word count=10,639

Learning from Adversity: Ethnic Ties and Ethnic Domination

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Abstract

This paper specifies a novel framework to explore how rival ethnic groups in one country *learn* from threats to ethnic kin in a neighboring country and from threats made by nominal rivals at home. I explore how a combination of external and internal threats results in animosity and violence, and argue that the lessons from these events are internalized differently across groups, leading to distinct trajectories of ethnic domination. I formalize the framework using an agent-based computational model which generates a range of outcomes, among which are: (*i*) domination by kin ethnic majorities; (*ii*) domination by rival ethnic majorities; (*iii*) domination by an ethnic minority when ethnic kin in the contiguous state constitute a dominated minority; (*iv*) domination by rival ethnic minorities; and (*v*) domination by kin ethnic minorities in contiguous states. I analyze (*v*) in greater detail to understand the puzzle of minority domination in both Rwanda and Burundi: namely, why a Hutu majority that was able to take control of the state from a dominant minority in Rwanda failed to retain power in the long run; and why a dominant Tutsi minority in neighboring Burundi was never dislodged from power by the dominated majority?

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"Given the structural similarities of ethnic configurations in both states, it should come as no surprise that perceptions of ethnic crises often tend to transcend national boundaries, thereby paving the way for a displacement of conflict from one setting to another. A kind of perverse dialectic is thus set in motion, whereby ethnic conflicts in one state have significant side effects in the other."   —Rene Lemarchand 1994a, p. 30

1.0   Introduction

How do ethnic groups learn from threats facing ethnic kin in neighboring states and the resultant domestic challenges these events give rise to? Why are lessons from past episodes of interethnic violence internalized differently across groups with ostensibly similar characteristics? And how does group learning affect patterns of ethnic domination? This paper specifies a novel framework to explore learning in groups with cross-border ethnic ties and the resultant trajectories of ethnic domination. In particular, I consider how a combination of external and internal threats causes violence domestically; violence causes casualties, increases interethnic animosity, and generates refugee flows which in turn contribute to further violence, reinforce or undermine disparities in power, and shape patterns of ethnic domination.   I argue that this process leads to different trajectories of ethnic domination in dyads with cross-border ethnic ties based on: (*i*) initial disparities in group advantage—the past domestic advantage a group enjoys vis á vis nominal rivals as well as the relative domestic advantage of ethnic kin abroad; and (*ii*) group size—whether a group constitutes a majority or minority at home, as well as the associated status of ethnic kin abroad.

As such, the framework developed in this paper seeks to account for *variation* in patterns of ethnic domination in dyads with cross-border ethnic ties, as depicted in Figure 1. A dyad characterized by "cross-border ethnic ties" consists of contiguous states that are each host to members from two (or more) rival ethnic groups—i.e., if two ethnic groups *a* and *b* exist then country 1 contains members of both groups, as does adjacent country 2. The proportion of *a* and *b* in each country may nonetheless vary. Group *a* may be a majority in both countries, a minority in

both countries, a majority (or have numerical parity) in one and a minority (or have numerical parity) in the other, or the groups may be equally distributed in both countries.[1] The cells in Figure 1 illustrate that ethnic majorities (rival or kin) can dominate in both countries with ethnic ties—the most frequently observed outcome in the 1965-2000 period; that an ethnic majority can dominate in one country and be dominated in another; or that ethnic minorities (rival or kin) can dominate in both countries, an infrequent but nonetheless plausible outcome.

Insert Figure 1 here
Domination in Dyads with Cross-Border Ethnic Ties: 1965-2000

In the next section, I consider existing theoretical approaches that pay close attention to the dynamics of violence and domination in groups with cross-border ethnic ties. Based on these approaches, I present the building blocks of a theoretical framework to explain different patterns of majority-minority domination in these dyads. A subsequent section formalizes the argument with an agent-based model of group learning and domination. Among the range of patterns generated by the model, those that bear a close resemblance to the trajectories of ethnic domination in the Rwanda-Burundi dyad are considered in greater detail.[2] The empirical puzzle, in these cases, concerns why a Hutu majority that was able to take control of the state from a dominant minority in Rwanda failed to retain power in the long run; and why a dominant Tutsi minority in neighboring Burundi was never dislodged from power by the dominated majority?[3] A concluding section discusses the general relevance of my findings for dyads characterized by cross-border ethnic ties, as well as potential extensions to the framework developed in this paper.

2.0   Existing Theoretical Explanations

In the literature on transnational ethnic relations, existing theoretical approaches focus, to a large extent, on explaining the incidence (or absence) of inter-state hostility, involvement in secessionist conflict, and resulting violence between states.[4]

One popular argument is that states *vulnerable* to separatism at home are less likely to support separatist movements abroad out of common insecurity and interest in supporting international norms of territorial integrity. This argument is particularly apt in the African context, given the weakness of state structures and the resilience of territorial boundaries (Jackson and Rosberg 1982, Herbst 1989, Touval 1972).[5] Shared vulnerability therefore deters leaders from supporting secessionist movements in other states and from engaging in irredentism, and may even strengthen support for a norm of territorial integrity (Zacher 2001), implying that separatist groups are less likely to receive external support, in comparison to other ethnic groups (Heraclides 1991, Saideman 2002).

In contrast to the vulnerability approach, which is largely silent about the behavior of states that are invulnerable to secession (Heraclides 1990, Saideman 1997), is an argument which highlights the salience of *ethnic ties* and contends that rational, office seeking politicians play the ethnic card to gain political support (Carment and James 1995, de Figueiredo and Weingast 1999, Gagnon 1995, Gleditsch 2005, Hardin 1995, Horowitz 1985, Saideman 1997, Sheplse and Rabushka 1972). In order to muster votes from domestic ethnic constituencies, this argument suggests, politicians adopt foreign policies that support ethnic kin abroad (Davis and Moore 1997, Saideman 1997, 2001). This approach therefore emphasizes the link between the ethnic composition of a dyad, domestic electoral incentives, and international hostility, yet fails to explain why some leaders succeed in

playing the ethnic card while others fail, or to account for transnational support of secessionist movements in the absence of ethnic ties.[6]

Perhaps more importantly, neither the vulnerability nor the ethnic ties approach takes the group as the unit of analysis, distinguishing between advantaged and disadvantaged groups—the host and target states' identity—or group size—whether the relevant groups constitute majorities in both states, a majority in one and a minority in the other, or twin minorities.

Dyadic approaches that explicitly assess the role of ethnic demographics on international conflict or cooperation find the likelihood of conflict to be higher where one state contains a minority at risk and the other integrates the minority into the power structure (Davis, Jaggers, and Moore 1997), or when ethnic kin are politically disenfranchised in one state (Davis and Moore 1997, Moore and Davis 1998).[7] Building on previous dyadic analyses, Woodell (2004) finds that "majority-majority" and, to a lesser extent, "minority-majority" dyads experience higher levels of conflict, the former due to competing national-ideologies and claims to leadership from elites within each state, and the latter as a result of diaspora-based nationalism or the political status of the minority group.

Thus, whereas the focus on groups as the unit of analysis is a welcome refinement, *dyadic-approaches* are characterized by three shortcomings: first, they take the composition of a dyad as given; second, they utilize ordinal measures of group size which fail to distinguish between near equivalently sized majority-minority groups (i.e. 29% Hausa-Fulani, 21% Yoruba, and 18% Igbo in Nigeria) and skewed majority-minority groups (i.e. 85% Hutu and 15% Tutsi in Rwanda);[8] and third, their emphasis on cross-border hostility is overstated, especially so in the Africa context, given the relative infrequency of inter- versus intra-state conflict (Scherrer 2003).[9]

Approaches that focuses on the *diffusion* of ethnic conflict through a number of interrelated mechanisms address a number of these shortcomings. For instance, civilian refugees or rebels

seeking refuge may alter the ethnic composition of a neighboring state (Newland 1993, Lake and Rothchild 1998), resulting in greater animosity, fear, and distrust of rivals. Alternatively, groups may learn or imitate the political tactics employed by a successful group abroad (Hill, Rothchild and Cameron 1998) or harbor fears of ethnic dominoes falling: a minority challenging a majority in one state may lead the majority in a neighboring state to fear a similar challenge in the absence of credible commitments (Fearon 1998, de Figueiredo and Weingast, 1999) or the collapse of central authority, leading to an intra-state security dilemma (Posen 1993).[10] Subsequent refinements to these arguments suggest that groups behave strategically; that the degree to which a minority believes it enjoys significant external support will determine its proclivity to make radical demands against its host state despite the presence of credible commitments by the center, and as well as its willingness to accommodate the host state in presence of significant repression (Jenne 2004). In sum, expectation or demonstration effects increase the likelihood of conflict in one state given events in a neighboring state, although these effects need not be symmetric or occur with any regularity (Kuran 1998, Lake and Rothchild 1998).

The next section of the paper builds on these approaches, which offer an excellent starting point to comprehensively explore variation in patterns of ethnic domination, by paying close attention to how groups in one country learn from events in a neighboring country and vice versa. My framework departs from pervious research on transnational ethnic relations in four key respects by: (*i*) explicitly examining the effect of group characteristics such as size and initial advantage (as continuous and not dummy variables); (*ii*) specifying a simple set of mechanisms to capture group learning as a dynamic process; (*iii*) shifting the focus away from *inter-state* to *intra-state* violence, and in so doing, (*iv*) depicting how distinct trajectories of ethnic domination emerge. Taken together, these steps provide a clearer specification of the relationship between group characteristics, learning, and

intra-state violence to demonstrate *how* a particular dyad comes to be dominated by a kin or rivals ethnic majorities, minorities, or some combination thereof.

3.0　　　　　Group Learning, Ethnic Ties, and Ethnic Domination

This paper explores how ethnic groups learn from threats to ethnic kin in neighboring states and from threats made by nominal rivals at home; and how these lessons are internalized differently across groups, resulting in distinct trajectories of ethnic domination.　My theoretical framework highlights the salience of: (*i*) *mechanisms* that capture the process of group learning—specified as a combination of reactions to external threats, internal threats, and refugee flows; and (*ii*) *initial conditions*—namely, group advantage and group size.　Taken together, these factors explain patterns of ethnic domination in contexts defined by cross-border ethnic ties.

I argue that groups face a combination of externally and internally induced threats which are difficult to extricate from each other.　Internal threats generate a reaction on the part of the dominant group with strong demonstration effects—opportunities to watch and learn—for the neighboring rival group(s) which faces its own set of internal fears and challenges.　Violence habitually ensues, often with predictive regularity, as the confluence of threats to a group is magnified.[11]　Interethnic violence generates casualties and serves as a tool for the dominant group to consolidate its rule.　Violence has two notable byproducts: it increases the animosity of victims—either as a direct response to a recent episode of violence or as a latent response to a cataclysmic episode that forms part of a group's collective consciousness—and creates refugees whose presence has a strong tendency to both agitate interethnic tension in the host state, and mount challenges to the rival regime at home.[12]

In short, a combination of external and internal threats generates violence domestically; violence results in casualties, increases interethnic animosity, and generates refugee flows—factors

that contribute to further violence, reinforce or undermine disparities in power, and shape patterns of ethnic domination.

Two additional factors remain critical in explaining why groups internalize lessons from previous events and encounters differently: initial disparities in *group advantage*—the past domestic advantage a group enjoys vis á vis nominal rivals as well as the relative domestic advantage of ethnic kin abroad; and *group size*—whether a group constitutes a majority or minority at home, as well as the associated status of ethnic kin abroad. In order for a minority to dominate a majority a critical initial advantage—most commonly economic, political, or military—is a necessary though not sufficient condition, whereas the conditions for majority dominance are arguably less stringent given numerical superiority.[13] Moreover, a dominant minority is likely to be even more apprehensive of its fate than a dominated minority (Blau 1977, 1994; Coser 1975; Londregan, Bienen and Van de Walle 1995), whereas a dominated majority is likely to be more restive than a dominant majority (Blalock 1967; Massey, Hodson and Sekulic 1999).[14] Thus, both the minority and majority are likely to be more intolerant, fearful, and threatened under minority rather than majority rule—which suggests that group size and group advantage influence group learning in non-trivial and unexpected ways.[15]

4.0   Model Description

I formalize the argument presented above by integrating the two components of my framework—learning mechanisms and group specific initial conditions—into an agent-based computational model. The model serves as a heuristic device which allows me to further explore variation in patterns of ethnic domination in dyads with cross-border ethic ties.

4.1   *Agents*

The model consists of a population of agents who belong to two rival ethnic groups *a* and *b*. Two neighboring countries of equal size P contain members of both ethnic groups, with the size of group

a in country 1 given by $\alpha_{a,1}P$ and the size of group *a* in country 2 given by $\alpha_{a,2}P$. Each agent *i* is characterized by a level of ethnic animosity e^i and strength s^i defined on the unit interval. Animosity serves as a threshold for violence or flight, while strength provides a measure of individual 'fitness' or advantage. The initial conditions in the model can therefore be set up to approximate those in Rwanda and Burundi, as well as numerous other dyads characterized by cross-border ethnic ties.

4.2   *Group Domination*

Given the existence of distinct ethnic groups, it is possible to compute measures of aggregate strength to determine which group dominates in each country. Let $\hat{s}_{a,1}$ and $\hat{s}_{b,1}$ denote the aggregate strength of groups *a* and *b* in country 1. If $\hat{s}_{a,1} > \hat{s}_{b,1}$ then group *a* is said to *dominate* group *b* in country 1.

4.3   *Domestic and External Threats*

Each group faces a combination of domestic and external threats in the model. Domestic threats capture challenges to a group from within the state, whereas external threats capture challenges to a group resulting from the persecution of ethnic kin in a neighboring state. A group is therefore threatened if the rival ethnic group is close in strength at home, or if one's ethnic brethren are persecuted abroad.

To begin with, the domestic threat is greatest when the aggregate strength of rival groups within a country is nearly equal. At such junctures, the fact that neither group clearly dominates the other increases the magnitude of the threat.[16] In country 1, as the difference in group strength given by $\Delta_1 = |\hat{s}_{a,1} - \hat{s}_{b,1}|$ decreases, the threat to both groups at home (*h*) given by $\tau_1^h = 1/(1+\Delta_1)$ increases. In a similar vein, as the proportion of ethnic kin attacked in country 2 increases, the external threat to each group from the neighboring country (*n*) given by $\tau_{a,1}^n$ and $\tau_{b,1}^n$ increases.

Note that while τ^h is symmetric (equal) across groups within a country, τ^n differs across groups within a country. As a result, threats are group and country specific.

The combination of domestic and external threats to group a in country 1, for instance, would therefore be given by $\tau_{a,1} = \theta \ (\tau_1^h) + (1 - \theta) \tau_{a,1}^n$ while the combined threat to group b in country 1 would be given by $\tau_{b,1} = \theta \ (\tau_1^h) + (1 - \theta) \tau_{b,1}^n$, with θ reflecting the weight placed on events at home versus those in the neighboring state. For the sake of simplicity, I assume that θ remains fixed at 0.5, thereby placing equal weight on domestic and external threats.

4.4   *Agent Actions*

I assume that individual animosity for nominal rivals determines the likelihood of violence by members of the dominant group as well as the likelihood of flight by members of the dominated group in response to group specific threats. As such, members of the dominant group resort to violence if their level of ethnic animosity—their hostility toward nominal rivals—exceeds the threat level, whereas members of the dominated group flee if their level of ethnic animosity exceeds the threat level. Thus if animosity is low, individuals are unlikely to engage in violence or flight in response to major threats, since these threats require a response that exceeds the current level of interethnic animosity.[17] In contrast, during periods of heightened animosity, both minor and major threats result in violence or flight, given that interethnic relations have broken down and any threat is sufficient to generate a strong reaction on the part of individual group members.

For instance, if group a dominates b in country 1, a member i of a will engage in violence against rivals if $e_{a,1}^i > \tau_{a,1}$, failing which he will do nothing. Consequently, a member j of the dominated group b will flee if $e_{b,1}^j > \tau_{b,1}$, failing which she will do nothing.[18] While this formulation disregards violence perpetrated by the dominated group, the simplification appears reasonable.[19]

Moreover, I implicitly assume that individuals who are more likely to engage in violence attribute similar characteristics to rivals, and are consequently more likely to flee in response to threats.

4.5   *Updating*

An agent's animosity for rivals is updated as the lagged weighted average of the most significant $(\tau^{\max})$ and most recent (τ^{t-1}) threat experienced by the group. In particular, for members of group a in country 1, $e_{a,1}^{i,t}$ takes on the value of $\phi\, e_{a,1}^{i,t-1} + (1-\phi)\, \dfrac{\tau_{a,1}^{\max} + \tau_{a,1}^{t-1}}{2}$ and can therefore increase or decrease over time depending on the severity of threats. In the runs I analyze, ϕ is set at 0.8, and agent animosity is updated every 10 time steps.

Agent strength is updated in two ways. During periods of contention it is not uncommon for state control to alternate between rivals, until one group is able to assert its power over the other. When the difference in aggregate group strength given by $\Delta_1 = |\ \hat{s}_{a,1} - \hat{s}_{b,1}\ |$ is within some bound ε of zero, the group that gains from state control (in each country)—the advantaged group—is determined randomly each step since no group clearly dominates the other, otherwise the advantaged group is simply the dominant group—the group whose aggregate strength exceeds that of its rival. The inclusion of a stochastic component to determine group advantage captures the initial struggle for state control along ethnic lines—characterized by the absence of clear victor—as well as subsequent struggles for state control as the aggregate strength of rival groups evens out.

The strength of every member of the advantaged group, say group a in country 1 is augmented by $\delta_{a,1} = \dfrac{\lambda}{P\alpha_{a,1}}$ each step, where λ is a constant and $P\alpha_{a,1}$ is the size of the group. In contrast, the strength of every member of the disadvantaged group, now group b in country 1, decreases by a constant γ each step, with probability proportional to the number of members of a

who engaged in violence against members of b. I set λ equal 0.1 and γ equal to 0.001 in the runs analyzed below.

Finally, as the population of refugees grows, the regime at home is likely to face greater external challenges to its rule.[20] In other words, as the total number of refugees (agents who flee) from either group within a country increases, ε (the bound within which the dominant group will be selected randomly) increases proportionally by a constant η. Specifically, if the number of refugees exceeds half the group size, then ε^t takes on the value of $\varepsilon^{t-1} + \eta$. For the runs analyzed, $\varepsilon^{t=0}$ is set at 35, and η is set equal to 0.01

4.6   *Sequence of Events*

Agent activity begins in country 1. For the purpose of discussion, assume that group a is found to dominate b. Members of a and b calculate their respective threat levels $(\tau_{a,1}, \tau_{b,1})$ and the former engage in violence (or refrain) while the latter flee (or stay put). Agent strength (s), animosity (e) and ε are updated (as specified). Then activity shifts to country 2. Assume that group b dominates a in country 2. Members of a and b in country 2 calculate their respective threat levels $(\tau_{a,2}, \tau_{b,2})$ and the latter engage in violence (or refrain) while the former flee (or stay put). Agent strength, animosity, and ε are updated in country 2, and the aggregate strength of groups a and b is compared to determine the advantaged group. The time step ends, and play continues as specified for the next time step.

4.7   *Model Parameters*

In each run of the model, 100 agents interact over a period of 1000 time steps in each country. Whereas the size of the population and model duration remain constant, initial conditions that reflect the particularities of various dyads characterized by cross-border ethnic ties can be specified for each run of the model. First, it is possible to specify the proportion of group a (and by

implication b) in country 1 ($\alpha_{a,1}$) and in country 2 ($\alpha_{a,2}$) to determine whether a is a majority in both

countries, a minority in both countries, a majority in one and a minority in another, and/or whether

a enjoys population parity in one or both countries. And second, it is possible to specify the initial

aggregate strength of groups a and b ($\hat{s}_{a,1}, \hat{s}_{b,1}, \hat{s}_{a,2}, \hat{s}_{b,2}$) independently in each country. As a

result, group a may dominate group b in one, both, or neither country.[21]

5.0   Description of Experiments

I run four experiments with a variety of initial conditions to test my intuition about the mechanisms

that generate various patterns of ethnic domination in contiguous states. In the first experiment,

which serves largely as a control case, the proportion of ethnic groups is equal in each country. The

second experiment is distinguished by rival majorities, such that group a is a majority (85% of the

population) in country 1 and a minority (15% of the population) in country 2. In the third and

fourth experiments group a enjoys majority status in both countries with the proportion of a

increasing from 70% in experiment 3 to 85% in experiment 4.

In each experiment, I explore seven different cases of *initial* ethnic domination: in case 1,

the groups are of equal strength in both countries (=, =); in case 2, a dominates b in country 1, b

dominates a in country 2 (a, b); in case 3, b dominates a in country 1, a dominates b in country 2 (b,

a); in case 4, a dominates b in countries 1 and 2 (a, a); in case 5, a dominates b in both countries with

more extensive domination in 2 (a, a^+); in case 6, b dominates a in countries 1 and 2 (b, b); and in

case 7, b dominates a in both countries with more extensive domination in 2 (b, b^+).

The column headings in Table 1 designate the experiments, whereas the row headings

designate the cases. In the table, results are expressed in terms a snapshot of the dominant group at

the end of a model run, whereas the Figures (2-5), which plot changes in aggregate group strength

over the course of a representative run of the model, depict the process of domination. In each of

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these plots, the *x*-axis denotes time, the *y*-axis denotes aggregate group strength, the black lines

denote groups in country 1, and the solid lines denote group *a*.

Insert Table 1 here
Initial Conditions and Experiments Results

Insert Figure 2 here
Deviations from Ethnic Parity

Consider the example of experiment 2-case 1. In Table 1, the initial conditions for this

example indicate that group *a* constitutes 85% of the population in country 1 and 15% of the

population in country 2 (0.85, 0.15), and that the strength of rival groups *a* and *b* is equivalent in

both countries (=, =), whereas the results indicate that group *a* dominates in country 1 and that

group *b* dominates in country 2 (*a*, *b*) at the end the run. Plot 2.1 in Figure 2 depicts the trajectory of

group relations for this example, and suggests the following: group *a* dominates in country 1

whereas *b* dominates in country 2 from the initial stages of the run; in country 1 group *a*'s aggregate

strength increases over time while group *b*'s aggregate strength decreases over time, resulting in

progressively greater domination; by contrast, in country 2 the aggregate strength of group *b*

decreases over time while the aggregate strength of group *a* increases over time, resulting in less

secure domination.

6.0   Experiment Results

Face Validity

To begin with, I note that the model behaves as expected with variation in results based on

(aggregate) initial strength and relative group sizes. For instance, where group size and initial

strength levels are equivalent, no clear pattern of domination exists (as illustrated by plot 1.1 in

Figure 2). In contrast, introducing ethnic majorities and minorities or skewing the initial strength

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level in favor of particular groups, results in markedly different patterns of domination (as evidenced

by plots 1.2, 2.1 and 2.2 in Figure 2). In plot 1.2, group size is equivalent while initial strength levels

favor group *a* in country 1 and group *b* in country 2. Domination by *a* over *b* in country 1 resembles

domination by *b* over *a* in country 2, with neither dominant group enjoying a particularly large

advantage. In plot 2.1, initial strength levels are equivalent across groups, although group *a* is now a

majority in country 1 and a minority in country 2. Majorities *a* and *b* dominate their rival minorities,

although domination by group *a* in country 1 is more comprehensive than domination by group *b* in

country 2. And in plot 2.2, initial strength levels favor majorities *a* and *b* in countries 1 and 2

respectively, resulting in a similar pattern of majority domination in both countries.

Insert Figure 3 here
Plots of Representative Model Runs

Variation in Patterns of Ethnic Domination

From the discussion above, it follows that the model generates various patterns of majority and

minority domination. For example, the model captures: (*i*) domination by kin ethnic majorities (a1

and a2) in contiguous states (see plot 4.3 in Figure 3); (*ii*) domination by rival ethnic majorities (a1

and b2) in contiguous states (see plot 2.6 in Figure 3); (*iii*) domination by an ethnic minority (b1)

when ethnic kin (b2) in the contiguous state constitute a dominated minority (see plot 3.3 in Figure

3); (*iv*) domination by rival ethnic minorities (b1 and a2) in contiguous states (see plot 2.3 in Figure

3); and (*v*) domination by kin ethnic minorities (b1 and b2) in contiguous states (see plots 3.6 and 4.6

in Figure 3). While each of these outcomes may be analyzed more extensively with the model, I

examine one such outcome (*v*) in greater detail to determine whether the model captures the

trajectory of minority domination in Rwanda and Burundi.

Capturing Minority Domination in Rwanda and Burundi

To do so, I set the model parameters to capture the initial advantage kin minorities enjoy over majorities in both countries, with the caveat that the minority in country 2 enjoys a greater advantage over the majority than its counterpart in country 1 (b, b^+). These initial conditions generate the following results.[22]

In country 2 (see plot 4.7, figure 4) no clear pattern of domination exists until event 100, after which the minority group b begins to dominate and consolidate its advantage over the majority group a. In contrast, the majority a in country 1 initially dominates the minority b, with the threat posed by the latter growing steadily until event 700. At this time, the minority challenges the majority and effectively begins to dominate, resulting in minority rule in countries 1 and 2. Thus whereas group b's initial advantage in aggregate strength leads to minority rule in country 2 early in the run, the narrower advantage in b's aggregate strength in country 1 only materializes much later, as in the Rwanda-Burundi dyad.[23]

These results suggest that the mechanisms incorporated into the model—threats, the resultant animosity, violence and flight mediated by group size and initial group advantage—effectively capture the *sequence* of minority domination in the Rwanda-Burundi Dyad, and that there is more to the model than a simple deterministic relationship between aggregate strength and ethnic domination.

Capturing Variation in Aggregate Animosity

A common presumption is that ethnic animosity between Hutu and Tutsi has always been high, a perspective that effectively fails to discern that animosity varies both within groups and over time, and that animosity alone is insufficient to generate violence between groups. For instance, Hutu animosity in Rwanda—linked to threat perceptions—heightened in 1963-64 after Tutsi commandos attempted to retake parts of the country and capital city; and once again with the RPF invasion in 1990 (Lemarchand 2002, Newbury 1998). In the interim, however, intergroup relations were

marked by greater cooperation—what Prunier (1995, p. 74) refers to as the "good years" under Habyarimana. Likewise, under the Micombero regime in Burundi anti-Hutu discrimination and violence peaked, whereas under Bagaza's Second Republic references to ethnic identity were forbidden and animosity (and violence) reached an all time low.

In Figure 4, plot 4.7 is juxtaposed with a second plot that depicts changes in the aggregate level of group animosity ($\hat{e}$) in each country over the same run of the model. The second plot indicates that group animosity is clearly not constant during the struggle for domination, with notable peaks in the aggregate animosity of group a (events 20, 100, 250, 300, 450, 650, 800-1000) and b (20, 350, 550, 800-1000) in country 1, and peaks in aggregate animosity of group a (events 200, 300, 400, 600, 950) and group b (events 150, 300, 500, 900) in country 2. In the interim, animosity tends to return to a baseline level for each group, reflecting the variation in interethnic tension characteristic of Rwanda and Burundi.

Underlying these dynamics, are changes in group animosity driven by domestic and external events. Groups that experience violence become more antagonistic, and in turn become more likely to react to threats and perpetrate violence when the balance of power is in their favor. As groups struggle to establish control over the state, and violence is perpetrated by both sides, animosity reaches its peak. Note that the peaks in aggregate animosity of both groups in country 2 occur relatively early in the run, close to the point at which group b begins to dominate a. After this point, there is less variation in animosity as domination by b becomes progressively more entrenched.[24] In country 1, the pattern is reversed. Animosity cycles, albeit with far less variation, until late in the run. By event 700, both groups begin to display increasing animosity (and little or no cycling) as the transition from majority to minority domination begins. Note also that prior to this point, the variation in animosity occurs at a much higher baseline in country 2 than it does in country 1.

The variation in group animosity depicted in Figure 4 occurs in other runs of the model as well, albeit with volatility or consistency that reflects the level of threats, ensuing violence, and patterns of domination particular to each model variant.

Insert Figure 4 here
Aggregate Strength and Average Animosity Under Minority Domination

General Implications for Minority Domination

Finally, the model results indicate that an initial advantage in aggregate group strength is a necessary but not sufficient condition for minority domination. In particular, if only one minority group enjoys an initial advantage in aggregate strength, holding all else constant, then the likelihood that it will dominate the rival majority in its home state is closely tied to its population share. Where group proportions resemble those in Rwanda and Burundi, as in experiment 4, minority domination in either country is unlikely (see plot 4.3 in Figure 4) given a narrow initial advantage in strength enjoyed by one minority group. As the proportion of both minority groups increases, in experiments 2 and 3 for instance, the likelihood of minority domination increases commensurately (see plots 2.6 and 3.3 in Figure 4).

Insert Figure 5 here
The Uncertain Future of Minority Domination

Extending Model Duration

Based on the analysis, an ensuing question concerns what the future bodes for the two Tutsi dominated regimes in Rwanda and Burundi? Extending the duration of the model beyond that reported in the paper (i.e. running the model for 3000 events as depicted in Figure 5), suggests that minority rule will be consolidated in both countries, although this exercise is not offered as a

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prediction of any sort.[25] In actuality, relations between the Tutsi regimes have been characterized by little cooperation—despite the existence of Hutu militias in the DRC who actively cooperate against them—given that the regime in Burundi harbors a strong distrust of Rwanda's regional ambitions and remains embittered about Rwanda's earlier support for sanctions against it.   As this scenario unfolds, the conditions for interethnic cooperation also appear to be grim. There is apparently little hope for ethnic balance within the Tutsi dominated militaries, a pre-condition for physical and cultural security of the remaining Hutu population. Likewise, if the past is any indication, elections that produce power-sharing agreements are precisely the catalysts that result in violence, setting the cycle of rebellion and repression in motion again.

7.0   Discussion

The framework developed in this paper explores how group learning, group size, and initial group advantage affect patterns of ethnic domination in dyads characterized by cross-border ethnic ties. Using an agent based model, I examine how a combination of external and internal threats causes violence domestically; violence causes casualties, increases interethnic animosity, and generates refugee flows, which in turn contribute to further violence, reinforce or undermine disparities in power, and shape patterns of ethnic domination.   By varying the size and initial advantage of rival groups, the model generates a range of outcomes, among which are those that bear a strong resemblance to the trajectories of ethnic domination in Rwanda and Burundi where the puzzle concerns why Rwanda's Hutu majority was able to take control of the state from the dominant Tutsi minority but unable to retain power in the long run, and why Burundi's dominant minority was not dislodged from power by the dominated Hutu majority.

The model developed in this paper may be easily tailored to analyze the dynamics of ethnic domination in numerous other dyads characterized by cross border ethnic ties: (*i*) *majority-minority*

dyads which include Hindus in India and Pakistan, Albanians in Albania and the former Yugoslavia; (*ii*) *minority-minority* dyads comprised of Kurds in Iran, Iraq and Turkey, Tamils in India and Sri Lanka, or Taureg in Mali and Niger; and *majority-majority* dyads such as Greek in Greece and Cyprus. The model may also be extended in a number of directions. As such, one may explore how regional dynamics increase or decrease the ability of a state to deter violence and assure the security of vulnerable groups domestically, or explore variation in patterns of ethnic domination within a single country, using the state or city as a unit of analysis. Other potential extensions involve the incorporation of a spatial dimension to explicitly analyze refugee flows—the conditions that induce flight, how flight affects power relations domestically and in the host country, and the conditions under which refugees return. Finally, it is possible to specify aggregate power in a more complex manner, endogenize the salience of domestic relative to external threats as well as the weight placed on the most recent versus most significant threat to a group.

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Table 1
Initial Conditions and Experiment Results

| Initial conditions (t=0)			$\alpha_{a,1}$, $\alpha_{a,2}$ group a's proportion in country 1, group a's proportion in country 2			
			0.5, 0.5	0.85, 0.15	0.7, 0.7	0.85, 0.85
$\bar{s}_{a,1}$, $\bar{s}_{b,1}$ dominant group in country 1	$\bar{s}_{a,2}$, $\bar{s}_{b,2}$ dominant group in country 2		Experiment 1	Experiment 2	Experiment 3	Experiment 4
0.5, 0.5 =	0.5, 0.5 =	Case 1	=,=	a, b	a, a	a, a
0.5, 0.3 a	0.3, 0.5 b	Case 2	a , b	a, b	a, **b**	a, a
0.3, 0.5 b	0.5, 0.3 a	Case 3	b, a	**b, a**	**b**, a	a, a
0.5, 0.3 a	0.5, 0.3 a	Case 4	a, a	a, **a**	a, a	a, a
0.5, 0.3 a	0.5, 0.1 a+	Case 5	a, a	a, **a**	a, a	a, a
0.3, 0.5 b	0.3, 0.5 b	Case 6	b, b	a, b	**b, b**	**b, b**
0.3, 0.5 b	0.1, 0.5 b+	Case 7	b, b	**b**, b	**b, b**	**b, b**

Note: The proportion of group *a* (and by implication *b*) in country 1 is given by $\alpha_{a,1}$, and in country 2 by $\alpha_{a,2}$. An agent's initial strength (s^i) is drawn from a normal distribution with specified mean ($\bar{s}$) and standard deviation (0.1) to determine the initial pattern of domination in each country. I use the following notation to describe patterns of domination: "=" indicates that no group dominates the other; "a" indicates that group a dominates group b; "b" indicates that group b dominates group a; "a+" indicates that group a dominates group b to a greater extent in one country than in the other; and "b+" indicates that group b dominates group a to a greater extent in one country than in the other. Results from the experiments are expressed in terms of the dominant group in each country following the notation introduced here. Cases of minority domination appear in bold print.

Figure 1
Domination in Dyads with Cross-Border Ethnic Ties: 1965-2000

		State 2			
		Majority	Minority	*Total*	*Year*
State 1	Majority	106	13	*119*	*1965*
		119	15	*134*	*1975*
		116	9	*125*	*1985*
		138	16	*154*	*1995*
		145	15	*160*	*2000*
	Minority	2	2	*4*	*1965*
		2	2	*4*	*1975*
		3	1	*4*	*1985*
		5	2	*7*	*1995*
		5	1	*6*	*2000*

Note: The table was constructed with information from the MAR dataset and depicts the number of dyads in each category of group domination over time. Two variables *polstat* and *gc11* were combined to reflect the political status of an ethnic group in a geographically contiguous dyad. The asymmetry in he majority-minority domination cells is due to the difference between dyads in which the majority and minority belong to different ethnic groups, and dyads in which they are ethnic kin.

Figure 2
Deviations from Ethnic Parity

0.5, 0.5　　　　　　　　　　　　　　　　　　**0.85, 0.15**

=,=

plot 1.1　　　　　　　　　　　　　　　　　　　plot 2.1

a, b

plot 1.2　　　　　　　　　　　　　　　　　　　plot 2.2
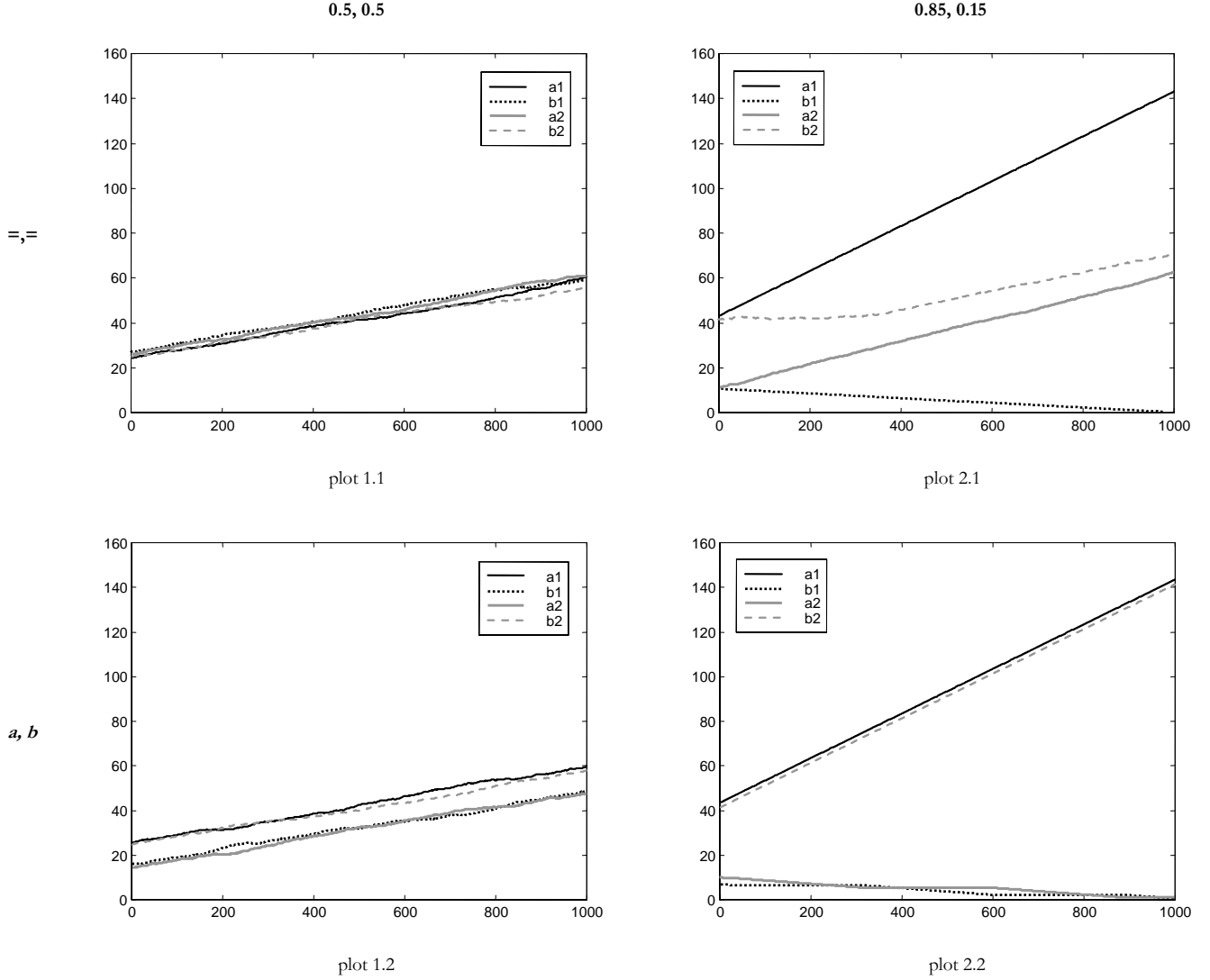
Note: The column headings designate values of $\alpha_{a,1}$, $\alpha_{a,2}$ (experiments 1 and 2), whereas the row headings designate the initial pattern of group domination (cases 1 and 2). Each plot depicts the result for a single representative model run for 1000 timesteps. Time is represented on the *x*-axis, and aggregate group strength is represented on the *y*-axis. The black lines denote groups in country 1, and the solid lines denote group *a*. Default values for all other parameters are as follows: the weight placed on domestic versus external shocks (θ) is set equal to 0.5; the weight agents place on the most significant versus the most recent episode of interethnic violence (ϕ) is set equal to 0.8; the numerator (λ) which determines the rate at which group fitness increases is set equal to 0.1; the decrease in fitness of agent who are attacked (γ) is set equal to 0.001; the bound within which the dominant group will be selected randomly (ε) is set equal to 35; and the increase in this bound (η)when the number of refugees exceeds half the group size is set equal to 0.01.

Figure 3
Plots of Representative Model Runs

0.85, 0.15

b, a

plot 2.3

0.7, 0.7

plot 3.3

0.85, 0.85

plot 4.3

b, b

plot 2.6

plot 3.6

plot 4.6
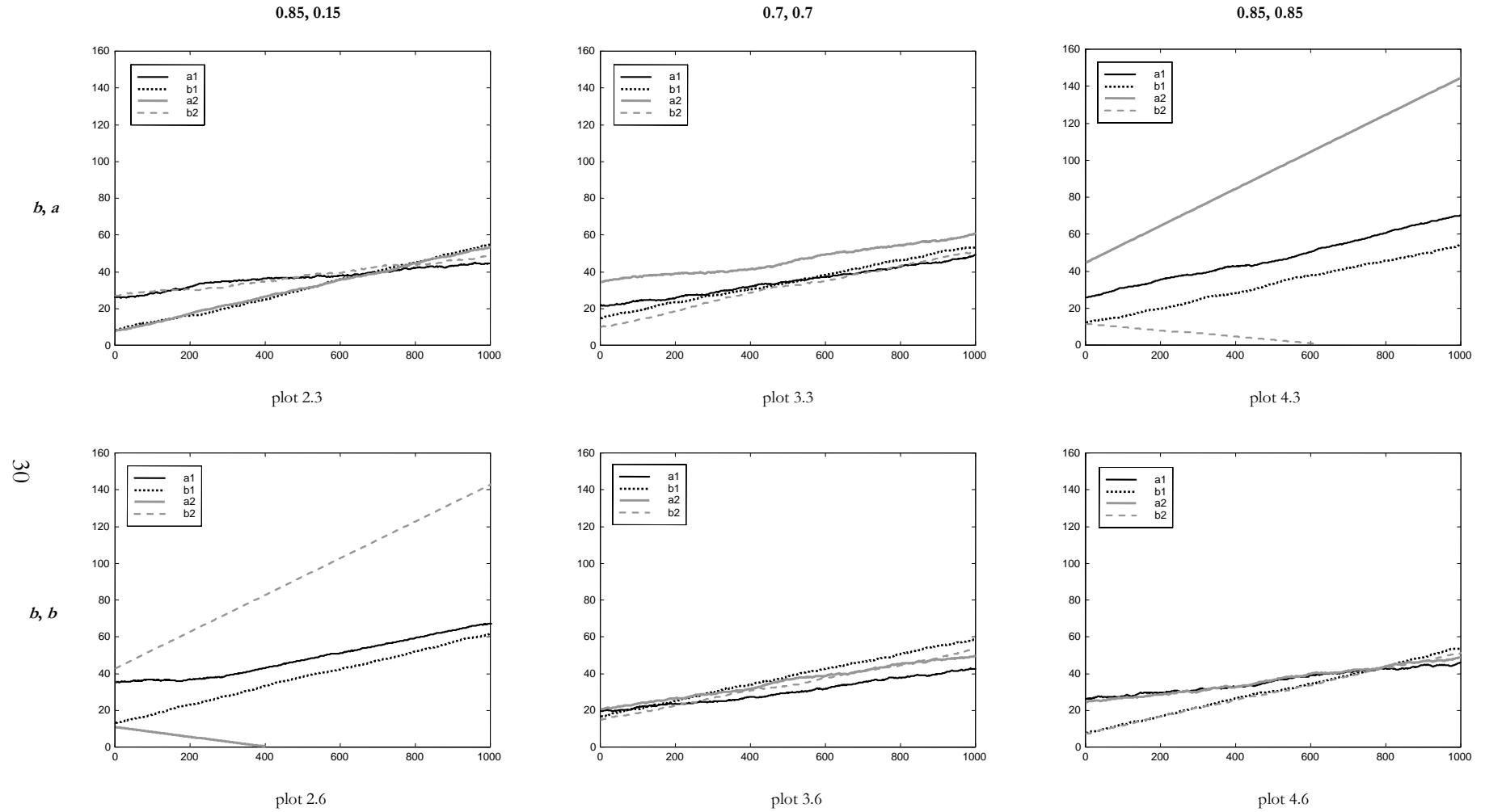
Note: The column headings designate values of $\alpha_{a,1}$, $\alpha_{a,2}$ (experiments 2-4), whereas the row headings designate the initial pattern of group domination (cases 3 and 6). Each plot depicts the result for a single representative model run for 1000 timesteps. Time is represented on the *x*-axis, and aggregate group strength is represented on the *y*-axis. The black lines denote groups in country 1, and the solid lines denote group *a*. Default values for all other parameters remain unchanged.

Figure 4
Aggregate Strength and Aggregate Animosity Under Minority Domination

plot 4.7

corresponding plot for aggregate animosity
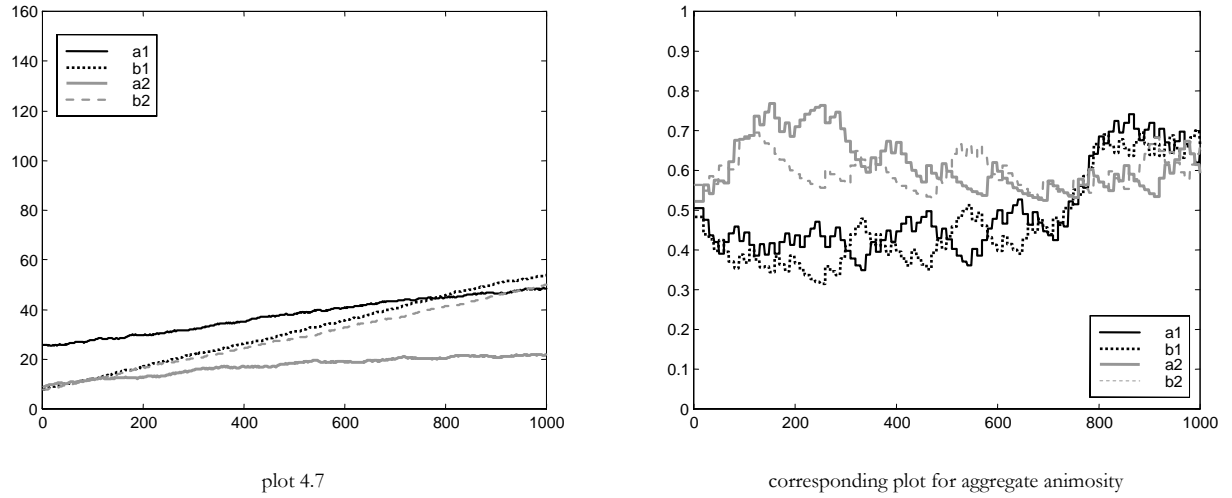
Note: In the left-hand plot, the *x*-axis denotes time and the *y*-axis denotes aggregate group strength. In the right-hand plot, the *x*-axis denotes time and the *y*-axis denotes average animosity of group members for nominal rivals. In this run of the model, 100 agents interacted (in each country) over a period of 1000 time steps; $\alpha_{a,1}$ and $\alpha_{a,2}$ equal 0.85; the initial pattern of domination is given by (b, b^+); default values for all other the parameters remain unchanged.

Figure 5
The Uncertain Future of Minority Domination
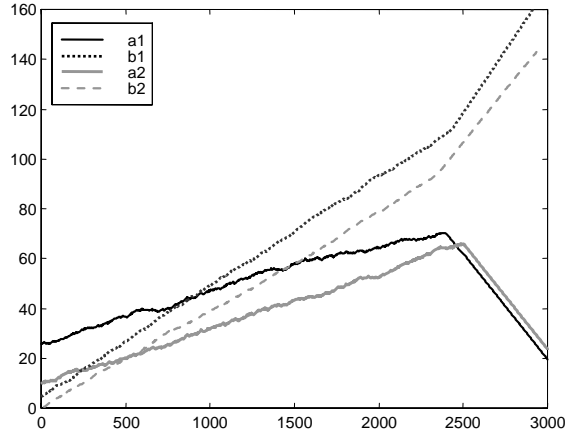
Note: In the plot, the *x*-axis denotes time and the *y*-axis denotes aggregate group strength. In this run of the model, 100 agents interacted (in each country) over a period of 3000 time steps; $\alpha_{a,1}$ and $\alpha_{a,2}$ equal 0.85; the initial pattern of domination is given by (b, b^+); default values for all other the parameters remain unchanged.

Notes

[1] I favor the term "cross-border ethnic ties" to the term "transnational ethnic alliance" used by Davis and Moore (1997), given that an explicit trans-boundary alliance need not exist between ethnic kin in contiguous states.

[2] In contrast to the argument advanced in this paper—that the same mechanisms can explain the initial asymmetry and subsequent symmetry in ethnic domination across these cases—Uvin (1999, pp. 253, 264) argues that the "dynamics that led to violence in Rwanda and Burundi are textbook cases of entirely different *processes* [my emphasis]" and serve as "archetypical examples of very different categories of violence." According to Uvin, systematic discrimination along ethnic lines led to violence in Burundi, whereas in Rwanda, the Hutu elite manipulated ethnicity to maintain state control, given that popular discontent was a class (intra-Hutu) and not an ethnic issue. Uvin therefore argues that the narrower social base of the minority-dominated regime in Burundi effectively precluded legitimization and required greater repression, resulting in fundamentally different dynamics of violence in both countries.

[3] In both Rwanda and Burundi, a Hutu majority—roughly 85 percent of the population—was pitted against a Tutsi minority—roughly 14 percent of the population—yielding *divergent* outcomes. In Rwanda, the Tutsi monarchy was overthrown in a revolution preceding independence, leading to majority rule for approximately 32 years. Whereas in Burundi, the Tutsi minority attained power in the years following independence and consolidated its control of the state shortly thereafter. As a result, events in Rwanda effectively presaged a catastrophic outcome for Burundi's Tutsi—life under majority rule—whereas subsequent events in Burundi effectively developed into a counterfactual for Rwanda's Hutu—that of life under minority rule. This asymmetric balance was altered by events in 1994, when the Tutsi minority regained control of Rwanda leading for the first time to minority rule in both countries. Apart from ethnic composition, similarities between the two countries abound. According to the Economist Intelligence Unit (2002), Rwanda has a territory of 26,338 sq km, a population of 8.3 million, a population density of 311/sq km, and a per capita GDP of $201, while Burundi's territory is 28,000 sq km, its population 6.68 million, its population density 265/sq km, and its per capita GDP $100. Whereas the per capita income of Rwanda is double that of Burundi, the figures for both

countries are among the lowest in Sub-Saharan Africa, as well as in the world. Finally, both countries were granted independence from Belgium in 1962.

[4] Heraclides (1990) lists the following assumptions to explain external involvement (or the lack thereof) in secessionist movements: (1) normative regimes against involvement; (2) neocolonialism; (3) instrumentalism; (4) cheap talk; (5) diffusion; (6) vulnerability; (7) *realpolitik* or security concerns. Carment and James (1995) parse the early literature on the international dimensions of ethnic conflict into the following categories: (1) conflict extension—how a specific conflict spreads to outside parties; (2) interactive processes—the emergence of linkages between dissatisfied groups and the international system; and (3) conflict transformation—the conversion of domestic strife to an interstate ethnic conflict. Finally, Jenne (2004) parses the literature on minority claim making with respect to secessionism and irredentism into the following arguments: (1) primordialist; (2) group traits; (3)economic disparities; (4)instrumentalism; (5) ethnic fears or grievance.

[5] A more comprehensive analysis by Englebert, Tarango, and Carter (2002) finds that the partition (dismemberment) and merging (suffocation) of preexisting political groupings are respectively associated with inter-state disputes and intra-state disputes, wheras Kornprobst (2002) finds that border disputes in the Horn of Africa are more likely to escalate into war than in West Africa, where the territorial integrity norm is embedded in society.

[6] Saideman's case studies (1997) and quantitative analysis (2002) find more support for the ethnic ties argument, with the caveat that identity—the nature of the ethnic cleavage defining the groups in question—matters less, and that groups in high risk neighborhoods—neighborhoods prone to separatist conflicts that need not involve kin—are more likely to receive external support.

[7] Group traits such as size and spatial dispersion affect the ease of rescue by ethnic brethen, likelihood of discrimination by host governments, and proclivity to pursue secessionism. See Van Evera (1994).

[8] Woodell (2004, p. 220) acknowledges this limitation.

[9] When the Hutu majority dominated Rwanda and the Tutsi minority dominated Burundi, both *inter-ethnic* and *intra-ethnic competition* led to widespread *domestic* violence against nominal ethnic rivals, rather than a marked change in foreign policy, such as increased support for ethnic kin abroad reflected at the level of interstate relations. In general, "successful" violations of the territorial integrity norm in Africa have been limited at best, with nine of eleven territorial wars since 1963 defused by the OAU. See Zacher (2001, p. 231).

[10] For examples of state learning in the international relations literature, see Cederman (2001), Goldsmith (2003), Knopf (2003), Mor and Maoz (1999), Reiter (1995). For a discussion and critique of scholarship on "ethnic" or "intrastate" security dilemmas, see Roe (1999).

[11] While most ethnic conflicts remain non-violent (Fearon and Laitin 1996), the framework developed in this paper applies to the subset of conflicts in which violence does ensue. A pressing question in the literature concerns the conditions under which ethnic conflicts will turn violent and why violence varies in scale and duration. For work that specifically addresses this question, see Bhavnani and Backer (2000).

[12] Note that while the animosity of victims increased in the context of Rwanda and Burundi as a result of violence and persecution, this statement may be less valid in other national contexts. For instance, Stalin repressed many minorities in a manner that (arguably) intimidated rather than polarized them. The same could be said of the U.S. suppression of native Americans. I am grateful to Robert Axelrod for noting these exceptions.

[13] The Tutsi were arguably the more "advantaged" group in pre-independence Rwanda, yet failed to capture the state.

[14] Building upon Allport's (1954) inquiry into prejudice and intolerance driven by opportunities for contact between ethnic groups, as well as Blalock's (1967) thesis that in an environment of rising insecurity and competition ethnic differences can become the basis of fear and distrust, Massey, Hodson, and Sekulic (1999) conduct an empirical analysis of tolerance levels within and outside 'ethnic enclaves'. In order to analyze average tolerance levels they identified three local living situations: (*i*) where the majority is numerically dominant; (*ii*) where the minority group is dominant; and (*iii*) where neither group has numerical superiority. They tested their model using survey data (N=13,442) from the former Yugoslavia collected in period between 1989 and 1990. Their survey results indicate that majority group members living in enclaves dominated by a minority group are more intolerant than in any other situation, whereas minority tolerance is high in ethnically mixed and majority-dominated areas, and lowest in minority-dominated areas. See Massey, G., R. Hodson, and D. Sekulic. (1999).

[15] Londregan et al. (1995) note that minority led regimes use military rule as a shield against majority threats due to greater apprehension on their part, and are more likely to retain power while leaders from the largest ethnic groups are more likely to lose power. However, their conjecture that ethnic majorities may enjoy enough confidence of political control to risk intra-ethnic succession, while minorities dare not risk a change in individual leaders, does not bear out in Rwanda where intra-ethnic succession occurred by force, or in Burundi which experimented with inter-ethnic power-sharing in 1993, 1998, and 2003. For a more detailed discussion, see Prunier (1995).

[16] This assumption bears a resemblance to power transition theory from the international relations literature, which argues that the likelihood of great power conflict is highest when economic, political, and military capabilities are evenly distributed and lowest when there is an imbalance in these capabilities. See Organski, A.F.K. and J. Kugler. (1980).

[17] One could alternatively argue that if animosity is low, only a major threat will evoke any reaction on the part of group members. However, this formulation is not consistent with my reading of low animosity which suggests a more restrained reaction to major provocations, and high animosity which suggests a less restrained reaction to even minor provocations.

[18] To retain the simplicity of the model, I make a number of assumptions. First, I avoid regenerating agents. As such, each cycle of violence (and flight) begins with the same pool of agents, whose strength is updated to reflect events in the previous period. Second, agents from the dominated group do not attack members of dominant group. Third, I assume that there is no difference in the organizational basis of violence— which requires coordination—and flight—which is more likely to be individualized. And fourth, the model does not include an explicit spatial component. As a result, refugee flight only indirectly affects the probability of regime change in the home country of the refugees, rather than directly changing the proportion of ethnic groups (and increasing animosity) in the host country. Each of these simplifications may be addressed as extensions to the basic model developed here.

[19] In the cases that motivate this paper, violence perpetrated by the dominant Tutsi minority overshadowed violence perpetrated by the dominated Hutu majority in Burundi, and vice versa in Rwanda. One notable exception involves the violence that followed Ndadye's assassination in 1993, after which Hutu militias went on a rampage in Burundi killing anywhere between 10,000-50,000 Tutsi.

[20] One problem with this formulation is that the dominant group often encourages refugees to flee in order to weaken domestic opposition. As noted earlier, in the interest of simplicity I do not incorporate population movement into this version of the model, given that this change in turn requires others which add to the complexity of model mechanisms. For instance, if refugees leave and relocate in the neighboring country, one also needs to determine when they return, why some return and not others, how many return, etc. Were movement to be incorporated, then refugee flight to a country in which ethnic kin dominate could also increase the power of their ethnic group in the host country.

[21] Note that while agents are assigned individual values for animosity and strength, for the most part the dynamics are expressed in terms of what happens to all the agents in one group or another. Thus while a systems dynamics approach may seem more reasonable for this problem, such an approach would necessarily limit my ability to explore the effects

of intragroup cleavages, particularly with respect to antagonism, as well as introduce movement or an explicit spatial component into the model—tasks I reserve for future research on this topic.

[22] The mechanisms and initial conditions that comprise the model are substantiated by the empirical details of these cases. With respect to mechanisms, *external threats* such as the Hutu Revolution in Rwanda contributed significantly to state capture by the Tutsi minority in Burundi (Adekanye 1996, Lemarchand 1994a, 1994b, Scherrer 2002, Uvin 1999), where Hutu uprisings in 1988, 1991, and 1995 and their subsequent suppression by the Tutsi military all had momentous effects in Rwanda. *Internal threats* also featured prominently, given that Hutu animosity heightened in 1990 (Lemarchand 2002, Newbury 1998) with the advent of multi-party politics in Rwanda, the scale of violence increasing gradually at first and then markedly, culminating in genocide. In a similar vein, violence in Burundi was closely tied to any shift in power away from the ruling Tutsi minority, with episodes of violence following the Hutu rebellion in 1965, an abortive coup attempt in 1972, political concessions to Hutu by Buyoya in 1987, and national elections in 1993. Not unexpectedly, episodes of violence in Rwanda and Burundi generated massive *refugee flows* which were decisive in fueling ethnic animosity, either by supporting the minority-led regime or by instigating violence locally or across the border.

With respect to initial conditions, in pre-colonial Rwandan society Tutsi *advantage* was institutionalized leading to more rigid social stratification on the basis of ethnicity, with the result that by 1959, 43 of 45 chiefs and 549 of 559 sub-chiefs were Tutsi (Chretien 1997; Prunier 1995). This advantage was eroded prior to independence by the Belgians, who replaced Tutsi with Hutu chiefs, before unveiling a new administrative structure that divided the country into 229 communes headed by 210 Hutu and only 19 Tutsi burgomasters. Burundi achieved independence as a constitutional monarchy, and the Hutu-Tutsi ethnic cleavage assumed political and social significance more gradually than in neighboring Rwanda. More specifically, of the 130 chiefs in 1929, only 30 were Tutsi and only 27 were Hutu, with the majority being Batare (41)—the colonial favorites—and Bezi (35) (Lemarchand (1994a, p. 66). Yet in marked contrast to the pre-independence power structure, by 1964, 83 of 133 high ranking civil service posts were staffed by Tutsis, while only 43 were staffed by Hutu (*ibid*, p. 66). Finally, while *group size* initially favored the Hutu majority in Rwanda, it paradoxically worked against the Hutu majority in Burundi. Indeed, greater threat perception on the part of Burundi's Tutsi minority appears to have keenly influenced the initial drive to capture the state as well as the rapid consolidation of minority rule, which in turn affected the regime's ability to withstand internal or external challenges—a lesson that appears to have been lost on Rwanda's majority-run regime.

[23] In particular, it appears that the difference in aggregate strength in both countries is initially smaller than ε, leading to a struggle for domination that favors the minority whose aggregate strength increases at a faster rate than that of the majority when in power.

[24] Beyond event 1000 when group b unambiguously dominates group a in country 2, b's animosity falls and remains steady at 0.4 while a's animosity rises and remains steady at 0.8; once group b unambiguously dominates a in country 1, the same pattern is replicated.

[25] Extending the duration of the model to 3000 events for all the remaining cases tested in this paper has no effect on patterns of domination in experiment 1, whereas in experiment 2 this change reinforces the patterns of domination for cases 3-7 reported in Figure 2. In experiment 3, extending the length of the run results in minority domination in both countries for cases 1-5 (between event 2000 and 2500), and reinforces patterns of domination for cases 6-7 reported in Figure 2. For experiment 4, extending the length of the run has no effect on patterns of domination for cases 1-5, whereas the effect for case 6 is similar to that reported for case 7 in Figure 4.