How Political Relevance and Democracy Affect Conflict:
Two Theoretical Propositions

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Abstract

The statistical literature on conflict studies has generated strong and consistent findings on the relationship of political irrelevance (distance, or more specifically, effective distance) and dyadic democracy on conflict: both reduce its probability substantially. Perhaps due to the strength of the associations, however, scholars have played scant attention to the interesting theoretical issue of *how* they matter. In this paper we argue that their effects are typically misspecified—that the impact of other conflict-causing variables should be seen as *contingent on* political relevance and the absence of dyadic democracy, rather than as additions to them, and that that contingency may be skewed, with a very pronounced effect at first tapering to a "long tail" as dyads become more irrelevant. Proper specification of this relationship is not only of interest in its own right but can also correct bias in the estimates of the relationship(s) of primary interest to a given study.

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Introduction

Democracy and the absence of what scholars have come to call political relevance have proven to be powerful predictors of peace across multiple studies. Their impact is so substantial that they have achieved a "taken for granted" status: as control variables in modern large-N conflict studies, they are ubiquitous.

The strength of their association with peace has come at a price, however: because coefficients on these variables will be statistically significant in nearly any model specification, we have paid insufficient attention to *how* these two factors produce peace. For the most part, we assume that they simply add (some typically sigmoid function of) a constant quantity to the probability of peace or war, and that the impact of all other variables remains the same. In the case of political irrelevance, the impact is so profound that irrelevant dyads are often simply omitted from the dataset, a practice that unfortunately omits a substantial number of conflictual events as well.

To be specific, a survey of 90 quantitative international relations articles in which militarized interstate dispute (MID) or war occurrence was the dependent variable, taken from six major political science journals[1] from 2000 to 2009, shows that the overwhelming majority of those articles (86%) include an additive control for democracy. Only a small minority either do not control for democracy (7%) or include it in some other way, for example, with case selection or as part of a multiplicative interaction term *without* including the democracy variable on its own (8%).[2]

The same survey demonstrated that, while most studies do control for political relevance in some way, the state of the art in doing so is entirely incoherent. Only 10 of 90, or 11%, make no attempt to control for political relevance at all. The plurality, but nowhere near a majority (36%), control for it in a purely additive manner. Very few (3%) control for political relevance by dropping dyads deemed irrelevant from the sample and doing nothing more. Fully 27% of the cases fall into the "other" category. Many of these studies control for shared borders or contiguity, but not distance more generally; others implement more creative coding rules or case-selection mechanisms.

Perhaps the most surprising finding is the number of studies (23% of the total) that both drop irrelevant dyads and include a strictly additive control. Doing so makes the results difficult, if not impossible, to interpret clearly. In cases in which the sample is limited to politically relevant dyads—defined as contiguous dyads

[1] These are the *American Political Science Review, American Journal of Political Science, Journal of Politics, Journal of Conflict Resolution, International Studies Quarterly,* and the *Journal of Peace Research*. We are grateful to Chaekwang You for his work on part of this survey.

[2] The percentages do not sum to 100 because of rounding error.

or those in which at least one state in the pair is a Great Power—and an additive contiguity dummy variable is included, for example, the contiguity dummy will capture the effect of being contiguous. It will also, however, serve as an excellent proxy for non-Great Power status, since in this subset of cases only Great Power dyads will be noncontiguous.

The larger point, however, is this: Though parsimonious from a statistical point of view, dropping irrelevant dyads, including additive controls, or doing nothing at all do not comport with intuition or with mainstream theoretical understandings of these phenomena. We seek to align data analysis more closely with intuition and theory by exploring two theoretical propositions about democracy and distance:

> **Proposition 1.** The impact of conflict-causing variables is *contingent* on political relevance and the absence of democracy. Factors such as trade, balances of power, differences over territory, and so forth, simply matter less, and at the margin virtually not at all, when the two combatants are politically irrelevant or democratic.
>
> **Proposition 2.** Power projection, like gravity, is a weak force: as distance increases the ability to project power falls off quite dramatically. Accordingly, changes in political relevance have the greatest marginal impact in relations among powerful states that are close to one another; as states become weaker and more distant, changes in political relevance will matter less.

We explore these propositions by re-analyzing two prominent studies of conflict using a widely-available Boolean statistical methodology that is appropriate to the theory. The results demonstrate considerably improved fit over the original models; moreover, the substantive impact of many variables of interest increases substantially. A graphical illustration of the results of one study highlights the importance of the respecified argument: joint dyadic democracy, at the limit, diminishes the impact of the other causes of war in the model by an estimated 77%. In short, the paper offers not just an alternative statistical test that can bring out the full impact of variables of interest but a fundamentally different understanding of how to model the impact of democracy and political irrelevance on conflict.

The Argument

The extent to which theories of conflict should be expected to hold across different pairs of states varies, sometimes substantially. Two sources of dissimilarity

in particular stand out: political relevance and dyadic democracy. Weak, distant states are not nearly as relevant to one another's foreign policies as are strong, adjacent states; moreover, even if the former do have a clash of interests, their inability to project military force may prevent them from being able to do anything other than talk about it. In the case of democracies, though informed opinion differs as to the cause, the empirical results demonstrate quite strongly that democratic dyads are unlike other dyads in terms of how they interact, and that one implication of that fact is a much greater propensity for peace.

As a result, we argue, standard theories of conflict do not apply with full force to these two types of states. Rather, dyadic democracy and political irrelevance mitigate, and in the extreme may nearly eliminate, the causes of conflict among states, and this effect probably kicks in at relatively low levels of each. This argument differs from the standard claim that dyadic democracy and political irrelevance merely reduce the probability of conflict: we argue that they do, but that they do so in large part by virtue of their effects on the impact of *other* variables.

Democracy

The various theories of the democratic peace strongly suggest such a formulation. The argument that democracies are peaceful because of shared liberal norms, for example, suggest that liberal democracy produces greater perceptions of equality, a greater sense of empathy, an emphasis on exchange and cooperation rather than coercion, and, ultimately, the de-legitimation of violence among democratic states (see *inter alia* Braumoeller 1997 and Russett 1993). As a result, any issue that might lead other states to issue threats, clash militarily, and ultimately go to war would be expected to produce less of an impact among democratic states. Cederman's (2001) explanation of the democratic peace as a macrohistorical learning process relies on the same logic: although the process by which norms and the rule of law spread over time is the focus of the theory, they have an impact on conflict as a result of "individuals' realization that war is both destructive and immoral." (16)

Similarly, theories that rely on the domestic political structure of democratic states tend to suggest that their importance lies in their impact on how potential threats to the peace are processed, regardless of what those threats might be. In *Perpetual Peace,* Immanuel Kant wrote,

> [I]f the consent of the citizens is required in order to decide that war should be declared (and in this constitution it cannot but be the case), nothing is more natural than that they would be very cautious

> in commencing such a poor game, decreeing for themselves all the calamities of war. . . . But, on the other hand, in a constitution which is not republican, and under which the subjects are not citizens, a declaration of war is the easiest thing in the world to decide upon, because war does not require of the ruler, who is the proprietor and not a member of the state, the least sacrifice of the pleasures of his table, the chase, his country houses, his court functions, and the like.

Here, again, the importance of democracy lies not in its direct impact on war or peace but on its impact on *other issues* that might lead to war or peace: a monarch faces fewer constraints than the leader of a democratic state[3] and is therefore more easily provoked to war.

Finally, Bueno de Mesquita, Morrow, Siverson, and Smith (1999) argue that democratic political structures give leaders an incentive to expend more effort, *ceteris paribus,* on fighting a war than their autocratic counterparts possess, as well as prompting them to be more selective when choosing targets. These two factors in combination decrease the probability that disputes of any sort, regardless of their nature, will lead to war among democracies.

These arguments explain why, for example, Schweller (1992) finds that power transitions, which prompt wars among autocratic Great Powers, produce accommodation among democratic ones, and Huth and Allee (2002) demonstrate that territorial disputes among democracies, which often lead to conflict and war, are more likely to lead to talks rather than force, to negotiation rather than escalation.

Distance

Theories regarding the impact of distance on conflict are considerably less well-developed, probably for the simple reason that the relationship between the two, in very broad strokes, seems empirically obvious: the absence of conflict between Nepal and Uruguay hardly merits comment. Yet the reasons for the absence of conflict are perhaps not quite so apparent.

First, one form of the political relevance argument, the loss-of-strength gradient proposed by Boulding (1962) and popularized by Bueno de Mesquita (1981) suggests that changes in distance have a dramatic impact on the ability to project force over short ranges, but that that impact tails off over medium to longer ones. This formulation suggests allowing for a skewed degree of contingency.

[3] By which, in Kant's terms, we intend to connote a republic, as do virtually all of those who seek to translate his meaning into the context of modern democratic peace theory.

A similar reason for which we might expect less conflict between states that are farther apart is, simply, that distance raises the cost of conflict. States that must pay a great price in order to attack one another will be considerably less willing to do so, given the same provokation, than will adjacent states, or states that can reach one another with little effort. The costs of conflict can be reasonably thought of as a function both of distance and of capabilities: this is the logic behind the common decision to code as relevant any dyad containing adjacent states *or* at least one Great Power.

The standard name in the literature for the phenomenon under discussion—"political relevance"—neatly captures yet another reason for which one might reasonably expect to find less conflict among distant states: in a world in which interstate interactions tend overwhelmingly to be local, the politics or characteristics or behavior of a state in a distant region are often simply uninteresting (Weede 1976, Maoz and Russett 1993). Because distant states play such a small role in one another's day-to-day calculations, grounds for war would have to be overwhelmingly compelling before either state would even consider attacking the other.

Statistical Implications

The implications of these arguments for statistical models of international politics are, as Beck, King, and Zeng (1999, 22) put it, that "the effects of most explanatory variables are undetectably small for the vast majority of dyads," or, more specifically, that "the effects of the causes of conflict differ by dyad, with trivially small effects for the vast majority and larger effects for a few." In other words, these observations do not possess the condition described by Cartwright (1979) as "causal homogeneity," which holds only when the impact of a causal variable is not attenuated or exaggerated by some other, correlated causal variable.[4]

Two existing solutions to this problem dominate the literature: domain restriction and the use of additive controls. Domain restriction is mostly used with political relevance and consists of simply throwing out dyads that are deemed irrelevant to one another. Aside from being wasteful of data, this correction is problematic in that it throws out quite a few (26%) of the dispute cases. The

[4]It is worth emphasizing that this understanding differs from the one described in Seawright (2002), who argues that causal homogeneity requires that any given case be able, with fixed probability, to take on any value on both the independent *and* the dependent variable. Cartwright's variant assumes, as do most IR conflict studies, that the values of the independent variables are fixed and only the probability of the outcome conditional on the covariates be constant across units.

fact that so many disputes occur among actors deemed nonrelevant by the coding procedure strongly suggests that either the criteria for relevance or the act of excluding all nonrelevant cases (or both) is very problematic.[5]

Additive controls, used most often in the case of dyadic democracy, are better in the sense that they reduce the probability of conflict in less war-prone dyads. They do so by adding or subtracting a constant to $\Lambda(X\beta)$ (in the logit context) or $\Phi(X\beta)$ (in probit)—which is equivalent to adding or subtracting a constant to the intercept term in a regression equation. The problem is that this procedure does not map to a very compelling substantive understanding of how political relevance and dyadic democracy have an impact on conflict outcomes. Because unit heterogeneity implies that the impact of X on Y will differ across units, resolving the problem involves adjusting the *slope* parameters of all of the independent variables in a manner that captures the effects of unit heterogeneity—in essence, generating a very large interaction term that permits the independent variables to interact with both political relevance and dyadic democracy. While doing so literally would be unwieldy and nearly impossible to interpret, the idea of an über-interaction term very nicely captures the essence of the solution on offer below.[6]

Beck, King, and Zeng (1999) proposed a considerably more radical solution involving the use of neural networks. The results are appealing to scholars who wish to examine variables without imposing any theoretically-derived assumptions on the relationship among them, but the fact that few quantitative IR scholars fall into this category, combined with the difficulty of deriving an objectively-defined "true" representation of the data,[7] the complexity of the method, and the modest increase in utility over ordinary logit (deMarchi, Gelpi, and Grynaviski 2004; *cf.* Beck, King, and Zeng 2004), have combined to produce few if any appli-

[5]Bennett (2005) examines different operationalizations of political relevance in an attempt to mitigate exactly this problem but concludes that capturing all disputes is exceptionally difficult.

[6]It is worth noting that the curvilinear functional form of logit and probit make it possible to adjust the slope by adjusting the intercept, in a crude fashion: for $X < 0$, the slope of the integral at $\Phi(X\beta)$ will be greater than the slope of the integral at $\Phi(X\beta - Z\gamma)$ for any dummy variable Z (such as political relevance) and arbitrary positive constant γ. Nevertheless, a coefficient β on X will not vary but will represent a weighted average of two quantities: the coefficient on X when $Z = 0$ and the coefficient on X when $Z = 1$. In general there is no reason to believe that those two quantities will equal one another, even approximately. If, for example, the probability of conflict is 0.0001 for all irrelevant dyads, regardless of the value of X, when $Z = 0$, then the reported value of β will reflect a combination of (a) the value of β when $Z = 1$ and (b) zero. Because irrelevant dyads predominate, β would probably be heavily biased toward zero—an outcome that would appeal to few researchers.

[7]To see this problem one need only run a lowess regression with different bandwidths on random data: it is meaningless to ask whether the flattish line derived from a high-bandwidth pass or the meandering line derived from a low-bandwidth pass is a "better" representation of the data.

cations of the method in IR in the intervening seven years.

It is also worth noting that Lemke and Reed (2001) used a censored probit to evaluate the extent to which using only politically relevant dyads introduces bias as a result of selection—i.e., whether the correlation between the error terms of two probit equations, one predicting political relevance and the other predicting conflict, biases the estimates in the latter equation. Their conclusion is that the coefficients are not substantially biased. While that alleviates concern that studies based on politically relevant dyads suffer from selection bias, however, selection bias is not the argument on offer here: we are arguing that coefficients are biased due to model misspecification, a claim that cannot be evaluated in any manner save by specifying the correct model.

Two recent studies have made some headway toward capturing this relationship in a parsimonious manner, but the potential for useful dialogue remains. Hegre (2008) arguably represents the state of the art in modeling the effects of political relevance in particular: the author utilizes a gravity model to capture the contingent relationship between relevance and the other variables of interest:

$$\ln(\Pr[y]) = \Lambda(\beta \ln[X]) \tag{1}$$

which is simply the log-additive (and therefore easier to estimate) version of

$$\Pr(y) = \Lambda(X^{\beta}) \tag{2}$$

This interactive specification does capture the contingency of every relationship on political relevance, which makes it a substantial advance, but because *everything* in a gravity model is interactive, it creates a potentially undesirable side effect in which every relationship is contingent on every other one. This was the goal of the original gravity model but often not of quantitative IR scholars.[8]

Another study, by Xiang (2009), seeks to model militarized interstate dispute onset as a function of trade and other variables, utilizing a split-population binary dependent variable model similar to the one proposed in an earlier version of this paper (Braumoeller 2006) to capture the contingent effects of political relevance. The differences remain substantial, however: aside from the fact that the effects of democracy are not modeled in the same fashion as those of distance and the possibility of a diminishing contingency is not taken into account, the vectors of

[8]More ominously, while the log-additive transformation works unproblematically for abstract two-dimensional curves, its behavior in statistical models, which potentially contain poorly behaved error terms that also undergo transformation, has received no attention at all in the applied literature.

independent variables utilized in the relevance and conflict equations are nearly identical, a fact that makes identification and interpretation problematic.[9]

A Proposed Solution

For the most part, scholars have taken little notice of the mismatch between the additive specification of a standard linear-in-variables model and the interactive nature of many hypotheses regarding democracy and political relevance. To date, inclusion of some measurement of democracy as an additive control is the typical method of capturing its effects. Political relevance, however, presents such a stark problem that politically irrelevant dyads are often simply omitted from the data.

Our approach, by contrast, is to model the heterogeneity among dyads rather than assuming it and throwing out the majority of the data in order to achieve homogeneity. It therefore improves on studies that take the latter approach because it permits the use of all of the data rather than requiring that the bulk of it be omitted. It moves beyond the Lemke and Reed approach by modeling threats to inference that result from sources other than selection bias, which the authors find to be largely unproblematic. Unlike the Beck, King and Zeng approach, the method is computationally relatively simple, and it fits quite well with researchers' desire to engage in deductive theory-testing. Indeed, if the researcher's original model is a logit or probit specification, as the vast majority of conflict models are, existing statistical software can incorporate the solution proposed here "out of the box" and without any additional programming.

Modeling the sources of dyadic heterogeneity necessarily reflects a theory of how political irrelevance and dyadic democracy produce heterogeneity. That theory, as the sections above suggest, is grounded in a fundamentally interactive understanding of variables and their impact. Simply put, political irrelevance and dyadic democracy attenuate the impact of variables that capture the sources of conflict, and they have an impact on all variables to roughly the same degree.[10]

[9] Specifically, the only information distinguishing the relevance equation from the conflict equation is a set of peace-year splines, which are part of the latter equation. This fact makes it difficult to sort the independent variables' impacts into the two posited categories or mechanisms, because statistically speaking, hardly any information exists that would help to distinguish between the two.

[10] We see no compelling theoretical reason to suspect shared democracy or political irrelevance would have less of a "suppression effect" on some causes of war rather than others. For the former, shared democracy is postulated to build tendencies toward tacit or explict conflict resolution that should mitigate sources of hostility regardless of type. For the latter, greater distance is postulated to reduce the number and intensity of issues over which states disagree, which seems an "equal opportunity" dispute mitigator.

How might such an understanding of the causes of heterogeneity be captured mathematically? Start with a very standard logit equation,

$$\Pr(y = 1) = \Lambda(X\beta), \tag{3}$$

where $\Lambda(X\beta) \equiv \frac{1}{1+e^{-X\beta}}$. Now imagine a very simple case in which two sets of dyads exist and the impact of a change in X in the second set of cases is exactly half of what it is in the first set. The simplest way to model this situation would be

$$\Pr(y = 1) = \Lambda(X\beta) \times f(Z), \tag{4}$$

where $f(Z) = 1$ in the first set of cases and $f(Z) = 0.5$ in the second set. As a result of the multiplication by $f(Z)$, a change in X has exactly twice the impact on $\Pr(y = 1)$ in the first set of cases that it has in the second—for all independent variables X.[11]

Typically, of course, we are not nearly so certain that a given change in Z will produce such an exact change in the outcome of interest, so we estimate it rather than assuming it. In order to do so we multiply Z by a coefficient, call it γ, and find a concrete functional form that fits our idea of how changes in Z relate to changes in the probability that $y = 1$. We could, for example, use a second logit density to capture the relationship, as in

$$\Pr(y = 1) = \Lambda(X\beta) \times \Lambda(Z\gamma), \tag{5}$$

to capture the assumption that the attenuation of $\Pr(y = 1|X, \beta)$ will be a smooth, sigmoid, and symmetrical function of changes in $Z\gamma$. This is a straightforward application of Boolean logit (Braumoeller 2003), which in turn is a generalization of bivariate probit with partial observability (Poirier 1980).

It is, of course, possible to go further, by introducing two separate functions to capture the effects of democracy and political relevance, so:

$$\Pr(y = 1) = \Lambda(X\beta) \times \Lambda(Z\gamma) \times \Lambda(W\xi), \tag{6}$$

—where Z represents a vector of covariates that captures dyadic democracy and W represents a vector of covariates that captures political relevance, on a dataset that includes all dyads. To the extent that these effects are modeled correctly,

[11] It is important to emphasize the proportionality in the reduction of coefficients across variables. This assumption is made purely for the sake of parsimony in the absence of specific theoretical reasons to do otherwise: it is possible that the impact of some variables would be reduced more than the impact of others in, say, irrelevant dyads, and while it would be possible to model such an outcome, it would add considerably to the complexity of estimation.

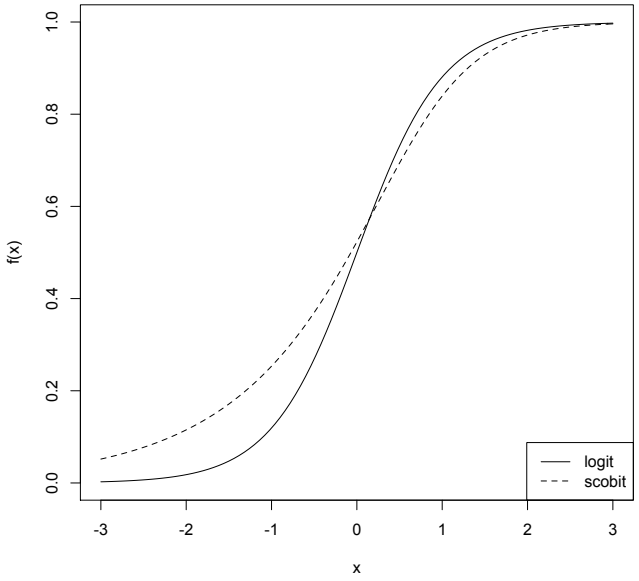

Figure 1: Logit (solid line) vs. Nagler's scobit (dashed line) c.d.f.s, demonstrating the ability of scobit to capture skew.

they will capture the sources of dyadic heterogeneity and permit asymptotically unbiased estimates of β.

Finally, it might be wise to relax the assumption of symmetry in $\Lambda(W\xi)$ if we wish to capture the effects of a loss-of-strength political-relevance gradient that has a dramatic impact in short- to medium-range distances but tails off over medium- to long-range ones. To capture such a possibility we can estimate

$$\Pr(y=1) = \Lambda(X\beta) \times \Lambda(Z\gamma) \times \Lambda^{\alpha}(W\xi), \tag{7}$$

where Λ^{α} represents Nagler's (1994) scobit estimator

$$\Lambda^{\alpha}(W\xi) \equiv (1+e^{-W\xi})^{-\alpha}, \tag{8}$$

a generalization of logit that permits skew in the c.d.f. The difference between the two is illustrated in Figure 1: in scobit, the value of f(x) drops off more quickly but then tails off more gradually as x decreases, relative to logit.

Asymmetric Impact: Monte Carlo Simulations

The difference between the logit and the scobit curve in Figure 1 appears fairly subtle, and potentially only of theoretical rather than practical interest. Is it, or can it be, substantial enough to warrant concern? That is, if we don't really care to test the loss-of-strength gradient hypothesis, are the results of logit models likely to be similar enough to the results of scobit models that we can safely ignore it? To answer this question, we turn to a series of Monte Carlo simulations to assess the potential importance of the argument that some variables, such as democracy and distance, may have an asymmetric impact on the dependent variable that belies the symmetry assumption embodied in standard, sigmoid logit and probit curves.

First, however, it is necessary to examine an alternative solution. The situation under examination is one in which changes in political relevance have a larger impact than linear distance would suggest at close range but rapidly diminishing impact thereafter. One possible way in which to handle this difficulty would be to transform the distance variable itself, into a variable that conforms to this expectation. If such a transformation succeeds in recovering the original parameters, it would be a simple and—relative to the techniques just described—computationally inexpensive solution. The danger, however, is that making a transformation like logging distance may be mathematically specific enough that it would fail to capture the exact form of the relationship, resulting in an unknown degree of bias.

To examine these issues, we simulated a dataset of 50,000 observations with four independent variables: expected utility (EU, drawn from a Normal density with mean zero and standard deviation 1); democracy (drawn from a uniform distribution on the -10...10 interval); scaled distance (each observation consisting of a zero with 20% probability and a draw from a uniform distribution with an 80% probability); and a variable reflecting whether one state or another is a Great Power (GP status; a Bernoulli trial with a 10% chance of success). The simulated dependent variable was militarized interstate dispute (MID) initiation, and the data-generating process was

$$\begin{aligned} \Pr(\text{MID}=1) &= \Lambda(\beta_{01}+\beta_{11}\text{EU})\times \\ &\quad \Lambda(\beta_{02}+\beta_{12}\text{democracy})\times \\ &\quad \Lambda^{-\alpha}(\beta_{03}+\beta_{13}\text{GP status}+\beta_{23}\text{distance}), \end{aligned}$$

For sample values, for ease of illustration we chose $\beta_{01}=\beta_{02}=\beta_{03}=3$, $\beta_{11}=\beta_{13}=1$, $\beta_{12}=\beta_{23}=-1$, and $\alpha=7$. We then generated 100 different datasets

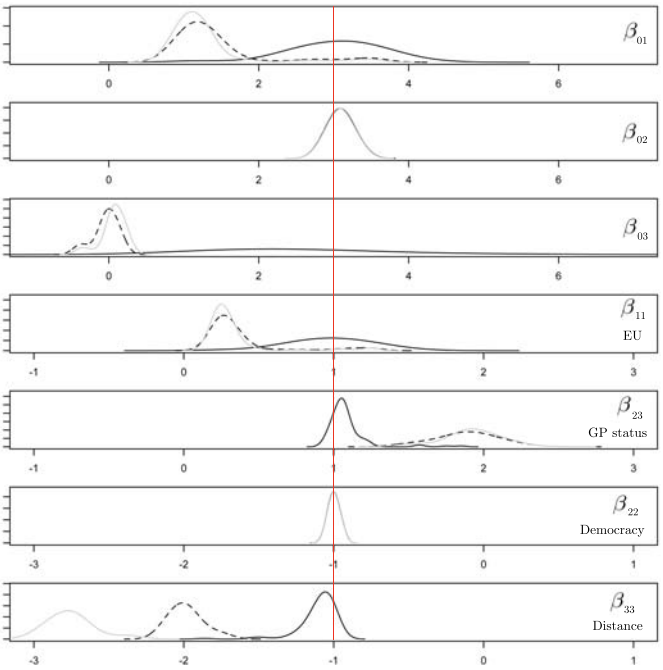

Figure 2: Coefficients for 100 Monte Carlo simulations (solid line: Boolean logit/scobit; dashed line: Boolean logit untransformed; grey line: Boolean logit with distance logged). Vertical line bisecting all coefficient graphs indicates population parameter values.

of 50,000 observations each, using these parameters, and analyzed those datasets using three different techniques:

- standard Boolean logit, without any adjustment for skew or recoding of the distance variable;
- standard Boolean logit, without any adjustment for skew but with the distance variable logged to capture the diminishing-returns argument; and
- a Boolean combination of logit (in the first two densities) and scobit (in the third, capturing political relevance).

The third captures the data-generating process and should produce the most accurate answers; the question is whether either of the first two will do so as well.

As the results in Figure 2 demonstrate unequivocally, the specifications without scobit do not perform as well. The Figure illustrates the fact that the violation

of the functional-form assumption has serious implications for the consistency of coefficients throughout the model, not just those in the single sub-equation implicated by the skew (e.g. political relevance vector).[12] The Boolean logit/scobit model, as anticipated, recovers the parameters well on average; the Boolean logit model with distance untransformed and the Boolean logit model with a log transformation for distance, on the other hand, do not. In fact, the log transformation makes little difference at all in the consistency of the coefficient estimates, except in the case of the coefficient on the distance variable itself, β_{33}—which actually becomes *more* biased rather than less.

With that illustration in mind, we turn to two tests of the arguments about democracy and distance, drawn from the literature on international conflict.

Applications

To assess the arguments elaborated above about the effects of democracy and political relevance on conflict, we have pursued a two-pronged strategy. In order to demonstrate the utility of capturing the Boolean theoretical logic underlying many existing theories, we have reanalyzed two prominent studies that capture the effects of democracy and distance on conflict. The first is Oneal and Russett's (1999) evaluation of the impact of trade on the initiation of militarized interstate disputes; the second is Schultz's (1999) study of democracy and escalation of such disputes. In the former study, we model democracy and political irrelevance as distinct paths to peace, testing this specification against the baseline specification described in the model. In the latter, we test a similar trivariate Boolean logit specification against a specification in which the distance c.d.f. is modeled as a scobit, allowing us to test the hypothesis that the relationship is asymmetric or skewed. In both cases we calculate Akaike's information criterion (AIC) for all models, which rewards both model fit and parsimony, as a way of adjudicating between the various models.

Oneal and Russett on Trade and Conflict

To see how a trivariate Boolean specification works, as well as to illustrate one way to think about the conditional nature of Boolean models, we now turn to Oneal and Russett's (1999) contribution to the literature on trade and conflict. We first replicate the original study, in order to provide a baseline. We then estimate what we call a "saturated Boolean model," which is simply the original logit

[12]The exceptionally wide distribution of coefficients for β_{03} reflects the fact that the skew coefficient and the constant term are, in general, fairly collinear…so one might reasonably expect greater uncertainty in estimating either when estimating both.

or probit model multiplied by additional logits or probits that contain variables that relate to the different "paths" to non-conflict. Here, it seems most plausible to break the analysis down into three separate paths: democracy, political relevance, and the measures of interdependence that are key to the argument. In the saturated model, the goal will be to compare the coefficients across sub-models to try to gauge whether an additive or multiplicative fit stands out as obviously more appropriate.

Here, the main variables of interest are levels of trade dependence, though a number of control variables have been thrown in—including joint democracy, contiguity, distance, and a dummy variable indicating whether or not the dyad in question is a major-power dyad (Table 1, column 1). It is straightforward to place the latter variables into separate logits in a Boolean specification that captures an alternative, more interactive understanding of the relationship among them.

In this case, the saturated Boolean model (column 2)[13] suggests quite strongly that the Boolean rather than the additive specification is appropriate: all of the democracy and contiguity variables have large and statistically significant coefficients in the multiplicative specification, whereas only one does, and to a much lesser degree, in the additive one. Accordingly, we estimated a trivariate Boolean logit model (column 3). Here, the results of the main variable of interest, the minimum level of dependence, was attenuated fairly drastically in the interactive model, while the impact of the democracy and political-relevance variables increased dramatically: the coefficient on contiguity doubled in size, while the coefficient on joint democracy quintupled, and the AIC metric bears out our intuition that this is the preferable model. This analysis demonstrates that a Boolean specification need not augment the impact of the researcher's variable of choice; it also demonstrates that the impact of democracy and contiguity may be artificially attenuated by an additive specification.[14]

Understanding Impact

It nevertheless remains difficult for all but the most analytically minded to get a clear grip on how to understand the impact of these variables. The Oneal and Russett reanalysis offers an unusually clear answer to that question. In short: The separate logits that are multiplied together in the Boolean logit analysis can

[13] Peaceyear splines have been included in the analyses summarized in columns 2 and 3, as in the original, but the coefficients have been omitted to save space.

[14] The coefficients in the first column of the Boolean logit analysis can be interpreted as reflecting the impact of the independent variable on the dependent variable when all other "paths" asymptotically approach unity—in this case, when $\Lambda(W\xi)$ and $\Lambda(Z\gamma)$ approach 1, i.e., political relevance and the level of democracy of the disputants provide no barrier to conflict at all.

	Logit	Saturated Boolean Model			Boolean Logit		
		Original	Democracy	Pol. Relevance	Original	Democracy	Pol. Relevance
Allies	-0.421^{***}	-0.466^{***}			-0.416^{***}		
	(0.100)	(0.102)			(0.098)		
Cap. Ratio	-0.124^{***}	-0.166^{***}			-0.179^{***}		
	(0.036)	(0.037)			(0.037)		
Lower dep.	−20.851	−11.188			−8.888		
	(13.913)	(12.291)			(12.097)		
Higher dep.	0.995	2.149			1.975		
	(1.429)	(1.326)			(1.373)		
Joint dem.	-0.003^{***}	0.000	-0.015^{*}			-0.017^{***}	
	(0.000)	(0.003)	(0.008)			(0.004)	
Contiguity	2.239^{***}	0.687^{*}		3.881^{***}			4.539^{***}
	(0.116)	(0.329)		(0.711)			(0.442)
Distance	-0.386^{***}	−0.048		-1.176^{***}			-1.064^{***}
	(0.046)	(0.088)		(0.183)			(0.107)
Maj. Dyads	1.163^{***}	−0.060		3.513^{***}			2.935^{***}
	(0.112)	(0.212)		(0.388)			(0.226)
Constant	−0.510	−0.843	4.869	6.437^{***}	-0.466^{***}	5.550^{***}	4.894^{***}
	(0.373)	(0.587)	(4.028)	(1.516)	(0.119)	(1.654)	(0.821)
AIC	5399.099		5239.210			5238.196	

Table 1: Reanalysis of Oneal and Russett's findings on the relationship between interdependence and conflict (numbers in parentheses are standard errors).

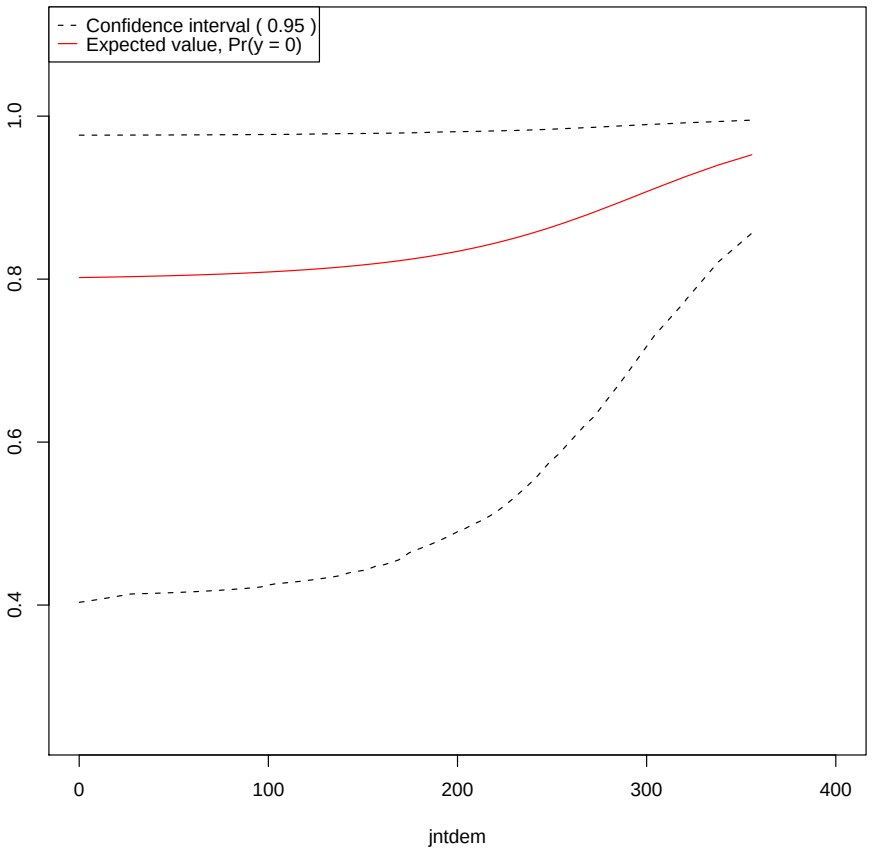

Figure 3: Extent to which joint democracy suppresses predicted probability of war based on other factors (dotted lines represent 95% confidence intervals).

each be understood separately, as if they were ordinary logits, and their predicted values tell us something about their impact on other variables, because in order to get a predicted probability for the occurrence of the dependent variable, the predicted values of the three logits are multiplied together. Therefore, as the predicted value for a given logit approaches 0, it has almost entirely suppressed the impact of the variables in the other logits; as it approaches 1, it permits their full expression.

We illustrate this point by calculating what we call the "suppression factor" associated with various levels of joint democracy. The suppression factor, which

is simply one minus the predicted value for a given logit, reflects the extent to which the variable in question suppresses or diminishes the impact of other variables when it takes on that value. Because the democracy "path" in the Oneal and Russett reanalysis contains only a single variable, this calculation is straightforward. Figure 3 demonstrates the result (dotted lines capture the 95% confidence intervals based on the standard error of the democracy coefficient). At very low levels of joint democracy, the confidence intervals are quite broad, making it difficult to say anything concrete about the extent to which regime type plays a role in conflict. At very high levels, however, our best estimate (in the face of much less uncertainty) is that dyadic democracy dramatically attenuates the impact of all other variables that lead to conflict—a result that clearly and parsimoniously captures the spirit of much of the democratic peace literature.

Schultz on Democracy and Escalation

Can the same logic that applies to the initiation of interstate disputes be applied to their escalation as well? Kenneth Schultz (1999) argues that democracy should have a pacifying effect even once disputes are underway, given that the democracy initiated the conflict, due to the informational properties of democratic states. Similarly, although the existence of a dispute indicates that states have to some degree "selected themselves in" to the set of politically relevant dyads, their inability to reach one another might nevertheless dissuade them from escalating to actual conflict.

The results of a straightforward Boolean specification[15] bear out Schultz's initial expectation (see Table 2, column 1): the democracy of the initiator decreases the probability of conflict. But in this case the substantive story that it tells differs significantly from the original: here, democracy increases the chances of peace by decreasing the impact of the various issues (territory, policy, regime, etc.) in the first column on the probability of escalation. Similarly, the political-relevance variables in the third column decrease the impact of the same variables on the probability of escalation, though only one of them—the absence of a land border—reaches standard levels of statistical significance.

In the mixed Boolean logit/scobit specification, on the other hand, while we see a similar pattern of statistical significance in the first two paths, the third is markedly different: land borders and separation by up to 200 miles of wa-

[15]We have modified two elements of Schultz's original specification, in the interest of increasing the amount of information available to the statistical routine: we have re-expanded the democracy variables from the 0-1 form used in the original article to the full -10 to 10 Polity specification, and we have disaggregated Schultz's contiguity variable into land and water. We have also added distance, as it bears directly on the question of political relevance.

	Boolean Logit			Boolean Logit/Scobit		
	Issues (Logit)	Democracy (Logit)	Pol. Relevance (Logit)	Issues (Logit)	Democracy (Logit)	Pol. Relevance (Scobit)
Alliance	0.407			0.362		
	(0.297)			(0.297)		
Territory	9.109			9.098		
	(81.999)			(97.568)		
Policy	-2.172^{***}			-2.229^{***}		
	(0.478)			(0.505)		
Govt./Regime	7.674			8.543		
	(39.988)			(62.999)		
Other	-1.978^{**}			-2.003^{***}		
	(0.754)			(0.779)		
Dem. Initiator		-0.083^{*}			-0.054^{***}	
		(0.056)			(0.002)	
Dem. Target		-0.022			-0.016	
		(0.027)			(0.015)	
Land			0.847^{***}			28.066^{**}
			(0.349)			(13.579)
Water			0.168			22.639^{*}
			(0.367)			(15.839)
Distance			-0.060			-4.524^{***}
			(0.056)			(2.968)
Major-Major			-0.205			-3.698
			(0.377)			(12.947)
Major-Minor			-0.317			-14.048^{*}
			(0.275)			(10.564)
Minor-Major			0.174			22.263
			(0.391)			(17.964)
Constant	2.052^{***}	2.068^{***}	0.944^{**}	2.164^{***}	1.332^{***}	-29.788^{**}
	(0.503)	(0.861)	(0.410)	(0.533)	(0.377)	(12.934)
$\log(\alpha)$						-4.583^{***}
						(0.258)
AIC		1777.567			1770.403	

Table 2: Reanalysis of Schultz's findings on the relationship between democracy and the escalation of militarized interstate disputes (numbers in parentheses are standard errors).

ter are both significant enablers of conflict initiation, while distance dampens it. The likely reason for the difference becomes apparent when we examine the skew coefficient, $\log(\alpha)$, which should be zero under the null hypothesis that the curve is equivalent to a standard logit curve. In this case, $\log(\alpha) = -4.583$, indicating a more abrupt decrease in the probability of conflict initiation at the top of the c.d.f. than ordinary logit would suggest and a more gradual decrease toward

the bottom—a finding consistent with the "loss of strength gradient" argument that changes in political relevance have the greatest marginal impact in relations among powerful states that are close to one another. Moreover, the standard error is small enough to assure us that the population parameter is very unlikely to be zero, and the Akaike Information Criterion supports the skewed specification.

Conclusion

The goal of this paper has been to forward and examine two propositions regarding the impact of democracy and distance on conflict. The first is that the impact of other war-causing variables on the probability of conflict will be contingent on the values of these variables rather than unconditional, and the second is that the magnitude of their impact in the case of political relevance will initially be quite abrupt but quickly "flatten" at larger values. The first proposition has found empirical support in John Oneal and Bruce Russett's study of trade and conflict, while the second proposition has found support in Kenneth Schultz's study of militarized interstate dispute escalation.

These propositions are both substantively interesting in their own right and of considerable theoretical interest to conflict research.[16] The choice between the strategies of adding a political-relevance variable or omitting dyads deemed politically irrelevant has long been one of the lesser of two evils; these findings suggest a theoretically informed and statistically straightforward alternative. Moreover, the democratic peace literature of the past two decades has built a strong case that shared democracy inhibits a wide range of the standard causes of war. The arguments here lay out these intuitions in more concrete form, and the tests formalize them for the first time and demonstrate that they are supported empirically.

[16]That said, these findings do come with a caveat. The assumptions underlying the simple, curvilinear-additive logit specification that are being relaxed in order to test these arguments are not made arbitrarily: they take the place of information. In a world of conflict data, consisting of 0s and 1s, the information needed to relax them can be surprisingly scarce. (Initial analyses using scobit for this paper, for example, encountered considerable convergence issues due to the demanding informational requirements, some but not all of which we were ultimately able to satisfy.) While we are staunch advocates of relaxing unwarranted assumptions in order to let the data better speak to theory, therefore, we should be clear that doing so is never costless: before long, the data may simply not have enough to say.

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