

## Online Appendix

### “Border Settlement, Commitment Problems, and the Causes of Contiguous Rivalry”

#### Summary

#### Part A. Supplement to in-text material

##### A.1 Graphic illustration of survival function for Models 1-3 in Table 2

Figure A.1 below presents our main substantive results visually. In this figure, we graph the survival function for each of the three models in Table 2 (see manuscript) under two conditions: possessing unsettled and settled borders. The survival function estimates the probability that the observation will “survive” past time  $t$ . For our purpose, “surviving” past time  $t$  refers to the likelihood that the two states under observation will remain (i.e., survive as) non-rivals, given that they have not become rivals prior to time  $t$ .<sup>1</sup> Thus, lower survival probabilities (i.e., lines that approach the x-axis) signify an increased likelihood of rivalry formation. Because the panels in Figure 1 derive from the models reported in Table 2 (see manuscript), the control variables are accounted for in the panels as well. All control variables are held at their mean values, with the status of the border settlement being the only factor allowed to vary.

Panels 1-3 of Figure 1 correspond to Models 1-3 of Table 2 respectively. The first panel of Figure 1 therefore plots the survival function for dyads with settled and unsettled borders using the KGD rivalry data (Model 1, Table 2). As the plot demonstrates, there are distinctly different survival functions when the dyad has unsettled, as opposed to settled, borders. For those dyads with unsettled borders, the likelihood of “surviving” (i.e., not becoming rivals), given that they have not yet experienced rivalry, is significantly lower than for those states with settled borders. Stated differently, neighboring states are at increased risk of rivalry onset when they have unsettled (rather than settled) borders. A similar pattern appears in the remaining panels, which examine the enduring and strategic rivalry populations respectively.

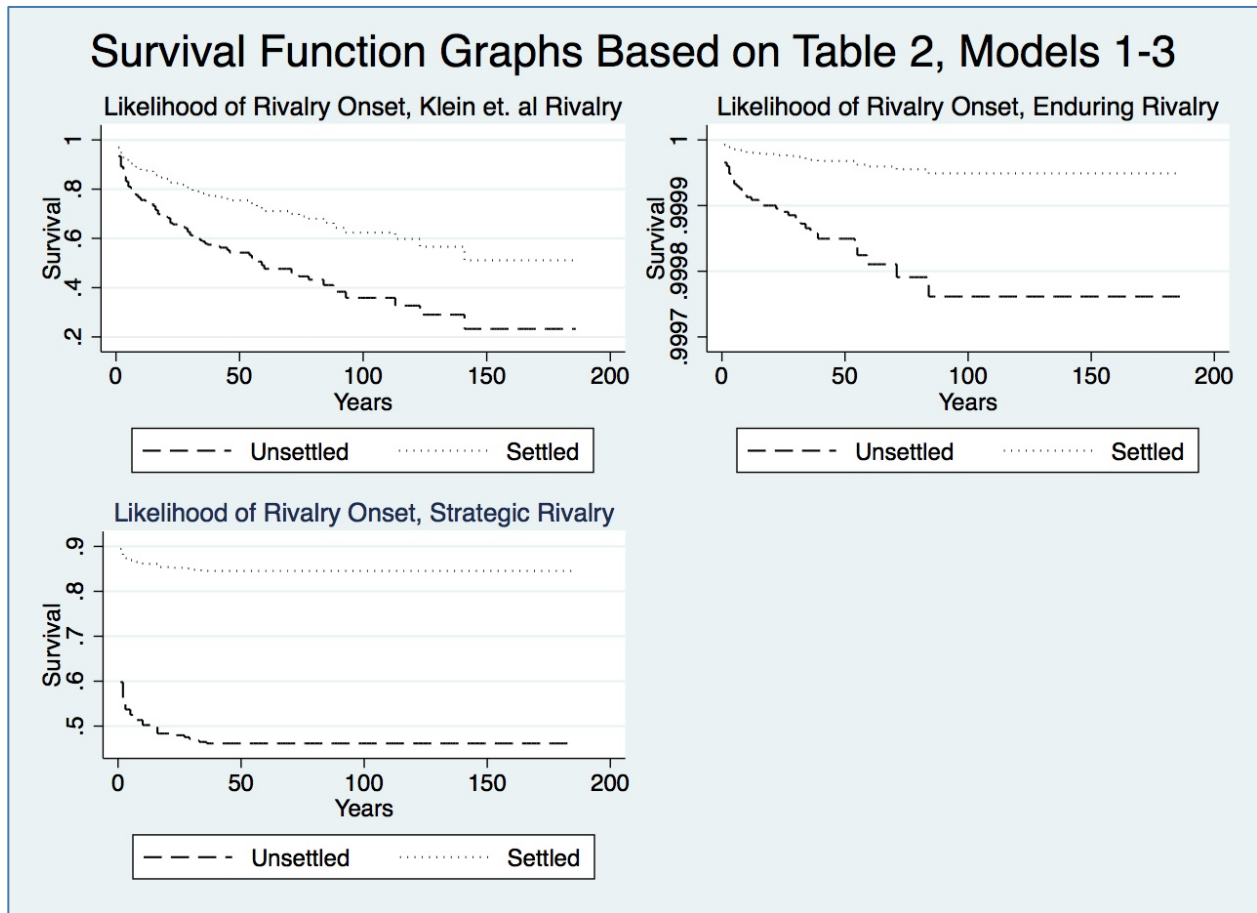
Of course, the figures clearly display some variation. For example, the initial probability of survival (i.e., non-rivalry) starts much lower for strategic rivals with unsettled borders (Panel 3) than for the other types of rivalry (Panels 1-2). Furthermore, the slopes of the survival functions vary slightly depending upon the population being examined and seem to reach equilibrium at different probabilities for rivalry onset as well - although we cannot draw any comparative conclusions about these equilibria values.<sup>2</sup> Despite such differences, we find a clear pattern that is consistent with our theoretical expectations and its predictions: neighboring states with unsettled borders are at a significantly higher risk of experiencing rivalry onset than those with settled borders.

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<sup>1</sup> Conversely, we could speak of “failure,” which is the opposite of survival. Failure denotes rivalry onset. As success falls, failure rises.

<sup>2</sup> The number of dyads in the sample decreases significantly in the later years of each graph, which causes the confidence bands around the point estimates to increase.

Figure A.1



## A.2. Defense of our decision to focus only on contiguous dyads.

Part of our argument is that the path to rivalry is fundamentally different for contiguous and non-contiguous states -- i.e., that there are (at least) two paths to rivalry. Although non-contiguous states can and do have territorial disagreements, our theoretical argument is specifically about *border territory*, rather than territorial conflict more generally, and non-contiguous states do not have borders to contest or settle. Thus, our argument applies only to contiguous dyads.

Nonetheless, one could empirically test whether there exist separate paths to rivalry for contiguous and non-contiguous dyads by pooling these dyad groups together in the same sample and then interacting all variables -- including our border settlement variable -- with a dichotomous, contiguity variable. Unfortunately, this cannot be done. The contiguity and border settlement variables are (naturally) highly correlated (0.82), making it impractical to include them in the same statistical model. Additionally, because only contiguous states can have settled borders, the border settlement constituent term and the interaction term between settlement and contiguity are perfectly correlated. As an alternative, we therefore estimated a pooled model in which we interacted (land) contiguity with all control variables but excluded the settlement variable. The findings of this model demonstrate quite convincingly that the traditional variables associated with rivalry behave differently across contiguous and non-contiguous states populations. Given these two potentially different paths, and that our theory only specifies a mechanism for rivalry onset among contiguous states, we do not include non-contiguous dyads in this work.

### A.3. Brief discussion of Owsiak's (2012) coding rules.

Owsiak (2012) follows four general coding rules. In brief, these are:

- A border is coded as settled beginning in the year after such an agreement is signed. If states settle their mutual border in pieces, the year after which they settle the last segment serves as the settlement year.
- (If applicable) the involved states must ratify the agreement before settlement occurs.
- New states that result from colonial boundaries or the break-up of larger states (e.g., Yugoslavia) may contest their borders during the first year after their independence. If no contestation occurs, the relevant border is considered settled by the colonial or administrative agreement under the principle of *uti possidetis*. On the other hand, any contested border remains unsettled until the involved states sign an agreement to settle it.
- States that leave and re-enter the international system (often a result of international wars) cannot "unsettle" their borders.

Additional information on these principles (as well as specific examples of each) can be found in Owsiak (2012).

## Part B. Robustness Checks

### B.1. Controlling for ethnicity

In this model, we replicate Table 4 from the manuscript, controlling for whether ethnic minorities living in a border area have support from and ties to an ethnically dominant group in another (in our case, neighboring) state (Huth 1996). These data come from Huth and Allee (2002).

The model considers the possibility that ethnicity is an omitted variable that affects both rivalry onset and border settlement. The table below illustrates that our results hold in the presence of this ethnic variable. Ethnic ties to those living in a border area increase the likelihood of rivalry onset across all three models, *but this increase in likelihood is never statistically significant*. Settled borders (unsettled borders), however, continue to reduce (raise) significantly the likelihood of rivalry onset – even after accounting for possible ethnic ties.

Table B.1. Cox Model of Rivalry Onset, 1919-1995

Variables	Model 1 KGD Rivalry Hazard Ratio	Model 2 Enduring Rivalry Hazard Ratio	Model 3 Strategic Rivalry Hazard Ratio
Power endowment	2.451* (0.919)	8.400** (4.072)	2.627* (1.284)
Joint democracy	0.310* (0.158)	0.166 (0.168)	0.140 (0.144)
Major power	1.051 (0.329)	1.023 (0.449)	0.370 (0.253)
Joint alliance	0.768 (0.182)	0.606 (0.224)	1.177 (0.398)
Parity	0.945 (0.319)	0.768 (0.411)	2.702* (1.078)
Civil war	1.898 (0.701)	0.514 (0.337)	1.670 (0.589)
Civil war * ln(time)	1.093 (0.158)	1.317 (0.378)	1.272 (0.251)
Independence	1.545 (0.494)	3.601** (1.607)	2.949** (0.792)
World war shocks	0.396** (0.110)	1.046 (0.434)	0.512* (0.172)
Ethnicity	2.066 (0.818)	1.126 (0.564)	2.004 (0.984)
Observations	9,613	10,081	10,448
Log-likelihood	-564.956	-188.674	-615.213
$\chi^2$	87.88**	55.29**	77.21**

Notes: Robust standard errors in parentheses. Two tailed tests: \*  $p < 0.05$ , \*\*  $p < 0.01$

## B.2. Controlling for dyadic trade (pure economic motivations)

In this model, we replicate Table 2 from the manuscript, controlling for dyadic trade. These data come from Barbieri, Keshk, and Pollins (2009).

The model considers the possibility that trade levels affect both rivalry onset and border settlement. As the results below demonstrate, our main findings hold. Trade does not seem to significantly affect the likelihood of rivalry onset, except in the case of enduring rivalries (Model 2). Nonetheless, settled borders (unsettled borders) continue to reduce (raise) significantly the likelihood of rivalry onset – even after we account for dyadic trade.

Table B.2. Cox Model of Rivalry Onset, 1816-2001

Variables	Model 1 KGD Rivalry Hazard Ratio	Model 2 Enduring Rivalry Hazard Ratio	Model 3 Strategic Rivalry Hazard Ratio
Border settlement	0.318** (0.081)	0.105** (0.038)	0.192** (0.061)
Joint democracy	0.273* (0.138)	0.270 (0.329)	-
Major power	1.348 (0.547)	1.570 (0.963)	0.557 (0.403)
Joint alliance	0.936 (0.236)	0.685 (0.274)	0.717 (0.264)
Parity	1.534 (0.663)	1.025 (0.656)	2.289 (1.127)
Civil war	1.227 (0.616)	0.582 (0.440)	2.563* (1.070)
Civil war * ln(time)	1.298 (0.214)	1.511 (0.438)	0.927 (0.206)
Independence	0.795 (0.418)	0.440 (0.300)	1.672 (0.682)
World war shocks	0.863 (0.339)	1.255 (0.584)	1.016 (0.494)
Cold war terminate	1.916 (1.227)	0.000** (0.000)	0.794 (0.863)
Cold war * ln(time)	0.869 (0.198)	0.479 (0.341)	1.144 (0.459)
Power distribution	0.161 (0.155)	0.101 (0.130)	-
Power distribution * ln(time)	1.583 (0.461)	1.944 (0.661)	-
Trade	1.000 (0.000)	1.000** (0.000)	1.000 (0.000)
Observations	8,394	10,131	7,886
Log-likelihood	-382.015	-140.469	-187.056
$\chi^2$	73.84**	11916.39**	55.18**

Notes: Robust standard errors in parentheses. Two tailed tests: \*  $p < 0.05$ , \*\*  $p < 0.01$

### B.3. Dropping dyads that enter the system as rivals with unsettled borders

In this model, we replicate Table 2 from the manuscript, dropping all cases in which a dyad enters the dataset (i.e., international system) as rivals with unsettled borders. As the table shows, our results hold for all rivalry measures. Settled borders (unsettled borders) continue to reduce (raise) significantly the likelihood of rivalry onset.

We suspect, however, that many of the dropped cases involve rivalries also triggered by unsettled borders. To gain additional insight, we therefore researched the 26 strategic rivalries dropped from Model 3 below. We focus our efforts here because Thompson and Dreyer's (2012) *Handbook of International Rivalries, 1494-2010* provides a narrative for *each* strategic rivalry.<sup>3</sup> Table B.3.2 presents the results of this research; this table lists the dyad, the dyad's year of entry into the international system (according to the Correlates of War Project's State System Membership Data), whether border territory triggered the rivalry that began at the dyad's entry into the international system, and the details of whatever issue triggered the rivalry. Of the 26 offending strategic rivalries, 23 (88.46%) begin as the direct result of contestation over border territorial issues. Nonetheless, three of these – Saudi Arabia-Iraq, North/South Vietnam, and India-Pakistan – might be considered borderline cases. Thus, a more conservative estimate is that 20 of the 26 (or 76.92%) offending strategic rivalries begin as a direct result of contestation over border territorial issues. This suggests that the vast majority of the dyads dropped in the robustness check should be included. When we include those 20 dyads in the analysis once again, our results strengthen further. We present these final results in Model 4 of Table B.3.1 below.

Combined with the models controlling for ethnicity (see Table B.1 above) – i.e., the most likely explanation for what would cause rivalry onset and unsettled borders to occur pre-independence – we are generally confident that unsettled borders yield rivalry onset as we argue.

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<sup>3</sup> A similar resource does not exist for the Klein, Goertz, and Diehl (2006) rivalries or enduring rivalries.

Table B.3.1. Cox Model of Rivalry Onset, 1816-2001

Variables	Model 1 KGD Rivalry Hazard Ratio	Model 2 Enduring Rivalry Hazard Ratio	Model 3 Strategic Rivalry Hazard Ratio	Model 4 Strategic Rivalry (Modified) Hazard Ratio
Border settlement	0.556* (0.128)	0.280** (0.098)	0.344** (0.092)	0.254** (0.061)
Joint democracy	0.384* (0.180)	1.101 (0.920)	0.221 (0.217)	0.181 (0.169)
Major power	1.174 (0.334)	1.824 (0.861)	0.373* (0.185)	0.529 (0.203)
Joint alliance	0.785 (0.182)	0.899 (0.379)	0.918 (0.331)	1.009 (0.317)
Parity	1.831 (0.685)	2.287 (1.457)	4.311** (1.701)	3.769** (1.353)
Civil war	1.156 (0.508)	0.470 (0.301)	1.662 (0.555)	1.389 (0.396)
Civil war * ln(time)	1.277 (0.192)	1.583 (0.380)	1.281 (0.295)	1.366 (0.303)
Independence	1.536 (0.654)	1.020 (0.633)	0.708 (0.329)	0.739 (0.290)
World war shocks	(0.754 (0.250)	1.053 (0.534)	1.220 (0.390)	1.274 (0.335)
Cold war terminate	2.495 (1.434)	-	0.326 (0.281)	0.268 (0.224)
Cold war * ln(time)	0.920 (0.187)	-	1.709 (0.580)	1.871 (0.616)
Power distribution	1.317 (1.555)	3.629 (4.080)	2.474 (1.303)	1.571 (0.789)
Power distribution * ln(time)	0.852 (0.334)	0.728 (0.279)	1.044 (0.336)	1.164 (0.370)
Observations	11,759	14,239	10,820	10,840
Log-likelihood	-524.673	-177.437	-346.038	-449.089
$\chi^2$	42.38**	27.94**	73.13**	93.17**

Notes: Robust standard errors in parentheses. Two tailed tests: \*  $p < 0.05$ , \*\*  $p < 0.01$



Table B.3.2. The Origins of Strategic Rivalries Dropped from Table B.3.1., Model 3.

Dyad	Year of Entry (Rivals with Unsettled Borders)	Border Territory Caused the Rivalry (Y/N)	Details of What Triggered the Rivalry
Belize-Guatemala	1981	Y	Territorial claim formerly between Britain and Guatemala, in which Guatemala claimed sovereignty over all of Belize.
Guyana-Venezuela	1966	Y	Conflict over the Esquibo region.
France-Germany	1816	Y	Prussian territorial expansion began the rivalry in 1756. The rivalry continued through when the COW data begins in 1816.
Germany-Poland	1918	Y	Dispute over claim to Upper Silesia, which Poland occupied after a plebiscite favoring Germany.
Germany-Austria	1816	Y	The Prussian seizure of Silesia in 1740. The rivalry continued through when the COW data begins in 1816.
Poland-Russia	1918	Y	Poland tries unsuccessfully to obtain the reinstatement of its pre-World War I borders.
Hungary-Yugoslavia	1918	Y	Hungary lost border land to Yugoslavia after WWI.
Hungary-Romania	1918	Y	Hungary lost border land to Romania after WWI.
Russia-Ottoman Empire	1816	Y	Russian expansion toward the Black Sea prompted a war in 1768 that generated the rivalry. The rivalry continued through when the COW data begins in 1816.
Ghana-Ivory Coast	1960	Y	Ghana announced just before independence that the Ivory Coast should be united and integrated with Ghana.
Ghana-Togo	1960	Y	Ghana announced just before independence that Togo should be united and integrated with Ghana.
Ethiopia-Somalia	1960	Y	Control over the Ogaden region.
Morocco-Algeria	1962	Y	A dispute over border territory containing valuable resources that resulted from poor delimitation by the French (during colonial rule).
Iran-Iraq	1932	Y	Issues concerning the placement of their common border.
Iraq-Kuwait	1961	Y	Iraq claims sovereignty over all of Kuwait, based on provinces as defined by the Ottoman Empire.
Iraq-Saudi Arabia	1932	Y*	The British delineated the border prior to independence to the disadvantage of Saudi Arabia. At the same time, an ethnic competition existed between the Saudis and Hashemites. This competition derives from the Saudi expulsion of the Hashemites from Hajiz and the latter's attempt to reclaim it.
Saudi Arabia-Jordan	1946	Y	The Saudi expulsion of the Hashemites from Hajiz.
Saudi Arabia-Yemen	1990	N	Although the border remained un-delimited at independence, the main driver involves Saudi preferences for a weak Yemeni state and Yemen's attempts to counter Saudi actions.
Israel-Jordan	1948	Y	Conflict centered on West Bank/East Jerusalem.
Israel-Egypt	1948	N	Conflict centers at first on support for Palestinians fighting against Israelis.
Israel-Syria	1948	Y	Conflict centers on border territory.
North/South Yemen	1967	N	Although the border remained un-delimited at independence, an ideological conflict (Marxist vs. leftist military regime).
Afghanistan-	1947	Y	Afghanistan began the rivalry over a claim to border territory.

Pakistan			
North/South Vietnam	1954	Y*	South Vietnam refused to allow elections after the First Indochina War, generating two ideologically distinct governments each claiming sovereignty over all of Vietnam.
India-Pakistan	1947	Y*	Muslim fears about being a minority within a predominantly Hindu state set the back-drop for conflict over Kashmir.

Notes: \* Potentially questionable cases of border territory driving rivalry.

Source: Thompson, William R., and David R. Dreyer (2012) *Handbook of International Rivalries, 1494-2010*. Washington, DC: CQ Press.

#### B.4. Controlling for the onset of Militarized Interstate Disputes within each dyad

In this model, we control for the onset of dyadic Militarized Interstate Disputes. Because the Klein, Goertz, and Diehl (2006) rivalry and enduring rivalry measures operationalize rivalry through MIDs, we run this model predicting strategic rivalry only (Colaresi, Rasler, and Thompson 2007). The model below therefore corresponds with Model 3, Table 2 within the manuscript text.

The model ensures that settled borders are not simply producing more MIDs, which then yield rivalry. Thus, we use this model to separate whether it is the *issue* driving rivalry onset or simply militarized behavior. As demonstrated below, our results hold. MID onset (i.e., militarized conflict) increases the likelihood of rivalry onset significantly. Despite this relationship, however, settled borders (unsettled borders) continue to reduce (raise) significantly the likelihood of strategic rivalry onset.

Table B.4. Cox Model of Rivalry Onset, 1816-2001

Variables	Model 1 Strategic Rivalry Hazard Ratio
Border settlement	0.304** (0.076)
MID onset	6.447** (1.680)
Joint democracy	0.139 (0.141)
Major power	0.679 (0.267)
Joint alliance	1.072 (0.326)
Parity	3.398** (1.166)
Civil war	1.380 (0.382)
Civil war * ln(time)	1.289 (0.298)
Independence	0.778 (0.340)
World war shocks	1.070 (0.299)
Cold war terminate	0.454 (0.314)
Cold war * ln(time)	1.536 (0.454)
Power distribution	1.103 (0.659)
Power distribution * ln(time)	1.397 (0.468)
Observations	10,846
Log-likelihood	-456.059
$\chi^2$	206.36**

Notes: Robust standard errors in parentheses. Two tailed tests: \*  $p < 0.05$ , \*\*  $p < 0.01$

## B.5. Controlling for the onset of the *first* Militarized Interstate Dispute in each dyad

In this model, we control for the onset of the *first* Militarized Interstate Dispute in each dyad. Once again, because the Klein, Goertz, and Diehl (2006) rivalry and enduring rivalry measures operationalize rivalry through MIDs, we run this model predicting strategic rivalry only (Colaresi, Rasler, and Thompson 2007). The model below therefore corresponds with Model 3, Table 2 within the manuscript text.

The model ensures that settled borders are not simply producing an initial MID, which then yields rivalry. Thus, we use this model to separate whether it is the *issue* driving rivalry onset or simply militarized behavior. As demonstrated below, our results hold. The first MID onset increases the likelihood of rivalry onset significantly. Despite this relationship, however, settled borders (unsettled borders) continue to reduce (raise) significantly the likelihood of strategic rivalry onset.

Table B.5. Cox Model of Rivalry Onset, 1816-2001

Variables	Model 1 Strategic Rivalry Hazard Ratio
Border settlement	0.261** (0.064)
First MID onset	26.207** (13.025)
Joint democracy	0.145* (0.127)
Major power	0.522 (0.200)
Joint alliance	1.123 (0.323)
Parity	3.432** (1.214)
Civil war	1.373 (0.382)
Civil war * ln(time)	1.312 (0.278)
Independence	0.730 (0.286)
World war shocks	1.266 (0.320)
Cold war terminate	0.445 (0.299)
Cold war * ln(time)	1.671 (0.494)
Power distribution	1.550 (0.750)
Power distribution * ln(time)	1.202 (0.400)
Observations	10,846
Log-likelihood	-459.844
$\chi^2$	141.95**

Notes: Robust standard errors in parentheses. Two tailed tests: \*  $p < 0.05$ , \*\*  $p < 0.01$

## B.6. The effects of salience on border settlement

In this model, we change the dependent variable to border settlement – in order to determine whether more salient border territory decreases the likelihood of border settlement as our argument predicts. The border settlement data come from Owsiak (2012).

The results presented below are consistent with our argument. Border territory that possesses strategic or economic value is significantly less likely to be settled in a given dyad-year than territory without such value.

Table B.6. Conditional Logistic Regression of Border Settlement, 1919-1995

Variables	Model 1 Coefficients
Total negotiations over border territory (running sum)	0.853** (0.133)
Third-party assistance to resolve border territory (running sum)	1.162** (0.243)
Salience (strategic or economic)	-3.394** (0.520)
Joint democracy	1.369* (0.541)
Joint alliance	0.192 (0.349)
Major power	0.803 (0.411)
Parity (ln of cap. ratio)	0.208* (0.090)
Dyad life	-0.216** (0.068)
Dyad life <sup>2</sup>	0.005 (0.003)
Dyad life <sup>3</sup>	-0.000 (0.000)
Constant	-1.264** (0.395)
Observations	1,661
Log-likelihood	-216.743
$\chi^2$	111.24**

Notes: Robust standard errors in parentheses. Two tailed tests: \*  $p < 0.05$ , \*\*  $p < 0.01$

## B.7. Replicating the results of Tables 3 & 4 (main manuscript) using ICOW data.

In this model, we replicate the results presented in Tables 3 & 4 of the main text using data from the Issue Correlates of War (ICOW) project (provisional data version 1.01). As with the Huth and Allee (2002) data used within the main manuscript, the ICOW data collects information on the strategic and economic endowments of territorial claims throughout the entire world – albeit for the expanded time period of 1816-2001. To be consistent with the main text, we limit the territorial claims under consideration to those contesting the homeland of at least one disputant in contiguous dyads.

The results presented below mirror those presented in the text exactly, thereby offering additional support our argument. As Table B.7.1 shows, border territory that possesses strategic or economic endowments is significantly less likely to exist within contiguous dyad-years containing settled (as opposed to unsettled) borders. This finding holds across all three rivalry measures and therefore strongly suggests that power endowments inhibit settlement attempts as we propose. Furthermore, Table B.7.2 demonstrates that these power endowments significantly increase the likelihood of rivalry onset. This also holds across all three indicators of rivalry, supporting our claim that power endowments drive the relationship we see between unsettled borders and the emergence of contiguous rivalries.

Table B.7.1. Border Settlement Status, ICOW Power Endowments, and Territorial Claims (Klein, Goertz, and Diehl Non-Rival Dyad Years)

	Strategic Importance (Row Percentage)		Economic Importance (Row Percentage)		Either Strategic or Economic Importance (Row Percentage)		Total
	No	Yes	No	Yes	No	Yes	
Unsettled Borders	1,530 (53.91%)	1,308 (46.09%)	1,629 (57.40%)	1,209 (42.60%)	1,259 (44.36%)	1,579 (55.64%)	2,838
Settled Borders	11,098 (92.65%)	881 (7.35%)	10,953 (91.44%)	1,026 (8.56%)	10,776 (89.96%)	1,203 (10.04%)	11,979
Observations		14,817		14,817		14,817	
$\chi^2$ (1 d.f.)		2700.00*		2100.00*		3100.00*	
$\gamma$ (A.S.E.)		-0.830 (0.0008)		-0.776 (0.010)		-0.8365 (0.007)	

Notes: \*  $p < 0.01$ .

Table B.7.2. Cox Model of Rivalry Onset, 1816-2001 (using ICOW endowment data)

Variables	Model 1 KGD Rivals Hazard Ratios	Model 2 Enduring Rivals Hazard Ratios	Model 3 Strategic Rivals Hazard Ratios
Power endowment	2.852** (0.545)	6.525** (1.974)	2.876** (0.706)
Joint democracy	0.412* (0.186)	0.197 (0.192)	0.141* (0.138)
Major power	1.010 (0.268)	1.916 (0.693)	0.818 (0.306)
Joint alliance	0.931 (0.202)	0.734 (0.264)	1.332 (0.385)
Parity	1.451 (0.479)	1.450 (0.740)	3.036** (1.158)
Civil war	0.965 (0.354)	0.462 (0.272)	1.292 (0.450)
Civil war * ln(time)	1.383* (0.179)	1.569* (0.338)	1.345 (0.258)
Independence	1.631 (0.568)	2.825** (1.083)	1.000 (0.367)
World war shocks	0.825 (0.212)	1.347 (0.450)	1.455 (0.374)
Observations	11,972	14,473	13,768
Log-likelihood	-594.530	-221.153	-361.398
$\chi^2$	62.41**	56.43**	53.23**

Notes: Robust standard errors in parentheses. Two tailed tests: \*  $p < 0.05$ , \*\*  $p < 0.01$