and robust p-values.
** Reports coefficients and robust std. errors.

Figure 2. Plot of Estimated Marginal Effect of Ethnic Group Size

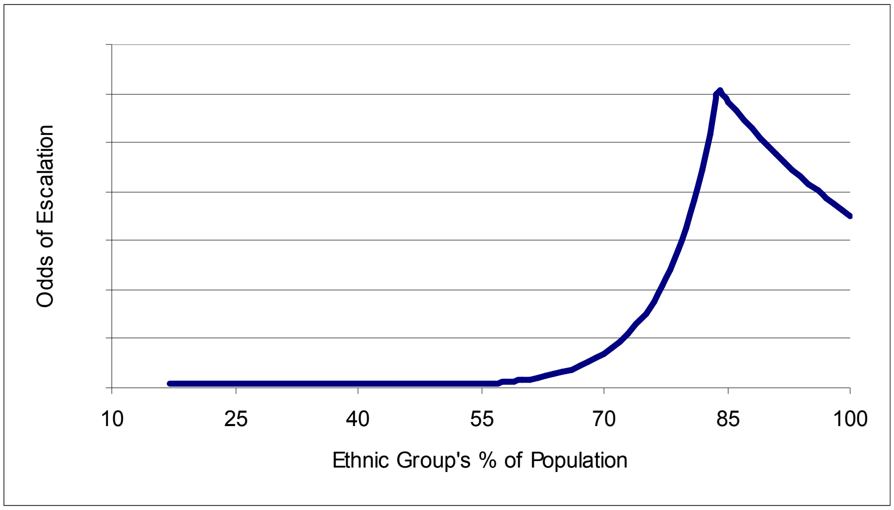

Figure 3. Topology Plots of Log-Likelihood with respect to Threshold Values