Integrating and Testing Models of Rivalry Duration

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Theory: Previously separate explanations of rivalry termination based in political shocks, security, and domestic politics can be integrated in a single model of bargaining between rational decision-makers who have multiple goals. Hypotheses from the previously separate models should be tested together.
Hypotheses: Security concerns, issue salience, democracy and democratization, regime change, and political shocks affect the probability of rivalry termination, and, in turn, rivalry duration. Duration dependence may also affect rivalry duration.
Methods: A parametric hazard model with a Weibull specification and time-varying covariates is estimated on a data set of sixty-three enduring rivalries generated from the latest militarized interstate dispute data.
Results: Domestic political factors and issue salience are the most likely causes of rivalry termination. Rivalries also appear strongly and positively duration-dependent, meaning that the hazard rate in rivalries increases over time, and thus that rivalry termination tends to accelerate as rivalries continue. Findings on political shocks and security concerns are sensitive to operationalization. Some causal relationships appear to differ between pre- and post-WWII rivalries.

The study of the duration and termination of so-called "enduring rivalries" has been underway for a number of years. Rivalries are dyads with a long history of repeated conflict, within which conflicts are connected over time. Rivalries are more conflictual than typical dyads. A number of interesting questions about rivalries have been posed in the literature, including why they begin, how conflicts within them are likely to be connected, and why and when they are likely to end. In this paper I concentrate on the third of these questions and combine three previously developed theoretical models of rivalry termination into one framework. In addition, I conduct an improved set of empirical analyses testing the hypotheses that emerge from those models.

An enduring rivalry ends when both states in the rival dyad stop using or threatening to use force in an attempt to change the status quo and either agree to a compromise resolution of the disputed issues or give up claims concerning them. The end of a rivalry marks a noticeable turning point in

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dyadic relations: the states stop treating each other as primary security and policy threats and engage in more cooperation. Typically, the end of a rivalry is marked by public acknowledgement (perhaps a treaty or policy announcements) that issues have been settled and that a rapprochement has been reached. Once an issue settlement has been accepted by state leaders and the government supports a rivalry settlement, rivalries typically remain settled because of (1) the cost to reputation of reneging on international agreements, and (2) the domestic cost of building a new coalition after switching policy.

The general need to examine enduring rivalries and rivalry termination as a specific phenomenon seems quite clear. The sudden and unexpected end of the U.S.-Soviet rivalry and the widely-held belief that serious conflict between the two countries is unlikely points to the need for a better understanding of the end of long-term conflicts. Broadly speaking, most disputes do not occur "out of the blue," but occur instead in a context in which the primary antagonists have significant hostile interaction over a long period of time. For example, before 1985, only 21 percent of militarized disputes and 16 percent of interstate wars occurred in isolation; 45 percent of such disputes and over half of the wars occurred within the context of enduring rivalry (Goertz and Diehl 1992, 1995). Moreover, wars emerging from enduring rivalry were more deadly than those that did not. Ten out of twelve of the most severe international wars (ranked by battle deaths in Small and Singer, 1982), including World Wars I and II, started as conflicts between rivals. After an enduring rivalry ends and issues are settled, the probability of further conflict drops significantly (see Goertz and Diehl 1992 for further discussion of the basic phenomenon of enduring rivalries).

In this paper I build upon three recent studies testing three different theoretical explanations for rivalry duration and termination (Bennett 1996; Bennett 1997a; Goertz and Diehl 1995). These studies offer explanations for rivalry termination based in state security concerns, domestic politics within rival states, and political shocks, respectively.[1] Unfortunately, the theoretical and empirical analysis of each explanation was performed separately; each of these studies used statistical methods that made particular and potentially inappropriate assumptions about the underlying rivalry duration process. As a result, we cannot be confident about the robustness of the results that have been presented. In addition, the theoretical models developed have been presented as quite distinct. This paper offers a model that integrates these

[1]Other studies have dealt with enduring rivalries as well. For instance, Rock (1989) examined four cases of rivalry around 1900 to explore rapprochement between Great Powers, while other recent works have examined the end of the Cold War with an eye towards drawing theoretical conclusions (e.g., Lebow and Risse-Kappen 1995). While these studies suggest plausible hypotheses about important cases that could be generalized and tested in further work, they have not attempted to do so using the population of enduring rivalries and so are not of prime importance to this study.

theoretical models within one rational framework and then presents a number of ways that the methods used to test theories of rivalry termination can be improved. The results presented here make clear that modifying the statistical techniques used for analysis and combining theoretical models have important effects on the substantive conclusions drawn about the effects of variables on rivalry termination. In particular, the analysis suggests that enduring rivalries are positively duration-dependent, even after accounting for other explanations of rivalry termination, and that domestic politics and issue salience receive robust support in the face of theoretical integration, new data, and statistical improvements.

1. Integrating Models of Rivalry Termination

At least two different underlying theoretical models have been used in explanations of rivalry termination. The models of security and domestic political concerns in rivalries developed in Bennett (1996) and Bennett (1997a) both assume underlying rational state leaders. By contrast, the political shock model developed in Goertz and Diehl (1995) focuses on a change in the political landscape as a necessary condition for rivalry termination without discussing rationality. Empirical support has been found in separate analyses for the hypotheses that followed from both general models. In particular, it has been found that mutual threats, a poor security situation, the presence of nonterritorial issues, polity change, democracy, territorial changes, and civil wars are associated with rivalry termination. However, these models and hypotheses have been examined separately and have neither been integrated into a single theoretical model nor tested together. In this section I discuss how these models can be viewed as fitting together in a single rational model.

The two models developed in Bennett (1996) and Bennett (1997a) assume that state leaders are rational actors, that is, goal seekers who hope to maximize the net gains resulting from their decisions. The first of these models assume that leaders want to achieve favorable outcomes on the issues which lie at the heart of their rivalries while at the same time maintaining and improving their state's military security situation. Given these goals, the rivals then bargain over how the rivalry should be settled. A rivalry is expected to end when the trade-off between the security gains from ending a rivalry and the gains or losses of an issue settlement is such that the net utility of settlement is greater than the utility of continuing the rivalry. The second model focuses on a third goal of state leaders, namely leaders' desire to remain in power internally. Many different domestic groups hold preferences about foreign policy outcomes, including whether a rivalry should continue or end. If such groups hold the key to a leader's remaining in power domestically, they might well have a critical influence on foreign policy.

Given the importance of domestic groups, rivalry termination is expected when there is a change in leadership reflecting new preferences and new groups backing a leader.

The political shock model developed in Goertz and Diehl (1995) did not explicitly assume either rationality or any other particular mode of decision making. Rather, the model centered on the argument that relations in a rival dyad are likely to continue on the same course unless there is a major change in the political landscape. Political shocks (abrupt changes to normal political interactions in a dyad) disrupt normal relations, forcing a shakeup that may (but does not have to) lead to rivalry termination. More explicitly, systemic, regional, and national-level shocks may open up new opportunities for conflict or conflict resolution through a number of avenues. According to Goertz and Diehl, different shocks may: (1) sever patron-client relationships and lead to less resource availability for clients to engage in conflict; (2) remove existing patterns of international interactions; (3) give rise to new states in the system; (4) affect national capabilities and subsequently states' abilities to compete with a rival or the balance of power; and/or (5) lead states to either turn inward or outward in a search for legitimacy.

These three rather different models can be subsumed under a larger bargaining model that treats state leaders as rational actors with multiple goals (not just one or two). The two models of rational decision making in rivalries can be combined simply by assuming that leaders would simultaneously prefer to "win" versus their rival on the issues at stake, ensure state security, and remain in power. The relative weight of achieving success in these three areas in an overall assessment of utility may vary from state to state or leader to leader without reducing the general applicability of the model. For instance, one leader may have security as her primary goal and even risk her domestic political position to obtain more security, while another leader may be willing to give up security to secure his domestic political power. More broadly, the relative weighting of domestic, security, and "victory" goals might differ systematically by regime type, time period, or type of international system. As long as state leaders are at least somewhat concerned with all areas, or as long as some leaders focus on each goal, hypotheses about how concerns and conditions in each specific subarea affect rivalry termination should be supported in the aggregate.

Political shocks dovetail neatly with the general idea that rational actors assess the costs and benefits of continued rivalry to make decisions about their termination. Shocks cannot have an autonomous effect on rivalry independent of decisions. Unless one state is conquered by another and so ceases to be an actor, there is always some decision or set of decisions associated with the end of a rivalry. Goertz and Diehl's list of mechanisms for change can be seen as a set of specific *variables* affected by the occurrence of a

shock, which in turn are relevant inputs to the decision process. For instance, changes in national capabilities, resources, the presence of patron-client ties, the presence of new states, and the creation or decline of alliances and alignments all affect the expected utility of different options for decision makers. Shocks operate simply by changing the utility of different options substantially, enough sometimes to make seeking an end to a rivalry appear rational. This view removes the argument that political shocks are unique and necessary conditions for rivalry termination. Rather, shocks are simply times that substantive variables—perhaps several of them—happen to change so much that decisions are strongly affected. Perhaps the only time variables change sufficiently to affect decisions are after shocks, but this is an empirical question rather than a necessary assumption.

Given this perspective, a model of bargaining in rivalries between actors with multiple goals can continue to serve as an overall model of rival behavior. From a bargaining perspective, rivals are seen as making successive offers to one another about issue settlements based on the costs and benefits to them of continuing versus ending the rivalry. When the costs to a state (in terms of security and domestic political payoffs) of continuing a rivalry surpass the benefits, a state is likely to make a more favorable settlement offer to its rival. As the offered settlement becomes more favorable, the receiving state becomes more likely to accept the settlement and end the rivalry. Rivalries are expected to end when conditions (and in turn, offers) are such that the net utility associated with accepting a given settlement offer and ending a rivalry becomes greater than the utility of continuing it. Changes in particular variables reflecting domestic politics and security conditions (possibly following a political shock) will increase the probability of rivalry termination at particular times.

The bargaining model points out one aspect of political shocks that may need to be explored further in future work. In the bargaining model, it is not simply any change in a variable that increases the odds of rivalry termination, but a change that expands the range of acceptable agreements between the rivals. At the level of generality presented by Goertz and Diehl, there is no guarantee that a shock will affect variables in this way. If some shock actually decreases the cost of continuing a rivalry for the involved states, or if it makes the rivalry more costly for one state but cheaper for the other, then the particular shock should have little effect on the probability of rivalry termination. This may help to explain why only some of the shocks examined in Goertz and Diehl (1995) appear to affect rivalry termination. This further suggests that if we reexamine shocks we may be able to better predict which shocks will positively influence rivalry termination. A world war, for instance, may increase the probability that rivalries throughout the system will end, because the war drains significant resources from most states in the sys-

tem. On the other hand, a power shock may affect only a few states near a newly powerful state or may benefit one side in a rivalry while disadvantaging the other. In this case, we might expect the global "power shock" variable to make little difference to rivalry termination. Rivals might only pursue settlement when a power shock reduces the power of both sides. Territorial changes in the system are similar in that they benefit some states while hurting others. Finally, civil war and regime change shocks are already focused on the particular states affected, and civil wars in particular make a rivalry costly for a particular state. As a result, these shocks might be expected to have more effect on rivalry termination than others.[2]

This integration of these models does not diminish their individual usefulness. The three original models focus attention on either different specific variables (such as security conditions and regime type) or on a class of variables (political shocks). These variables are at different levels of generality and so may be more or less useful for different purposes. For instance, the breadth of the "political shock" concept may lead to useful theorizing about what sorts of concrete events are "shocking" to international actors. However, considering shocks to security or to domestic stability may bring out the effects of specific elements of substantive politics. The fact that both "narrower" and "broader" concepts can be integrated into a single model provides researchers with a degree of flexibility in conceptualization and analysis.

2. Improving the Analysis of Rivalry Termination

While models of security concerns, domestic politics, and political shocks can be integrated into a single theoretical structure, we do not yet have a combined test of the multiple related hypotheses. Depending on the relationships between the variables, all or only some of the original, independently tested explanations may receive support after controlling for other explanations. The empirical component of this project will conduct such a combined test of hypotheses from different models. I also make three other specific improvements in testing by relaxing a potentially inappropriate statistical assumption that may be wrong and by using new data. Making changes in any of these areas could lead us to rethink the prior conclusions

[2]Another possibility is that even if only some shocks expand the contract range, all shocks should have a statistical effect in the aggregate. The modal decision in rivalries is "continue rivalry"; we are concerned here with the single change late in each rivalry to "settle rivalry." Both the absence of a shock and a shock that shrinks or leaves the contract range unchanged merely reinforce the modal behavior. However, the occurrence of a shock at least raises the possibility that the contract range will expand, while in the absence of a shock the contract range remains unchanged. As a result, since shocks at least offer the possibility of change, the aggregate probability of termination may increase in their presence.

that security concerns, political shocks, and domestic politics are important sources of rivalry termination.

The first improvement made here is allowing for and measuring the duration dependence present in rivalries. The statistical technique most appropriate for studying rivalry termination is duration or hazard analysis. One important feature of hazard analysis is that it can model the "duration dependence" of a process under consideration. Quite generally, and in the context of interstate rivalries, duration dependence measures whether the prospect of a rivalry terminating at any given duration rises or falls over its life. Unfortunately, earlier analyses of the causes of rivalry termination have used an exponential form as the basis for analysis, either in the context of a parametric hazard model (Bennett 1996, 1997a) or in logit analysis (Goertz and Diehl 1995).[3] Using this form makes the problematic assumption that duration dependence is not present in rivalries. This leads to two problems. First, no conclusions can be drawn about duration dependence, even though the presence or absence of duration dependence would suggest rather different processes at work in rivalries. Second, incorrectly modeling duration dependence can affect coefficient estimates on other variables, and the exponential allows no modeling of it. Only limited work has examined whether duration dependence is present in rivalries. In an analysis of a set of 712 rivalries (which includes proto-rivalries as well as enduring rivalries), Cioffi-Revilla (1998) finds that the hazard rate (prospect of rivalry termination) increases over the life of rivalries, suggesting positive duration dependence.[4] Focusing solely on enduring rivalries, Beck and Tucker (1996) also found positive duration dependence when they examined Bennett's (1996) data on rivalry termination. Moreover, Beck and Tucker found that different inferences about the effects of security concerns and issue salience on rivalry duration are drawn when duration dependence is allowed. These findings suggest both that duration dependence is likely in rivalries and that measuring it may affect our conclusions about hypotheses.

A second improvement made here is that the initial years of each rivalry are dropped from the data set. Dyad-years are excluded until the full criteria

[3]As Beck and Tucker (1996) and Beck, Katz, and Tucker (1997, 5) note, conducting logit analysis of binary, cross-sectional time-series data (such as in Goertz and Diehl 1995 and the first analysis in Bennett 1996) parallels using a duration or hazard model while assuming an exponential model.

[4]Cioffi-Revilla's analysis is concerned with characterizing dynamics within a range of rivalries, a separate, although related, question than explaining what drives rivalry termination. Two key differences of that study compared to the analysis here are that it includes many cases outside the set of "enduring" rivalries and that it characterizes duration dependence without controlling for the effects of exogenous variables. His prior findings will not necessarily be supported here, since the inclusion of variables can eliminate unexplained duration dependence and since this study focuses only on the extreme set of enduring rivalries.

for a dyad being identified as a rivalry are met. Rivalries are identified operationally by requiring the occurrence of six militarized interstate disputes (MIDs) over a 20-year period. Some prior analyses of rivalry duration have included data for rivalries beginning with the first dispute, or started with the 21st year of each rivalry. However, until both 20 years have passed and six disputes been observed, the probability of termination is actually 0.0, and in fact the dyad can not yet be considered a rivalry. The rivalry *could not* have ended during those initial years; including those data points means that irrelevant cases have been included in prior analyses.

A third statistical improvement is that robust standard errors are used to account for clustering on rivalries. Enduring rivalry data consist of a pool of individual rivalry time-series. It seems reasonable to think that there are connections between subsequent time periods within each rivalry. Unfortunately, within-rivalry connections over time and heteroskedasticity across rivalries have not been accounted for in previous studies. Conventional standard error calculations assume that the observations in the data set are independent and that the error variance is constant. Assuming this incorrectly can lead to incorrect standard error estimates and in turn to possibly mistaken inferences about variables. Here I estimate robust standard errors (Beck 1996; Huber 1967; White 1980) that take into account clustering within each rivalry.

The final set of improvements is related to the input data. Two minor changes are that the analysis uses the most up-to-date COW capabilities data and the recently released Polity III data (Jaggers and Gurr 1995) to generate key security and domestic political variables. The more important change is that I analyze a new population of sixty-three rivalries generated by applying the operationalization of "enduring rivalries" from Goertz and Diehl (1995) to the 1996 (version 2.1) release of the updated COW MID data (Jones, Bremer, and Singer 1997). This measure has been argued (Goertz and Diehl 1993) to be perhaps the best of the set of rivalry operationalizations available. Since the new MID dataset is now complete (albeit subject to minor corrections), we can hope in the future that a more stable population can be used in multiple analyses.[5] More importantly, the new MID data extends the time period that can be analyzed, corrects errors in prior versions of the data, and adds additional disputes that were overlooked previously.

[5]A number of different operationalizations of rivalry have been used over the past few years. In some ways this has been both necessary and good, since different conceptions of rivalry and different research questions may require different operationalizations, and the presence of multiple operationalizations has pointed out important underlying issues in the study of rivalries. However, it has been difficult to directly compare the results of different rivalry studies because different populations have been used.

3. Hypotheses

In this section I summarize the hypotheses that have been developed from the theoretical models discussed above. These hypotheses are tested in the main equations below. Since these explanations have all been examined in detail in earlier work, only short discussions of the arguments are presented.[6]

3.1 Security and Rivalry Termination

Level of security

Ending a rivalry will result in an improvement in a state's military security, as it reduces the hostility between the (former) rivals and allows military resources to be redirected against other enemies. This security gain is likely to be particularly important to a state when its security situation is relatively poor. As threats to a state increase, the benefits to the state from ending a rivalry in which it is involved will increase. This gives the state an incentive to make better offers to its rival and gives it incentives to accept compromise offers made by its opponent. Bennett (1996) found empirical support for this hypothesis, while Beck and Tucker (1996) found somewhat weaker support for it.

H1: The greater the level of threat faced by states (the worse their security), the greater the probability that their rivalry will end.

Common security threats

When both parties to a rivalry are concerned with a common enemy, both improve their security by ending the rivalry, and each potentially gains an ally with whom they can cooperate against their common foe. Part of this argument is captured in hypothesis 1, which focuses on a general rise in total threats. However, there may be an additional impetus contributing to the end of rivalries when there are large shared, or common, threats. Bennett (1996) found empirical support for this hypothesis, while Beck and Tucker (1996) again found somewhat smaller effects in their reanalysis.

H2: The greater the level of shared threat faced by two rivals, the greater the probability that their rivalry will end.

[6]Bennett (1996) develops three other hypotheses about the balance of capabilities, polarity, and war that suggests these variables should not effect rivalry termination. Since the variables were found not to have any effect on rivalry termination in accordance with the theory, these variables are excluded from the following tests to keep the presentation simple. If they are included, these variables are not significant, and other coefficients remain essentially the same. Similarly, Bennett (1997a) found support for the argument that polity changes imposed from outside a state should have little effect on rivalry termination. Imposed polity changes are omitted from the equations here, but again adding a variable marking them makes no difference to the results.

Issue salience

Not all issues are equally important to states. Any given level of possible security (or domestic political) gain from terminating a rivalry is weighed against the gains and losses on the issues at stake in a rivalry to give the net utility of rivalry termination and continuation. States should accept more costs when the benefits of continued bargaining are large. Since the benefits of continuing a rivalry involve issues, states should be more willing to accept costs when the issues at stake are more important. Thus rivalries involving salient issues should continue longer than those involving less salient issues. Bennett (1996) found weak empirical support for this hypothesis. After accounting for duration dependence, Beck and Tucker (1996) actually found stronger support for it.

H3: The more important the issues at stake are, the less likely it is that a rivalry will end.

3.2 Domestic Politics and Rivalry Termination

Polity change

If state leaders desire to remain in office, they will be aware of the preferences of groups backing them. As a result, national policy in both domestic and foreign affairs may be partly a result of the preferences of the leader's constituents. Once a rivalry begins, groups benefiting from the continuation of the rivalry are likely to gradually obtain additional internal influence and promote continuation of the rivalry. Groups who support compromise with the rival will likely gain a larger voice in policy making only after there is a leadership or regime change, since new leaders may be uncommitted to the same constituents. As a result, a rivalry will more likely end after a change in regime than when a regime remains in place. In its main analysis, Bennett (1997a) found empirical support for this hypothesis using Gurr's polity change measure to measure regime change (Gurr, Jaggers, and Moore 1989).

H4: A change in the leadership or political system of a rival will increase the probability that its rivalry will end, leading to a decrease in the duration of the rivalry.

Democratic states

Applying the logic underlying the democratic peace literature (e.g., Doyle 1983; Maoz and Russett 1993) to rivalries, democratic states in rivalries should be able to settle contentious issues more easily than nondemocratic states in rivalries. In particular, norms of compromise and institutional restraints restricting actions that may be taken against a democratic state's leader (such as removal by extraordinary means) can reduce the domestic

cost of compromising with a rival. If the cost of accepting a compromise agreement is lower, a lower demand on issue settlement is possible, a slightly less favorable issue settlement can be accepted, and an end to the rivalry is more likely. Following arguments about the dyadic nature of the democratic peace, there may also be additional effects when both rivals are democratic. Bennett (1997a) found empirical support for this hypothesis using various measures of democracy.

H5: The more democratic the states involved in a rivalry, the sooner the rivalry is likely to end.

H5a: If both states in a rivalry are democratic, the rivalry is likely to end sooner than if neither or just one of the states is democratic.

Democratization

The dynamics of regime development toward or away from democracy may also affect rivalry termination. As democratic norms develop and come into play, such norms will begin to help with rivalry resolution. States (particularly already democratic ones) observing increased democratization in each other are likely to view such shifts favorably. When states become more authoritarian, however, it is a sign of devolving democratic norms and a lowering of the probability of compromise. Bennett (1997a) found little empirical support for this hypothesis.

H6: The more the states in a rivalry are democratizing, the sooner the rivalry is likely to end.

3.3 Political Shocks and Rivalry Termination

Political shocks are assumed to disrupt normal relations between states. The shakeup that follows such a disruption may lead to rivalry termination. Goertz and Diehl (1995) suggest that such shocks are "necessary conditions" for rivalry termination.[7] As argued in the theoretical section, though, there is no necessary reason to make such an extreme argument. Rather, shocks may have an independent effect on the probability of a rivalry ending at any point in time, supplementing but not overshadowing the effects of other independent variables.

[7]Testing for necessary conditions in a multivariate manner in combination with other variables may appear difficult, because necessary conditions suggest a threshold effect (rather than a continuous or merely additive effect). Even necessary conditions, though, may be expected to show statistically significant effects on outcomes in a multivariate analysis. If some condition is necessary for an outcome (rivalry termination) to occur, then when the condition is present we expect to see the outcome at least sometimes, while if the condition is not present, we never expect to observe the outcome in question. This should show up as a statistically significant relationship in a multivariate analysis, be it logit or duration analysis. This may explain why Goertz and Diehl conduct a logit analysis while using shocks as independent variables, even though they argue that shocks are a necessary condition.

Five types of events were examined in Goertz and Diehl (1995) as causing political shocks. Three of these were at the system level, while two were at the national level.

System shocks

H7: The occurrence of a world war will increase the chances of rivalry termination for all states in the system.

H8: Major changes in the distribution of territory between states in the international system will increase the chances of rivalry termination for all states in the system.

H9: Major changes in the distribution of power among states in the international system will increase the chances of rivalry termination for all states in the system.

State shocks

H10: The occurrence of a civil war will increase the chances of rivalry termination in rivalries where the state with the civil war is a participant.

H11: The occurrence of a regime change will increase the chances of rivalry termination in rivalries where the state with the regime change is a participant. (Note: this is identical in expectation to hypothesis 4.)

Goertz and Diehl (1995) found strong results (that is, highly significant coefficients) that territorial and civil war shocks increased the probability of rivalry termination. Weaker support was found for a positive relationship between world war shocks and rivalry termination. Moderate support (p=.10) was found for a *negative* relationship between regime change and rivalry termination; that is, it appeared that regime change made rivalries *less likely* to end. This finding ran counter to hypothesis 11 and differs from the evidence found in Bennett (1997a).

4. Statistical Methods and Research Design

I use hazard analysis to test the hypotheses simultaneously. Rivalries have an observable length or duration from onset until they terminate or the collection of data ends (called right censoring). Hazard analysis (also referred to in different literatures as event history, survival, duration, transition, failure-time, or reliability analysis) focuses on modeling the *hazard rate,* the instantaneous rate at which rivalries terminate after duration t, given they have survived until t. When conditions (variables or covariates) exist that increase the rate of rivalry termination at any given time, the rivalry is expected to have a shorter duration than when such conditions do not exist. Recent comprehensive sources on hazard analysis include Blossfeld and Rohwer (1995) and Lancaster (1990); a recent introduction in political science is Box-Steffensmeier and Jones (1997).

4.1 Functional Form and Specification

Prior studies of rivalry employing hazard analysis have used the exponential form. This is the simplest parametric form allowing the inclusion of independent variables as time-varying covariates. Once covariates (independent variables) are added into the hazard model with an exponential function specified, the hazard rate can be written as

$$\lambda(t|xi) = e^{-B'X_i}$$

where the function $\lambda(t|x_i)$ is the hazard rate function at some time t given a vector of independent variables x_i.[8] Utilizing this model allows direct comparison to the common logit model. However, the specification of an exponential distribution *assumes* that duration dependence is not present in the data. To explore the existence and type of duration dependence in rivalries, I use a more general functional form in this paper, specifically a Weibull specification. Without any covariates, the form of the hazard function using a Weibull specification is

$$\lambda(t) = \lambda p(\lambda t)^{p-1}$$

The parameter λ on the right hand side of the model is a constant. The parameter p accounts for duration dependence. When $p = 1$, the hazard rate is independent of time, the process has no duration dependence, and the hazard rate $\lambda(t)$ equals the constant rate λ. In this case the Weibull specification reduces to the exponential. When $p > 1$, the distribution shows positive duration dependence, with a hazard rate that increases monotonically over time. In such a case termination accelerates over time, and an event is more likely to end in each subsequent time interval. When $0 < p < 1$, the distribution shows negative duration dependence, with a hazard rate that decreases over time. This would occur when an event or situation was becoming institutionalized over time.

Covariates are added into the model as influences on the hazard rate by specifying

$$\lambda = e^{-BX_i}$$

The values of the parameters β, which influence the hazard rate, are estimated by maximum-likelihood estimation and can be assessed for statistical significance using standard errors and asymptotic t-ratios. I estimate robust standard errors (Beck 1996, Huber 1967, White 1980) that take into account

[8]The presentation here uses the hazard notation of Greene (1993).

clustering within each rivalry. Positive coefficients in β predict longer duration, and negative coefficients predict shorter durations. For the duration dependence parameter p, the correct significance test involves assessing the probability that p is different from 1 rather than that p is different from 0, since $p = 1$ is the parameter value when there is no duration dependence. A likelihood ratio test can also be used to assess whether the addition of a duration dependence parameter improves the fit of the model significantly, as the exponential specification is nested within the Weibull specification.[9]

4.2 Censoring

Censoring occurs when some values of the dependent variable are unobserved. In the case of rivalries, duration is measured for each rivalry either until the rivalry ends or 1992 is reached (the end of available data). If 1992 is reached before a rivalry ended, then the end of the rivalry is unobserved. The true duration of the rivalry is unknown in such cases. In the list of rivalries based on the new MID data, censoring actually occurs in almost 60 percent of the rivalries in the dataset.[10] Hazard analysis accommodates censoring by treating cases that are *not* censored as having a duration specifically of the observed time. However, cases that *are* censored are treated as having a duration *at least as long* as the observed time. Basically, this distinction is accommodated in the estimator by using the probability density function of the underlying distribution of duration times when cases are uncensored and the survival function (one minus the cumulative distribution function) when cases are censored.

5. Population of Cases and Dependent Variable

5.1 Rivalry

I analyze a population of rivalries generated by applying Goertz and Diehl's (1995) operationalization of enduring rivalries to the new Militarized Interstate Dispute dataset (version 2.1) from the Correlates of War

[9]It is important to note that testing for the presence of duration dependence must occur at the same time as testing for the effects of the covariates included in the model. There is no way to determine the correct functional form for the model separately from a combined analysis, nor is it possible to assume that findings on a set of covariates will remain the same if a different functional form is specified. If a specification without any covariates found that a Weibull distribution was better than an exponential, for instance, it would still not be guaranteed that such a distribution would be superior once covariates were added. It could turn out that the covariates were actually accounting for explained variance ascribed to the parameter p. Alternatively, when p is added to an exponential model, it could be that the effect of other variables goes to 0 or become insignificant. As a result, the best tests of both duration dependence and variable effects will come from testing a model that includes covariates and a duration dependence parameter.

[10]This is a higher percentage of cases than in some prior lists of rivalries, in which about 40 percent of the cases were censored. Many of the new rivalries found by examining the new MID data set started after WWII and may simply not have had time to be resolved yet.

project (Jones, Bremer, and Singer 1997). The new MID data set codes disputes from 1816 to 1992 and has approximately twice the number of disputes as the original MID data (Gochman and Maoz 1984). This operationalization identifies enduring rivalries as any dyad in which six MIDs occurred over a period of 20 years. A maximum of a 15-year gap between any two disputes is allowed in the rivalry. Sixty-three rivalries are generated when this operationalization is applied to the version 2.1 MID data set.[11] Comparing these to the forty-five rivalries listed in Goertz and Diehl (1995) (which were generated using the old MID data set), there are twenty-seven new rivalries, while eight previously coded rivalries are dropped. Following the argument from Bennett (1996) that disputed issues continued to be a problem despite a long gap in disputes, two separate rivalries between Argentina and Chile are then recoded as one, resulting in sixty-three rivalries. Table 1 lists these rivalries, along with the date of the first dispute in the rivalry, the date at which the dyad can be identified as a rivalry *ex ante* (when both the six disputes and 20-year criteria are satisfied), and the rivalry end date.

5.2 Rivalry Termination

To measure rivalry termination, I combine information on militarized disputes with information from formal documents and statements concerning issues at stake and their settlement. It has been argued (Bennett 1997b) that rivalries should be judged as over only when the issues in dispute in the dyad have been settled. Until the fundamental issues on which states disagree are resolved, the possibility of recurring conflict remains relatively high even if states do not show outward hostility in the form of wars or disputes. Combining statements or documents with visible behavior (a cessation of hostile actions) creates an operationalization of rivalry termination that has both objective behavioral criteria and takes into account the political settlement of the underlying issues at stake. This measure of rivalry termination is different from that used in Goertz and Diehl (1995), which coded termination after 10 years had passed without a militarized dispute. The difference between the two measures is one of precision regarding when issues are settled, since the Bennett (1997b) measure starts with dispute information and supplements it with details of issue settlements. However, different analytic results could emerge between this study and prior studies by Goertz and Diehl, especially if there is reason to believe that

[11]Gary Goertz provided an initial version of this list that was updated as termination date codings (following) were generated; the updated list reflects the concern with issue settlements as well as militarized dispute behavior.

Table 1. Rivalries 1816–1992, Using New MID Data

Rivalry	First Dispute	Start Year	End Year	Duration
US / Haiti	1869	1891	1915	25
US / Mexico	1836	1859	1927	69
US / Ecuador	1952	1972	1992[c]	21+
US / UK	1837	1858	1903	46
US / Spain	1850	1873	1898	26
US / USSR	1946	1966	1992[c,a]	27+
US / China	1949	1969	1972	4
Ecuador / Peru	1891	1911	1992[c]	82+
Brazil / UK	1826	1849	1865	17
Bolivia / Paraguay	1906	1927	1938	12
Chile / Argentina	1873	1897	1984	88
UK / Germany	1887	1919	1955	37
UK / Russia-USSR	1833	1876	1907	32
UK / USSR	1940	1961	1992[c]	32+
UK / Ottoman-Turkey	1876	1905	1926	22
Belgium / Germany	1914	1938	1954[g]	17
France / Germany	1830	1866	1955[g]	90
France / Ottoman-Turkey	1897	1920	1939	20
France / China	1860	1898	1929	32
Austria-Hungary / Italy	1904	1926	1930[h]	5
Italy / Ottoman-Turkey	1880	1908	1928	21
Greece / Ottoman-Turkey	1854	1878	1923	46
Greece / Turkey	1958	1978	1992[c]	15+
Russia / Ottoman-Turkey	1876	1898	1923	26
Russia-USSR / China	1862	1898	1992[c]	95+
Russia-USSR / Japan	1895	1917	1992[c]	76+
Somalia / Ethiopia	1960	1980	1992[c]	13+
Jordan / Israel	1948	1968	1992[c]	25+
Iraq / Israel	1967	1991	1992[c]	2+
Egypt / Israel	1948	1968	1979	12
Syria / Israel	1948	1968	1992[c]	25+
Lebanon / Israel	1965	1985	1992[c]	8+
Afghanistan / Pakistan	1949	1974	1992[c]	19+
China / Japan	1873	1894	1951	58
China / India	1950	1971	1992[c]	22+
India / Pakistan	1947	1967	1992[c]	26+
Thailand / Kampuchea	1953	1975	1992[c]	18+
Iran / Iraq	1953	1973	1992[c]	20+
N. Korea / S. Korea	1949	1970	1992[c]	23+
Honduras / Nicaragua	1907	1929	1962	34
Germany / Italy	1914	1939	1956	18
Italy / Yugoslavia	1923	1953	1956	4
Greece / Bulgaria	1913	1940	1954	15
Serbia / Bulgaria	1913	1940	1956	17

(continued on next page)

Table 1. Rivalries 1816–1992, Using New MID Data *(continued)*

Rivalry	First Dispute	Start Year	End Year	Duration
USSR / Norway	1956	1978	1992[c, f]	15+
Spain / Morocco	1957	1979	1992[c]	14+
Morocco / Algeria	1962	1984	1992[c]	9+
Israel / Saudi Arabia	1957	1981	1992[c]	12+
Syria / Jordan	1949	1971	1992[c]	22+
Iraq / Kuwait	1961	1990	1992[c]	3+
UK / Iraq	1958	1984	1992[c]	9+
US / Cuba	1959	1979	1992[c]	14+
US / Peru	1955	1992	1992[c]	1+
US / N. Korea	1950	1975	1992[c]	18+
China / S. Korea	1950	1976	1992[c, e]	17+
S. Korea / Japan	1953	1977	1992[c]	16+
Cyprus / Turkey	1965	1988	1992[c]	5+
Russia (USSR) / Iran	1908	1933	1992[c]	60+
Congo / Zaire	1963	1987	1992[c]	6+
Uganda / Kenya	1965	1989	1992[c]	4+
Ethiopia / Sudan	1967	1987	1992[c]	6+
Thailand / North Vietnam	1960	1980	1992[c]	13+
Thailand / Laos	1960	1980	1992[c, d]	13+

Notes: Start year indicates first year dyad is known to be a rivalry, *ex ante*
Duration indicates duration after initial conditions are met
[c] End of rivalry censored
[a] Rivalry probably ended 1991
[b] Rivalry probably ended 1989
[d] Rivalry may have ended 1988/1989
[e] Rivalry may have ended 1992
[f] Rivalry probably ended 1991
[g] Assumes Germany continues as West Germany for purposes of rivalry
h Assumes Austria-Hungary continues as Austria for purposes of rivalry

shocks might affect overt hostile activity (disputes) more than they affect political issue settlements.[12]

Details of coding procedures are given in Bennett (1997b). Briefly, the end of a rivalry is coded by identifying the connected issue(s) that run through the rivalry, looking for long periods in which no disputes occur, and then looking for political settlements of the issues. Generally, if the rivals

[12]However, while this is possible, it is difficult to make a strong case for why any of the variables included here should have fundamentally different effects on the two versions of rivalry termination. While political settlements may be harder to achieve than military ones, changes in the decision environment should affect both types of relationship.

sign an agreement recognizing a settlement of the issues at stake, followed by 10 years without a militarized dispute related to those substantive issues, or if the states involved renounce their conflicting claims against the status quo followed by 10 years without a dispute, the end of the rivalry is dated as the date of the agreement or renunciation. However, if a militarized dispute follows a signed agreement within 10 years and represents either a clear abrogation of the agreement or a new claim against the settlement of the issue(s) at stake, then the agreement is not coded as ending the rivalry. If no formal agreement or public statements by leaders recognize settlement or abandonment of issue claims, and the issues continue to be a source of disagreement, then the rivalry is coded as continuing, even in the absence of militarized disputes. If no settlement occurs by 1982, then the end of the rivalry is censored.[13] A variety of sources on disputes, alliances, and political interactions are used to make these codings. The specific issues identified in each rivalry, the specific sources used, and the explanation for the codings presented here are presented in detail in a document available from the author. Using the version 2.1 MID data set and these sources, rivalry terminations up to 1992 were identified.

5.3 Data Organization and Aggregation

Aggregating annual data on each rivalry into 5-year periods and pooling the resulting set of time-series data creates the data set analyzed here.[14] Each observation in the dataset (that is, each line of data) consists of data about one 5-year period in the life of a particular rivalry. The use of robust standard errors will help account for the effects of connections between cases within each rivalry that are not between rivalries. Aggregating the data into many observations for each rivalry (rather than one observation per rivalry) allows the inclusion of *time-varying* covariates, that is, variables that vary independently over the course of an event (Greene 1993; Lancaster 1990; Petersen 1986). Each subinterval contributes to the log-likelihood function computed for each rivalry. In the actual data, a variable indicating the length of time that a rivalry has been ongoing at each observation is used to indicate that certain conditions (independent variables) were present for a period of time. The underlying dependent variable being analyzed is the hazard rate, the rate at which rivalries terminate at a point in time.

[13]1982 is the cutoff because the termination measure requires 10 years to pass after a settlement without a MID to code termination, and the new MID dataset ends in 1992.

[14]When the data is aggregated to 10-year periods, similar results are seen to that presented here.

5.4 Dropping Initial Years and Calculating Duration

In the analysis performed here, I drop the initial years of each rival dyad from the data set and code duration starting with the first year a dyad can be coded as a rivalry, *ex ante*. Every rivalry *by construction* continues for at least 20 years and has six disputes. Until both rules are met, the dyad is not a rivalry, and as such, should not be included in analyses of behavior *within* rivalries. Another way of phrasing the problem in terms of rivalry termination is that until both rules are met, the probability of the rivalry ending is *exactly 0.* Since the rivalry could not end in that initial period, and since the dyad is not even a rivalry yet, including early dyad-years results in irrelevant information in the analysis. Table 1 reports both the date of the first dispute in each rival dyad and the year in which both the six disputes and the 20-year rules are met. Each rivalry's time "at risk" of termination only begins at the latter of these dates.

6. Independent Variables

These measures have been used in Bennett (1996), Bennett (1997a), and Goertz and Diehl (1995), and full details of each measure are in those sources. Only a brief discussion of each is provided here.

6.1 Security

A state's security situation is conceptualized as how strong the state is relative to outside threats, taking into account the possible support of allies, where threat is a combination of capability and hostile intentions. Threats are identified as posed by "enemy" states, defined as (1) any other state with whom state X had a 30-day reciprocated militarized dispute or war in the past 5 years and (2) any rival of X. "Allies" against some particular enemy are identified as those who have previously joined with X in a dispute against that enemy state. The final overall security of a state X is then measured as

$$Security(X) = -\sum_{i=1}^{n} \frac{Capabilities(Enemy\_i)}{Capabilities(X) + Capabilities(Allies\_Enemy\_i)}$$

where

$Enemy\_i$ = the ith country in the set of X's rivals and states who had a militarized dispute with X in the past 5 years or were a rival of X;

$Allies\_Enemy\_i$ = the set of allies against enemy state i, i.e., countries who were on the same side as X in a militarized dispute against enemy i in the past 5 years;

n = the number of X's enemies.

Capability is measured using the Correlates of War project's national capabilities index (Singer, Bremer, and Stuckey 1972) and are discounted by the distance between states using the procedures of Bueno de Mesquita (1981, 105). Security is averaged over the 5 years of the aggregation period, and the security of both rivals is summed to create the final variable. I expect a positive coefficient on the variable.

6.2 Common External Threats

The magnitude of common threats is measured by summing the capabilities of all states with which *both* rivals had a dispute or war in the past 5 years, and all third states that are themselves rivals of both rivals. The distance to each rival again discounts capabilities, and threats are averaged over the 5-year aggregation period. The variable is the total distance-adjusted percentage of system capabilities facing both rivals. I expect a negative coefficient on the variable.

6.3 Issue Salience

I use a realist conception of important issues to code salience for each country in a rivalry. I code a dummy variable marking whether the issues at stake in a rivalry concerned border or homeland territory (1) or were over colonial issues or issues of regional influence (0). States should be more concerned about threats to adjacent or homeland territory than to more distant areas since changes in the status of nearby areas have a more immediate effect on the state's security. The issue salience for the two rivals is summed to give a variable ranging from 0 to 2. Data for identifying issues and salience came from the same sources used to operationalize rivalry termination. I expect a positive coefficient on the variable.

6.4 Regime/Polity Change

Regime change here is measured by using polity change. Serious governmental changes marked as polity changes will likely be accompanied by changes in the key groups supporting the top leadership and policy change. I create a variable counting how many polity changes occurred in the two rivals during each time period, lagged by 1 year so as not to count changes that occur after the rivalry ends. The more polity changes occur, the more opportunities there are for policy vis-à-vis rival states to change. Data through 1986 came from the Polity II data set. From 1986 to 1992, polity changes were coded from the authority and regime characteristics given in the Polity III data set (Jaggers and Gurr 1995) following the coding rules in the Polity II codebook (Gurr, Jaggers, and Moore 1989, 26–29). I expect a negative coefficient on the variable.

6.5 Democratic States

I employ the measure of regime type developed by Maoz and Russett (1993, 628). Regime type is measured by an index where

regime type = power concentration * (level of democracy – level of autocracy).

The index ranges from –100 in extremely authoritarian systems to +100 in highly democratic states. For each rival, I averaged the values over the 5 years of each aggregation period. Following Maoz and Russett, I used the regime type measure to create a dichotomous democracy/nondemocracy variable for each state, coding states with an average index of 30 or greater as democracies, and all others as nondemocracies. The individual codings were then combined into two measures of democracy in a rivalry. The first measure uses two final dummy variables in the analysis; the first takes the value "1" when *only one* of the states in the dyad was democratic during the aggregation period; the second takes the value "1" when *both* of the states in the dyad were democratic during the time period. The omitted or baseline category represents situations in which neither rival was democratic during the period. The second measure uses a dummy variable marking whether *at least one* of the states in the dyad was a democracy (this is coded because there are few instances of both rivals being democratic). Using these variables will allow us to judge whether either, one, or both states being democratic increases rivalry termination.[15]

6.6 Democratization

The democratization measure derives from the annual change in regime type obtained by differencing the initial regime type index for each state. The value of this differenced variable is positive when a state becomes more democratic. The change is averaged over the 5-year aggregation period, and then values are summed for the two countries. A negative coefficient is expected on the variable.

6.7 Political Shocks

Two sets of shock variables are created. The presence of world wars, territorial changes, power distribution changes, and civil wars are measured by dummy variables marking whether that type of shock occurred within 15 years (the first set) or 20 years (the second set) of a data point. In addition, two dummy variables were created marking whether *any* of these types of shock occurred within 15 or 20 years of a case. World War years are 1914–1918 and 1939–1945. Territorial shocks occur during the periods 1845–

[15]That there are few rivalries involving two democratic states suggests that democracy may be effective in settling the issues on which rivalries are built.

1849, 1884–1894, 1898–1903, and 1956–1962. Power distribution shocks occur only during 1859–1877. Data on civil wars with at least 1000 battle deaths are taken from an updated version of Small and Singer (1982). Complete justification for these dates and coding procedures are in Goertz and Diehl (1995, 40–41).

7. Results

Overall, the results confirm that changing the model specification and dataset has important effects on the inferences we draw about the causes of rivalry duration and suggest that more attention should be given to domestic political factors as sources of behavior within rivalries. After an initial graphic display of survival probabilities over time, I present tables with the main results of a series of analyses. I also present some auxiliary analyses intended to show that some of the results are rather sensitive to specification in terms of time lags. Overall, the tables point out several key findings. First, rivalries appear *positively* duration-dependent, and it is clear that a Weibull model gives a much better fit to the data than does an exponential model. Second, while several of the variables included in the model appear to have consistent effects on rivalry duration, the role of security conditions and political shocks are called into some question by these results. This is related to the final point, which is that findings about the effects of political shocks and security variables on rivalry termination depend critically on time lags built into the variables. I deal with these findings in turn.

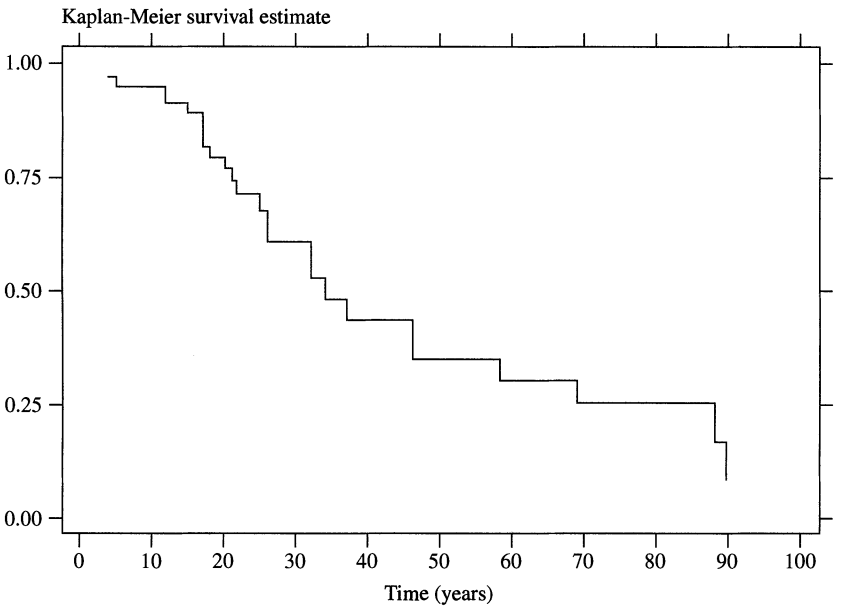
Figure 1 presents a Kaplan-Meier survival curve, which computes the probability that a rivalry will survive at least as long as some time t, without controlling for any explanatory variables. The formula for the Kaplan-Meier estimate is $S(t) = \prod_{j<t}(nj - dj)/nj$, where S(t) is the survival probability at time t, n_j is the number of observations at risk at time j, and d_j is the number of observations that "die" at time j. Time t is calculated from the time at which the rivalry becomes "at risk" of termination, namely the start year listed in Table 1. Initially the probability of survival for rivalries is near 100 percent, but hits a 50 percent rate before the rivalries' 40th at-risk year. The probability of survival reaches its lowest level shortly before 100 years have passed. Of course, since this figure is based purely on termination times without accounting for why terminations occur when they do, it only presents a first cut at understanding rivalry termination in this data set.

7.1 Baseline Results

Table 2 contains the results of key initial analyses.[16] Perhaps the most consistent result through all of the tables is that the shape parameter p of the

[16] The values reported in the tables are coefficients, not hazard ratios. They were generated in STATA using the "nohr" and "time" options on the "stweib" command.

Figure 1. Unadjusted Survival Probability over Time: Kaplan-Meier Survival Curve



Weibull specification strongly suggests the presence of positive duration dependence, regardless of the precise specification. In the equations presented here, p (the duration dependence parameter) is always estimated between 1.4 and 1.7. This value of p, which is significantly greater than 1, suggests that the hazard rate *increases* over time. That is, the likelihood of failure at time t, conditional on a rivalry lasting up to time t, appears to increase with t. This suggests that the exponential specification used in much prior work on rivalry termination has been incorrect and supports the findings of positive duration dependence found by Cioffi-Revilla (1998) in a larger set of rivalries and by Beck and Tucker (1996) in a smaller set of thirty-seven rivalries. Only if p had been near 1 would the previously assumed exponential distributions have been vindicated. The statistical evidence that p is greater than 1 is quite strong, with the improvement in fit from a Weibull over an exponential being highly significant in all specifications. Substantively, the presence of positive duration dependence suggests (perhaps counter-intuitively) that rivalries do not tend to become entrenched over time, suggesting

Table 2. Hazard Model Coefficient Estimates, Effects on Rivalry Duration, Baseline Estimation

		Model A (Single Democracy Variable)			Model B (Separated Democracy)		
Variable	Expected Sign	Coef.	(Robust Std. Err.)	Prob.	Coef.	(Robust Std. Err.)	Prob.
Polity Change	–	–0.207	(0.124)	0.051	–0.196	(0.120)	0.050
One or Both Democratic	–	–0.493	(0.410)	0.12	—	—	
Only One Democratic	–	—	—		–0.391	(0.394)	0.16
Both Democratic	–	—	—		–1.198	(0.669)	0.035
Democracy Growth	–	0.0007	(0.0035)	—	0.0018	(0.0037)	—
Common Threats (5 yr.)	–	–0.496	(1.070)	—	–0.799	(1.054)	—
Security (5 yr. lag)	+	0.0009	(0.0041)	—	–0.0006	(0.0044)	—
Issue Salience	+	0.398	(0.149)	<0.01	0.363	(0.161)	0.012
Civil War Shock (20 yr. lag)	–	0.193	(0.293)	—	0.297	(0.339)	—
World War Shock (20 yr.)	–	–0.914	(0.584)	0.059	–0.856	(0.607)	0.079
Territorial Shock (20 yr.)	–	–0.377	(0.287)	0.090	–0.474	(0.305)	0.060
Power Shock (20 yr.)	–	–0.044	(0.664)	—	–0.150	(0.707)	—
Constant		4.535	(0.784)		4.586	(0.829)	
p		1.48	.287		1.45	.293	
Log-Likelihood		–37.5			–36.2		
Log-Likelihood w/exponential		–79.7			–78.0		
Number of Rivalries		63			63		
Number of Observations		319			319		

Notes: One-tailed significance levels of 0.20 or less are reported. Standard errors are adjusted for clustering by rivalry. The log-likelihood of a duration model with a Weibull specification but only a constant is –48.6. The log-likelihood of an exponential model with a constant only is –91.7.

that an institutionalization conception of rivalries may not be valid.[17] Rather, the longer rivalries last, the more likely they become to end in the future and so can be seen as ultimately self-terminating. At this point we know little about what mechanism might be driving this unexplained positive duration dependence, but the empirical finding is quite robust.

Turning to the variables included to test various key hypotheses, Table 2, Model A presents the initial baseline equation for discussion. By examining log-likelihoods, it is clear that the variables in the model are adding important explanatory power to understanding rivalry duration. However, an examination of coefficients and standard errors reveals that only a small set of variables are strongly statistically significant, suggesting that relatively few factors are accounting for this power. In particular, the positive coefficient on issue salience suggests that rivalries lasted longer when they concerned more important issues. The negative coefficient on polity change suggests that polity changes in rival states led to shorter rivalries. While it is not entirely clear in Model A, democracy also has an effect on rivalry duration. Table 2, Model B, splits dyads into the three categories of neither state being democratic, only one being democratic, or both states being democratic. Model B makes clear that the presence of joint democracy has an important effect on rivalry termination. However, democratization appears not to affect rivalry duration, a finding that matches Bennett (1997a). The effects of two shocks (besides regime change) also appear to have some effect on rivalry duration. The "world war" and "territorial" shock variables have negative coefficients and approach conventional significance levels ($p < 0.10$ for both). Two other types of shock, however, civil war and power distribution shocks, appear to have little effect on rivalry termination. This is a somewhat different result than that found in Goertz and Diehl (1995), where territory and civil war shocks appeared clearly to play an important role in rivalry termination. Finally, and also unlike prior findings, security conditions appear to have little effect on rivalry duration given this set of data and specification. In summary, then, Table 2 suggests that democracy and issue salience affect rivalry duration, certain political shocks affect duration, and security and democratization do not appear to affect rivalry duration.

7.2 Sensitivity to Coding

The initial results show some clear differences from prior work on rivalry termination. This is not surprising given improvements in the data and

[17]Alternatively, it could be that institutionalization is occurring within the rival dyad, but that some outside factor overwhelms that institutionalization. For instance, outside states might react to a lengthening rivalry in such a way as to force the rivalry to end earlier than it "should." Whatever the sources, though, forces leading to a shortening of rivalries over time (positive duration dependence) appear to overwhelm any dyadic institutionalization.

methods used here. Analysis could stop at this point, but further probing of the data suggests that the relationship among some of the key variables is actually less clear than this initial conclusion suggests. Table 3 presents further analyses suggesting that the findings on political shocks and security are quite sensitive to specification on these variables in terms of the time lags included in them. Two key coding decisions are important to the results seen in Table 2. First, security conditions were measured only within the 5-year time period that each data point covers. Second, reflecting Goertz and Diehl's argument that shocks may have effects that are diffuse and operate over a long period, the dummy shock variables were coded as a "1" if the time period was within 20 years of the shock in question. Varying either of these time periods—which until now has been operational choice rather than a theoretically guided one—leads to different conclusions about whether security conditions and political shocks affect rivalry termination.

Table 3, Model A, presents the results of analysis when a 15-year lag is substituted for the 20-year lag on political shocks (a "1" is coded for a case when a shock occurs within 15 years of a case). In this equation, it appears less clear that any type of shock is affecting rivalry duration. The coefficients on the 15-year shock variables are somewhat smaller than those on the 20-year shock variables, and standard errors in general are larger. To examine whether and how collinearity among shock variables might be playing a role, Model B shows what happens when a single shock variable marking the presence of any of four shocks (civil war, world war, territorial change, or power change) is substituted. In this specification, the presence of any shock within 20 years appears highly significant. Model C then changes this lag to 15 years. Again, the inferences drawn about shocks are quite different depending on which model (B or C) is consulted, with a 15-year lag of shocks appearing to have little effect on rivalry termination. These comparisons suggest two important conclusions. First, the results in model B alone suggest that one possible problem with the "significance" of individual shock variables in Table 2 is collinearity among them.[18] But second and more importantly, what might appear to be a minor change in lag—a change from 20 to 15 years—in fact makes a large apparent difference in the relationships among variables in this study.[19] With little theoretical guidance to

[18]Combining the types of shocks also reveals, however, that one of these four types of shocks within 20 years was present in over 90 percent of the cases in the data set. This suggests that shocks can only be a very weak necessary condition, because the condition of some nearby shock is almost always met. The "any shock within 20 years" variable is actually almost a constant, and its magnitude is amplified because it is picking up effects previously ascribed to the constant; note the change in the coefficient on the constant term in Model B.

[19]Although I do not present them, coefficients on a 10-year lag version of the shock variables are even smaller and the effects less certain.

Table 3. Hazard Model Coefficient Estimates, Effects on Rivalry Duration, Showing Sensitivity of Shocks to Coding

		Model A (Separate Shocks)			Model B (Any Shock, 20 yr)			Model C (Any Shock, 15 yr)		
Variable	Expected Sign	Coef.	(Robust Std. Err.)	Prob.	Coef.	(Robust Std. Err.)	Prob.	Coef.	(Robust Std. Err.)	Prob.
Polity Change	–	–0.213	(0.136)	0.059	–0.267	(0.121)	0.014	–0.260	(0.118)	0.014
Only One Democratic	–	–0.412	(0.479)	0.195	–0.323	(0.332)	0.165	–0.256	(0.312)	0.206
Both Democratic	–	–1.153	(0.695)	0.048	–1.151	(0.641)	0.036	–0.997	(0.593)	0.046
Democracy Growth	–	0.0015	(0.0036)	—	0.0036	(0.0034)	—	0.0035	(0.0037)	—
Common Threats (5 yr.)	–	–1.069	(1.205)	0.185	–1.134	(0.942)	0.114	–1.132	(0.889)	0.101
Security (5 yr.)	+	–0.0008	(0.0042)	—	–0.0044	(0.0053)	—	–0.0013	(0.0056)	—
Issue Salience	+	0.351	(0.164)	0.016	0.317	(0.157)	0.021	0.349	(0.145)	<0.01
Shock:										
Civil War (15 yr. lag)	–	0.283	(0.347)	0.208	—	—		—	—	
World War (15 yr. Lag)	–	–0.727	(0.560)	0.097	—	—		—	—	
Territorial (15 yr. Lag)	–	–0.353	(0.332)	0.143	—	—		—	—	
Power (15 yr. lag)	–	0.259	(0.875)	—	—	—		—	—	
Any (20 yr. lag)	–	—	—		–7.619	(1.627)	<0.01	—	—	
Any (15 yr. lag)	–	—	—		—	—		0.384	(0.501)	0.222
Constant		4.399	(0.800)		11.563	(1.968)		3.513	(0.661)	
p		1.43	.302		1.51	.275		1.57	.275	
Log-Likelihood			–37.3			–40.7			–40.9	
Number of Rivalries			63			63			63	
Number of Observations			319			319			319	

Notes: One-tailed significance levels of 0.2 or less are reported. Standard errors are adjusted for clustering by rivalry.

Table 4. Hazard Model Coefficient Estimates, Effects on Rivalry Duration, Showing Sensitivity of Security Coding

Variable	Expected Sign	Coef.	(Robust Std. Err.)	Prob.
Polity Change	–	–0.282	(0.129)	0.014
Only One Democratic	–	–0.337	(0.359)	0.176
Both Democratic	–	–0.925	(0.602)	0.062
Democracy Growth	–	0.0035	(0.0038)	—
Common Threats (10 yr. lag)	–	–1.423	(0.869)	0.050
Security (10 yr. lag)	+	–0.0013	(0.0056)	—
Issue Salience	+	0.318	(0.163)	0.025
Any Shock (20 yr. lag)	–	–7.965	(1.940)	<0.01
Constant		12.081	(2.343)	
p		1.45	.283	
Log-Likelihood		–39.3		
Number of Rivalries		63		
Number of Observations		319		

Notes: One-tailed significance levels of 0.2 or less are reported. Standard errors are adjusted for clustering by rivalry.

suggest whether 15 or 20 years is an appropriate lag, further work investigating how the effects of shocks are felt over long periods of time is clearly called for.

Table 4 demonstrates one final operational sensitivity in the model. While Bennett (1996) found that security conditions measured within the 5 years of an aggregation unit had important effects on rivalry termination, the results in Table 2 clearly suggest that they did not. The model reported in Table 4 replaces the 5-year security lag variable with a variable measuring security conditions over a 10-year period. When this substitution is made, it appears that an increase in the magnitude of mutual threats to the two rivals leads to shorter rivalries. It is unfortunate that the inferences made about the effects of security conditions are sensitive to this choice, because as with shocks, there is little strong theoretical guidance for choosing an appropriate lag.[20] As with political shocks, an avenue for further research is to explore more carefully how different lags of relevant conditions affect rivalry termination.

[20]Further changes in the lag structure have not been tried to see how effects appear to grow or shrink.

7.3 The Effect of the Superpower Era

I explore further the effect of differences before and after WWII on the effect of key variables on rivalry duration. One of the features of the new MID data set is that many militarized disputes are coded in the post-WWII era, and many more disputes fall in this period than in prior versions of the data. This leads to the presence in the list of rivalries of more rivalries since 1945 than in the 1815–1945 period.[21] Most of the new rivalries included in Table 2 have not been analyzed in previous versions of rivalry datasets that also have post-1945 start dates. It is possible that most post-WWII rivalries are qualitatively different from the typical rivalry of the 19th and early 20th century. Many rivalries after WWII were closely tied to the global U.S.-Soviet superpower rivalry and may have been fueled by the superpowers rather than (or in addition to) a concern over disputed issues in the dyad. Different factors may be necessary to explain the end (or lack thereof) of these rivalries. The model in Table 5 explores this possibility, presenting the results of an analysis that differentiates between rivalries that began before and after WWII.

The best way to explore the effects of variables in different periods is to include a dummy variable marking the cases in question (here, rivalries that started after 1945) and a series of multiplicative terms between the dummy and substantive variables. The effect of a variable on all the cases is given by the uninteracted version of the variable, while the additional (either more or less) effect on post-WWII rivalries is indicated by the interacted variable. Because of collinearity, the equation includes the single variable indicating that at least one rival was democratic and does not include an interaction to separate out the effect of shocks after 1945. Table 5 shows that while there are some commonalities between pre- and post-WWII rivalries, there are also some important differences. Common effects appear with regime changes and political shocks, the presence of which are associated with shorter rivalry durations throughout the data. In addition, unreported analysis reveals positive duration dependence within both the pre- and post-WWII sets of enduring rivalries. However, the presence of democracy appears to have an effect primarily in rivalries that began after WWII, as indicated by the insignificant coefficient on the noninteractive variable. In addition, while salience increases the duration of rivalries that began before WWII, the effect essentially disappears in rivalries after WWII (the coefficient is 0.51 for

[21] Some have wondered whether the frequency of MIDs after WWII requires a change in the criteria for identifying rivalries in the form of increasing the minimum # of MIDs required in a dyad. It is true that in absolute numbers there are more MIDs after WWII than before and hence more rivalries. However, if you normalize the number of MIDs by the number of dyads in the international system, the number of MIDs per dyad-year is not very different before and after WWII. Since rivalries are based on frequency within dyads, this suggests that there is no need to change the operationalization of rivalry.

Table 5. Hazard Model Coefficient Estimates, Effects on Rivalry Duration, Examining Effects of Time Period

Variable	Coef.	(Robust Std. Err.)	Prob.
Polity Change	–0.315	(0.118)	<0.01
Polity Change x Post-1945	0.567	(0.738)	—
At Least One Democratic	–0.072	(0.316)	—
Democratic x Post-1945	–9.956	(1.440)	<0.01
Democracy Growth	0.0021	(0.0033)	—
Democracy Growth x Post-1945	0.0048	(0.0085)	—
Common Threats (5 yr. lag)	–0.930	(0.816)	0.127
Common Threats x Post-1945	0.695	(5.085)	—
Security (5 yr. lag)	0.0033	(0.0037)	—
Security x Post-1945	–0.015	(0.011)	0.092
Issue Salience	0.511	(0.139)	<0.01
Salience x Post-1945	–0.620	(0.310)	0.04
Any Shock (20 yr. lag)	–9.476	(1.525)	<0.01
Post-1945 (Rivalry Began 1946+)	9.592	(1.480)	<0.01
Constant	13.164	(1.760)	
p	1.64	.351	
Log-Likelihood	–37.3		
Number of Rivalries	63		
Number of Observations	319		

Notes: One-tailed significance levels of 0.2 or less are reported. Standard errors are adjusted for clustering by rivalry.

all rivalries, and the additional –0.61 for post-WWII rivalries makes the net effect very close to 0). In the specification tested here, neither security variables nor democratization appear to have clear effects in either period.

These findings fit with the (*post hoc*) possibility that superpower-fueled rivalries are different than more traditional, independent rivalries, as well as with the idea that democracy has become an increasingly important element of politics. Salience as coded here reflects realist territorial interests; if rivalries after WWII were not over such interests (instead being over ideology, perhaps), then it makes sense that salience mattered less. On the other hand, regime change and political shocks affect governments no matter what interests are at stake and external pressures are applied, and so they reasonably could have been expected to influence rivalries whenever they occur.

7.4 Summary

What do these results taken as a whole suggest? In combination, these comparisons suggest that using new data from the new MID data set, improving the analytic techniques used to study rivalry duration, and combining multiple explanations of rivalry in one analysis have important effects on

our understanding of enduring rivalries. Clearly there is positive (and unexplained) duration dependence in rivalries, a finding that is somewhat surprising theoretically. In addition, the domestic political factors of democracy and regime change appear to affect rivalry termination. However, the new analysis reduces our confidence that security concerns and political shocks affect rivalry termination and reveals that operational decisions in coding security and shocks have an important effect on our conclusions about those factors. Finally, with enough rivalries to now separate out period effects, these data suggest that there may be important differences in how certain variables affect rivalries before and after WWII.

These results also raise interesting questions about our existing models of rivalry termination. If one believes that the variable operationalizations used here are good measures of the underlying concepts, then the findings that only some of the included variables affect rivalry termination could be taken as a challenge to the rational bargaining model presented. One possible answer discussed previously is that certain types of political shocks may not actually expand the contract range in the rivalry. Another possibility is that the goals I assumed leaders to have (settlement, security, and satisfying domestic constituencies) are not equally important, or that variation between different leaders are greater than the commonalities. In this regard, the results suggest that domestic political aspects of the decision environment may consistently take precedence over security considerations when it comes to relations with rivals. However, the basic form of the rational bargaining model explored here does not have a foundation built in that would allow deduction of this difference. Expanding this model remains for additional work.

8. Conclusions

This paper improved on previous statistical work exploring rivalry termination and duration in several ways. I used a larger set of rivalries for analysis, employed a more general statistical form of the duration model in testing, and combined variables from different theoretical explanations in one simultaneous model and test. The results suggest somewhat different inferences about the validity of several hypotheses regarding rivalry duration than previous studies have drawn. In particular, it now seems that low issue salience, regime change, and the presence of democracy all lead to shorter rivalries and that other political shocks and security concerns may influence rivalry duration. Operational coding appears to play an important role in what inferences are drawn about these latter two variables. Rivalries also appear to be positively duration-dependent, meaning that the hazard rate increases over time, and so that rivalry termination accelerates as rivalries continue. This finding, which is counter to the intuitive notion that rivalries are

long lasting because they become institutionalized over time, suggests that rivalries may be self-terminating over time.

These results have important implications for research on rivalry termination. In particular, the sensitivity of certain of the findings here suggest that we need to pay careful attention to justifying measurement as well as the underlying models of rivalry termination being tested. In addition, the finding that enduring rivalries are positively duration-dependent raises the question "why" and suggests a set of questions that have not yet been investigated. In the area of more traditional variables, the results suggest that we should focus additional attention on the internal politics of rival states, since domestic political factors appeared to make an important—and consistent—difference in rivalry duration. Uncertainty about the effects of other variables suggests that they may have been previously overemphasized. It will be important in further research to examine what other domestic political factors, such as economic conditions or domestic political conflicts, affect behavior within rivalries.

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