

# Dangerous Dyads

## CONDITIONS AFFECTING THE LIKELIHOOD OF INTERSTATE WAR, 1816-1965

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Theoretical arguments and some empirical evidence suggest that war is more likely to occur between states that are geographically proximate, approximately equal in power, major powers, allied, undemocratic, economically advanced, and highly militarized than between those that are not. Bivariate analyses of these seven factors in relation to the onset of interstate war over all pairs of states in the period from 1816 to 1965 generally support these associations. However, multivariate analyses reveal some differences. In order of declining importance, the conditions that characterize a dangerous, war-prone dyad are: presence of contiguity, absence of alliance, absence of more advanced economy, absence of democratic polity, absence of overwhelming preponderance, and presence of major power. Taken together these findings suggest that our research priorities may be seriously distorted and that the idealist prescription for peace may be better than the realist one.

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Clauswitz's assertion that war is "nothing but a duel on a large scale" reminds us that one of the core questions in the study of conflict is "who fights whom?" A good deal of theoretical speculation and some empirical evidence suggest that war is more likely to occur between states that are

geographically proximate,  
roughly equal in power,  
major powers,  
allied,  
undemocratic,  
economically advanced, and/or  
militarized

than between those that are not. Some of the component propensities in this summary statement are so widely assumed to be true that they have become

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“stylized facts” that, to some observers, need no further verification. But a closer scrutiny of the empirical evidence on which this confidence is based reveals one or more critical deficiencies in the relevant research. The most important of these follow.<sup>1</sup>

*Inappropriate unit of analysis.* In spite of the fact that interstate wars arise out of the interactions between states,<sup>2</sup> the overwhelming majority of empirical studies of war have been undertaken at the systemic or (less frequently) national level. If one is willing to make a number of critical and controversial assumptions, then some of these nondyadic studies will yield deductions that pertain to the question of who fights whom, yet the direct evidence they offer is, at best, inconclusive. My own assessment is less generous, because I view these studies as largely irrelevant to the dyadic question.

*Limited spatial-temporal domain.* In spite of the fact that wars are comparatively rare events, too many empirical studies to date have used narrow spatial and/or temporal domains. The spatial domain most frequently used is typically limited to the major powers, and the favored temporal domain is the post-World War II period. And there appears to be a fairly clear inverse relationship between the spatial and temporal domains used in previous studies, that is, the longer the time period studied, the fewer the states included. I do not dispute the fact that, within a given resource constraint, there is an inevitable tradeoff between the two domains; my point is rather that, given the comparative rarity of interstate war, narrow spatial and/or temporal domains provide us with a very weak basis for drawing conclusions about who fights whom.

*Faulty case selection strategy.* As Most and Starr (1989) point out, there has been a tendency in previous empirical work to use research designs that exclude a control group. That is, cases are selected for analysis based on the values of the dependent or independent variables, rather than some other factor not obviously related to either of these. For example, tests of the impact of some factor on war at the dyadic level are limited to dyads that experience

1. In stating these criticisms, it is not useful to single out individuals who are guilty of particular “sins” of research. Indeed, all war (and peace) researchers (including the author) have committed one or the other of these sins in the past.

2. After assessing a variety of war data collections, Most and Starr conclude that all share the following definition: “A war is a particular type of outcome of the *interaction* of at least dyadic sets of specified varieties of actors in which at least one actor is willing and able to use some specified amount of military force for some specified period of time against some other resisting actor, and in which some specified minimal number of fatalities (greater than zero) occur” (1989, 73, italics in original).

war. Such practices logically lead to problems in assessing necessary and/or sufficient conditions and limit the value of conclusions drawn in ways that are not always readily apparent to the casual reader.

*Bivariate analytical methods.* Although less true now than earlier, empirical studies of war still tend to be bivariate in nature. This by itself is not indicative of negligence, for the number of potentially important factors that are excluded from any analysis must necessarily be very large in number, but the problem of spurious and masked associations in bivariate analyses is a serious one. However, the call for multivariate analyses of interstate war is especially difficult to respond to because the basic frequency of war is small and the statistical degrees of freedom can quickly be exhausted by the addition of independent variables. Recognizing this estimation problem does not, however, obviate the need for more multivariate analyses of who fights whom.

*Questionable measures of war.* Many years ago Duvall (1976) pointed out that the onset and amount of war are two conceptually different phenomena (an opinion shared at the time by others, including myself), yet too often the various standard measures of war are still treated as substitutable for one another. For theoretical and methodological reasons, it is important to distinguish between the occurrence of war and the manner in which it evolves thereafter. More important for the topic under discussion here is the fact that tests with different measures of war as the dependent variable do not, with few exceptions, add up to multiple tests of the same hypothesis. On the contrary, they usually entail the testing of implicitly different hypotheses. I believe this is one key reason why it has proved so difficult to integrate the findings of empirical studies of interstate war.

All of the factors indicated above contribute to a general lack of comparability between empirical studies of interstate war. Different levels of analysis, different spatial-temporal domains, different cases, different analytical methods, and different measures of war all make it very difficult to assess the relative importance of factors that purportedly contribute to the occurrence of war. While not claiming to avoid or solve all the problems outlined above, this study does aim to rectify the more serious errors found in previous research. To discover or verify the relative importance of the seven factors listed at the outset of this article, a broad spatial-temporal domain (i.e., all states, 1816-1965) is used here, and the interstate dyad is the unit of analysis. A uniform measure of war that clearly reflects the focus of this study — the onset of interstate war — is employed, and both bivariate and

multivariate analyses are conducted. Given that the primary mission of this article is of a “fact finding” nature, no elaborate formal models will be presented, nor will I dwell at length on subtle theoretical issues. However, I think the results reported below do have important theoretical implications and suggest directions for future modeling work. Now, let us briefly review the theoretical arguments and empirical literature relevant to the seven predictors of war under consideration here.

## SEVEN PREDICTORS OF WAR

### GEOGRAPHICAL PROXIMITY AND WAR

The proposition that war is more likely to occur between states that are geographically proximate than between those that are not is disputed by few, and even considered trivial by some, perhaps because of the strong geopolitical component that is inherent in the very act of war. Boxers, after all, cannot fight until they are physically able to reach one another. This analogy is somewhat misleading, however, since the proposition does not state that war is more likely if the armed forces of two states are within striking distance of one another. Rather it argues that war is more likely between states that share a common border zone, regardless of whether that border zone is a heavily fortified no-man’s land or an almost forgotten boundary for which little physical evidence exists save its designation on maps.

A stronger and more interesting argument for why geographical proximity promotes war builds on the notion that proximity engenders serious conflicts of interest between states, a fraction of which are bound to lead to war. Shared access to a physical area can lead directly to interstate friction, even if the states involved agree as to where the border lies between them. A common example of this is where insurgents use the territory of an adjacent state as a basing area, and the state thus being used is unable or unwilling to suppress the insurgents’ activities on its territory. A large variety of other examples of how proximity can introduce an unwelcome degree of interdependence between states can be cited. Because this enforced “common fate” breeds frustrations and rivalries between states, so the argument runs, interstate tension increases and, *ceteris paribus*, war is more likely.

The empirical evidence linking war and proximity is scattered but generally consistent.<sup>3</sup> Several studies have found an association between the number of borders states have and their foreign conflict behavior generally

3. See Diehl (1991) for a recent review of geography and war.

or war involvement specifically (Richardson 1960; Rummel 1972; Starr and Most 1976, 1978; Terrell 1977). These studies do not enable us to conclude that sharing a common border increases the likelihood of conflict and war between a given pair of states because they do not demonstrate that the increased conflict involvement of states with many neighbors is directed toward those neighbors. Thus, the evidence that these studies present for the proposition must be considered indirect.

More direct evidence is to be found in studies by Gleditsch and Singer (1975), Garnham (1976), and Gochman (1990a).<sup>4</sup> Gleditsch and Singer found that the average intercapital distance between warring states was significantly less than the average such distance between all states over the period from 1816 to 1965. Garnham also employed an intercapital measure of distance to assess proximity, and found that the distance between warring pairs of states was significantly less than what would be expected by chance. This led him to conclude that "international war is more probable between more proximate pairs of nation-states" (p. 240). Gochman reported that about two-thirds of militarized interstate disputes occurring between 1816 and 1976 were between states that shared a common land border or were separated by 150 miles or less of water. Gochman also found that the proportion of disputes in which contiguity was present has tended to increase with the passage of time. Hence, if any trend is present in the effect of proximity on conflict, it would appear to be in the opposite direction from that commonly thought; that is, proximity may be more salient today than it was a century and a half ago.

#### POWER PARITY AND WAR

Whether equality in power between states promotes war or peace has been hotly debated in the theoretical literature. Both sides make convincing arguments that appeal to common sense. One side argues that states that are radically different in power should not engage in war because the clearly weaker side would not be so foolish as to initiate or allow itself to be drawn into a war it cannot win. Hence, at the dyadic level, preponderance promotes peace. The other side of the debate argues that when two states are relatively equal in power, neither can be certain of victory, and they therefore deter one another from war. Ergo, power parity promotes peace between states. The

4. The work of Diehl and Goertz (e.g., Diehl and Goertz 1988; Goertz and Diehl 1990) which focuses upon territorial changes does not deal directly with the overall propensity for proximate states to engage in war, but the basic thrust of their work certainly supports the notion that geographical proximity is an important determinant of interstate conflict.

first of these two views is found in more contemporary treatments of the question (e.g., Organski 1968; Blainey 1973; Gilpin 1981), whereas the second prevails in the older balance of power tradition (e.g., Claude 1962).

Although many empirical studies have examined the relationship between power and war, very few have looked specifically at the dyadic level. Garnham (1976) examined two-nation wars during the period from 1816 to 1965 and found that warring pairs of states were more equal with respect to several power-base measures (i.e., area, population, fuel consumption, iron and steel production) than would be expected by chance. This led him to conclude that power parity is more likely to lead to war than preponderance. Weede (1976) restricted his analysis to a smaller spatial-temporal domain (i.e., contiguous Asian dyads over the period from 1950 to 1969), but found essentially the same result, that is, that preponderance of power promotes peace. More recently, Gochman (1990b) found evidence to support the proposition that major powers are more likely to engage in war with other major powers when their capabilities are relatively equal. After reviewing the empirical literature on dyadic power and war, Sullivan concludes that "though the findings do not speak with one voice, a tendency seems to be, with some certain exceptions, that situations of preponderance are more likely associated with nonwar than the opposite" (1990, 129), an assessment with which I essentially agree.

#### POWER STATUS AND WAR

As with geographical proximity and war, there may be a tautological element in the proposition that major powers are more likely to engage in war than minor powers. It can be quite convincingly argued that major powers achieve and maintain their status as such because, in large measure, they pursue an active, interventionist, perhaps even aggressive, foreign policy that brings them more frequently into violent conflict with other states. The literature on war making and state making suggests that the two phenomena are intimately connected (Rasler and Thompson 1989). To the extent that this is true, it may be impossible to determine on balance whether states become major powers because they engage frequently in war or states engage frequently in war because they are major powers. A true test of the two propositions may come when and if Germany and Japan are readmitted to the major power club.

The nondyadic empirical evidence is quite clear (Bremer 1980b; Small and Singer 1982); major powers are much more likely to become involved in wars than minor powers. *Ceteris paribus*, dyads that contain one or more major powers should be more war prone than those that do not.

## ALLIANCE AND WAR

In the modern era, alliances tend to be seen as defining “security communities” among their members, and, as such, it is expected that they will reduce the likelihood of war between members. In truth, this expectation may be based largely on a few durable and institutionalized alliances like NATO in the post-World War II era rather than on alliances in general. Yet the assumption that allies are more likely to resolve disputes by means other than war and, therefore, are less likely to engage in war with one another seems deeply ingrained in conventional wisdom. The older, more traditional view of alliances sees them as growing out of expediency and reflecting nothing deeper than a temporary need of two or more states to coordinate their actions against one or more other states. In this second view, alliances are not seen as contracts but rather as bargains, wherein it is understood by all parties that each has the right to withdraw quickly should a better deal come along. Under this conception of alliances as limited, transient arrangements, war between allies should be neither more nor less frequent than between nonallied states. In theory, then, alliances may or may not reduce the chances of war between allies, but they should not increase the likelihood of war between allies.

Perhaps for this reason, Bueno de Mesquita’s assertion that “war is much more likely between very close allies than between enemies” (1982, 30) was a counterintuitive, if not startling, deduction from his expected utility theory.<sup>5</sup> And the empirical evidence he offered (1981, 159-64) seemed to confirm this assertion. After a thoughtful review of Bueno de Mesquita’s arguments and evidence, Ray concluded that “in light of the fact that it would be surprising to find that allies are even as conflict prone as unallied pairs of states, it is not unreasonable to conclude that allied dyads were disproportionately involved in international conflict with each other in the 1816-1974 time period” (Ray 1990, 86). Thus, contrary to most theoretical expectations, war appears to be more likely between allied states than between nonallied states, at least since the end of the Napoleonic era.

## DEMOCRACY AND WAR

At a time when democracy seems to be experiencing a resurgence, the argument that democracies are less war prone (at least vis-à-vis one another) gives some grounds for optimism about an otherwise turbulent future. The

5. Of the 347 propositions about alliances that Holsti, Hopmann, and Sullivan (1985) gleaned from the traditional literature, not one posits that an alliance should increase the likelihood of war between member states. This may be a good indicator of just how counterintuitive Bueno de Mesquita’s assertion is.

philosophical justifications for why democratic states should be less war prone than others will not be repeated here.<sup>6</sup> Instead, I will focus on the empirical debate that has been underway for some years.

Until recently, the prevailing appraisal of the empirical evidence regarding the linkage between democracy and war proneness supported the conclusion that democracies were neither more nor less war prone than other states. Studies by Wright (1965), Rummel (1968), Russett and Monsen (1975), and Small and Singer (1976) all reached this conclusion. Rummel (1983) challenged this conclusion and gave evidence that democracies were less war prone and especially so vis-à-vis one another. This prompted Weede (1984) to reexamine the question focusing on the period from 1960 to 1980, after which he concluded that democracies were neither more nor less likely to engage in war than other states. Chan (1984) considerably extended the analysis of Rummel's contention by examining the period from 1816 to 1980, and, although he did not dispute the proposition that democracies do not tend to fight one another, he did conclude that democracies were not less war prone in general than undemocratic states. Domke (1988) used Gurr's Polity (I) data set and failed to find any consistent association between the degree of democracy and likelihood of war. Dixon (1989) also failed to find much association between the degree of democracy and the frequency of war over a long span of time (1816-1971), but his study, like most others discussed here, was conducted at the national rather than dyadic level. Maoz and Abdolali (1989) did include a dyadic analysis as part of their larger study of regime type and militarized interstate conflict. They found strong evidence that democracies tend not to go to war with one another, but little evidence that democracies tend to be less war prone overall.

Most of the studies surveyed above contain one or more serious design flaws, such as using a monadic level of analysis when a dyadic one is called for, failing to control for the number of democracies, or using an inappropriate measure of war. Nevertheless, the weight of evidence they yield clearly supports the proposition that democracies have a much lower likelihood of becoming involved in wars against other democracies than would be expected by chance. Russett has even gone so far as to assert that "this is one of the strongest nontrivial and nontautological generalizations that can be made about international relations" (1990, 123). The evidence as to whether or not democracies are less war prone overall is far less conclusive, but the absence of strong evidence to the contrary leads one to conclude that democracies have been neither more nor less war prone than nondemocracies.

6. See Waltz (1959) and Doyle (1986).



## DEVELOPMENT AND WAR

The rise of international political economy as a subfield has resensitized many to the importance of economic factors and international conflict. A central focus of much of the literature in this area is the way in which economically advanced states relate to each other and, more importantly, to states that are not economically advanced. Although war appears not to be a central concern of most of those engaged in research in this area, two propositions relating to war can be deduced from their work. The first derives from the Leninist thesis that states that are more economically advanced will tend to come into sharp conflict with one another as they compete for markets and resources in a largely zero-sum world. Of course, a critical caveat for the Leninist thesis is that these states be capitalistic in nature, and this is, no doubt, an important theoretical distinction. Unfortunately it is not a distinction that can be used meaningfully in empirical analyses because, with few exceptions over the last 2 centuries, all more advanced states have also been capitalistic. For this reason the proposition examined here is simply that more advanced states are more likely to start wars with one another than are other states.<sup>7</sup>

The second proposition that is suggested by this literature is that war is more likely between more advanced and less advanced states than between pairs of more or less advanced states. This would follow from an admittedly unsophisticated dependencia theory that states that the likelihood of war increases when a more advanced economy attempts to penetrate a less advanced economy, or when a less advanced economy attempts to shake off the yoke imposed by a more advanced economy. If this pattern of conflict were widespread, then one would expect to see a disproportionate amount of war between more and less advanced economies.

Efforts to uncover empirical studies that bear directly on these propositions were unsuccessful. Studies that include measures of development, as opposed to economic size, were not conducted at the dyadic level (e.g., Rummel 1968), whereas dyadic studies (e.g., Garnham 1976) used measures of economic size rather than development. And some (e.g., Bremer 1980a) that considered the linkage between economics and war were neither dyadic nor concerned with development. It would appear, then, that we are in virgin territory, empirically speaking, with respect to these propositions.<sup>8</sup>

7. This proposition is also broadly consistent with the lateral pressure theory (Choucri and North 1975) because it posits, *ceteris paribus*, that technologically advanced societies should exhibit high levels of conflict among themselves.

8. I should note that the distinction between more and less advanced states cuts across other distinctions made in this study. Among major powers, for example, England falls into the first

## MILITARIZATION AND WAR

According to the old maxim, "states that seek peace should prepare for war." The questions that concern us here are whether states that devote a disproportionate share of their resources to military preparedness succeed in reducing their chances of war, as the maxim implies they should, or will such states exhibit a higher likelihood of war? I should emphasize that more militarized states are not necessarily those with the largest absolute military capability. Several countries in the Middle East, for example, maintain armed forces much larger than most other countries of comparable size and are more militarized, as I use the term here, even though their armed forces are small in a global sense.

The war-avoidance properties of militarization flow clearly from the logic of deterrence. If a state can persuade a potential attacker that the costs of war will be high relative to the expected gains, then the odds of being attacked will be lower. And this logic applies to small states as well as large since, although small states may not be able to avoid defeat in wars with large states, they can, by extensive military preparations, guarantee that victory will be costly to the large states and thereby deter attacks. According to deterrence theory, then, more militarization means less war.

As is usually the case, for each maxim there is an equally convincing counter-maxim. In this instance it would be that "those who live by the sword, die by the sword." For a variety of reasons, states that prepare for war may get exactly that for which they prepare. The construction of a "garrison state" may call forth leaders that are bellicose and unyielding rather than flexible and accommodating. The militarization of a society may cause leaders and followers alike to conclude that war is inevitable rather than merely possible. Justifying the sacrifices that high degrees of military preparedness require may strengthen enemy images and even lead to collective paranoia. And, of course, other states may not see the defensive motivation behind the heightened military posture, and perceive instead a substantial threat to their own security. On balance, I find the second argument more persuasive than the first so the exact proposition under examination is stated accordingly; that is, pairs of more militarized states are more likely to begin wars than other states.

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category throughout the 19th century, whereas Russia does not, and Germany moves from less advanced to more advanced during that century. Similarly, economically advanced states need not possess large capabilities, as witnessed by the existence of Austria, the Netherlands, Belgium, and so on in the contemporary system. In short, distinguishing more advanced from less advanced states should provide us with a different perspective on the possible preconditions of war.

The empirical evidence on this proposition is, at best, indirect. The most germane comes from the numerous but inconclusive studies on the relationship between arms races and war. On one side of this question we find Wallace (1979, 1981, 1982, 1990) who has presented evidence that arms races do increase the likelihood of war between racing states. On the other side, we find Diehl and others (Diehl 1983, 1985; Weede 1980) who dispute this connection. To a great extent the outcome of this debate hinges on the definition of what constitutes an arms race.<sup>9</sup>

Even if it were shown conclusively that arms races increase the likelihood of war, this would not constitute direct confirming evidence for the proposition under consideration here for two reasons. First, the arms race thesis is dynamic while the militarization hypothesis is static. That is, continued increases in preparedness are central to the former, while high levels of preparedness are the concern of the latter. Second, the arms race thesis is not concerned with the relative defense effort of racing states, while the militarization hypothesis is. Two states could be involved in a low level arms race with neither reaching the stage of militarization referred to here, although continued, large increases in resources devoted to the military should eventually lead to that stage.

## DEFINITIONS AND MEASUREMENTS

Given the way in which our seven key propositions are stated and the underlying theoretical arguments from which they derive, it seems obvious that the interstate dyad is the appropriate level of analysis. An interstate dyad is defined as any pair of states that are members of the interstate system, where system membership is defined by the standard Correlates of War rules.<sup>10</sup> Because I wish to test the veracity of the propositions over a long historical period (i.e., from 1816 to 1965) rather than at only one point in time, the basic observational unit must be time based, and I have selected the year as the time unit. Hence, the interstate dyad-year is the observational unit employed in the analyses that follow. Aggregating over time and space yields a population of 202,778 nondirectional<sup>11</sup> interstate dyad-years during the 1816 to 1965 span.

9. For a recent "recap" of this debate see Siverson and Diehl (1989).

10. Save a few modifications that have been made since the publication of Small and Singer's *Resort to Arms*, the states examined here and their qualifying years are the same as those given in Table 2.1 of that volume (Small and Singer 1982).

11. A nondirectional dyad is one in which no distinction is made between the U.S.-USSR and USSR-U.S. dyads, for example. In directional dyads this differentiation is, of course, retained.

### DEFINING WAR OCCURRENCE

One of the key reasons that the findings derived from empirical studies of war do not add up in a cumulative fashion is the wide variation in operational definitions of war that have been employed. Thus, for example, two studies may, as this one does, accept the Correlates of War definition of what constitutes a war, yet adopt quite different measures of war participation (e.g., nation-months of war underway versus battle deaths begun), and, by doing so, make it virtually impossible to compare their findings in any direct way. Too often, I think, the measurement of war has been guided by statistical considerations<sup>12</sup> or by an eclecticism that sees the various war measures as more or less substitutable rather than by a deeper theoretical examination of the questions under review.

As stated above, the seven propositions under examination deal only with the likelihood of wars between states and say little directly about the length, severity, or ultimate size of those wars that do occur. Hence, measures of war that rest on the latter are inappropriate for this study. If wars did not have the analytically annoying and sometimes catastrophic tendency to change in composition (i.e., states enter and leave a war after its start or before its end, occasionally switching sides in the process), our definition of war onset would be straightforward at this point. But because wars do have this tendency, we must deal with the question of whether a distinction is to be made between the initial combatants (originators) in a war and those states that become involved after its start (joiners).

I share the growing view that war must be seen as a process rather than only an event,<sup>13</sup> and, according to this view, it is important to distinguish between the occurrence of a war and how it evolves thereafter. In other words, the question of why wars begin is fundamentally different from the questions of why wars grow in size, duration, or severity. Studies that fail to make this distinction are fundamentally flawed. If we turn back to the seven propositions under study, it seems clear that their focus is the likelihood that a war will begin between two states and not the likelihood that a state will join an ongoing war. Hence, I will examine only the original participants in a given war and disregard subsequent joiners in the analyses that follow.

If all wars began as one-on-one confrontations, then for each of the 56 interstate wars that began during the period under study there would be one

12. For example, the distributions of many war measures are badly skewed, and transformations have been done to bring in outliers to which regression analysis is very sensitive.

13. Duvall (1976) is an early (in print) advocacy of this view, while Most and Starr (1989) contains a more recent endorsement of it. My own view is elaborated in Bremer (1991).

dyad of original participants, but the historical record is not quite so simple.<sup>14</sup> In 13 of the 56 qualifying wars, two or more states became involved in war with one or more other states on the very first day of the war.<sup>15</sup> These may be instances of genuine collusion or very fast joining behavior (I favor the former interpretation), but unfortunately the available historical evidence does not allow us to distinguish reliably between the two. In view of this, we are left with little choice but to treat these simultaneous outbreaks of dyadic war as independent events even though we strongly suspect they are not.<sup>16</sup> Employing this assumption, one finds 93 cases of war onset at the dyadic level during the period from 1816 to 1965.<sup>17</sup> Because the year *prior* to the beginning of each war was used as the observation point for the seven independent variables rather than the year of the war itself, three of the 56 wars are not usable due to the fact that not all of the participants on one side were members of the interstate system in the year prior to the war. This reduces the number of war dyads by eight, leaving a total of 85.

#### GEOGRAPHICAL PROXIMITY

To ascertain whether any given pair of states are geographically proximate to one another, I turned to the Correlates of War contiguity data set.<sup>18</sup> In that data set, four types of direct state-to-state contiguity are distinguished: contiguous by land, or separated by 12, 24, or 150 miles or less of water. In this study I have chosen to disregard the tripartite water distance distinction and deal with only three types of contiguity. Thus, in a given year, a dyad is either land contiguous, sea contiguous (i.e., separated by 150 miles of water or less), or not contiguous. At this time, unfortunately, the contiguity data extend only from 1816 to 1965, and it is this limitation that essentially defines

14. As implied above, I rely on the war data compiled by the Correlates of War project. More specifically, they were derived from Small and Singer (1982).

15. Seven wars began as two-to-one confrontations, two as three-to-one, one as four-to-one, and two as five-to-one. In one case, the Seven Weeks War, the initial confrontation was between two and five states.

16. Avoiding this assumption would require solving the rather formidable problem of identifying when and under what conditions two or more states will undertake joint action against one or more other states. This is an important and interesting question but beyond the scope of this article.

17. The observant reader will note that I have not dealt with the question of war initiation. This is because the propositions under consideration are nondirectional in nature and have little to say about which of the two states involved in a war will be the first to undertake sustained combat.

18. The particular version of this data set that I used was supplied to me by Charles S. Gochman, to whom I here express my thanks. Those interested in learning more about this data set should consult Gochman (1991).

the temporal span of the whole study. Applying these criteria to the 202,778 interstate dyad-years yielded 10,542 cases of land contiguity, 3,019 cases of sea contiguity, and 189,217 cases of no contiguity.<sup>19</sup>

### RELATIVE POWER

To assess the degree to which any pair of states is equal in power, I have used the Correlates of War material capabilities data set<sup>20</sup> that covers the period from 1816 to 1985 and records the military personnel, military expenditures, iron and steel production, energy consumption (after 1859), urban population, and total population for state system members. In the usual fashion, I first derived indexes of military, economic, and demographic capability by computing each state's average share of system-wide capability across the two variables within each of the three dimensions and then averaged these values to arrive at the Composite Index of National Capability (or CINC).<sup>21</sup>

Based on these CINC scores, I computed the larger-to-smaller capability ratios for all dyad-years and classified them into three groups. If the capability ratio was less than or equal to three, then the dyad was considered to constitute a case of small power difference. If the ratio was larger than 10, then the power difference was coded as large, whereas a ratio between 3 and 10 was coded as a medium power difference. If either of the CINC scores was missing (or equal to zero) for a ratio calculation, then the power difference score for that dyad was coded as missing also.

The 3-to-1 threshold was chosen because of its prominence in the folklore of military strategy while 10-to-1 threshold is quite arbitrary.<sup>22</sup> To my

19. Relying only on direct state-to-state contiguity as a measure of geographical proximity may partially distort the results reported below, because indirect contiguities (e.g., state-to-dependency-to-state contiguities) will not be recorded. The United States and Great Britain are not directly contiguous at any time but obviously they shared a geographical proximity with one another via Canada until it achieved its independence. In general, I expect this absence of indirect contiguity to weaken the observed effect of geographical proximity. A test of this supposition will be possible in the near future with data recently provided to me by Randolph Siverson and Harvey Starr, because their contiguity data set does include colonial borders. These data are described in Siverson and Starr (1991).

20. The revised and expanded version of this data set was kindly provided to me by the Correlates of War project.

21. Although the version of the capability data set I employed has significantly less missing data than previous versions, some data (e.g., from 19th-century Latin American states) are still missing. After experimenting with several alternative methods of handling missing data, I adopted the following procedure. If both values within a dimension were missing, then the score on that dimension was recorded as missing. If only one of the two values was missing, then the score on that dimension was set equal to that of the value present. If, after this procedure, any one of the three dimensional values was missing, then the CINC score was recorded as missing.

22. This is the same threshold value used by Weede (1976) to define what he called overwhelming preponderance.

surprise, the use of these thresholds yielded roughly equal groups of dyad-years. That is, 74,620 of the 202,778 dyad-years were found to exhibit a large power difference, 56,432 were characterized by a medium power difference, and 62,055 by a small power difference. The 9,671 remaining cases (less than 5%) were missing.

#### POWER STATUS

To investigate the effects of power status, each dyad-year was examined to determine whether both, one, or neither of the relevant states were or was a major power in that year. Accordingly, the dyad was coded as having a power status of major-major, major-minor, or minor-minor. The identity and qualifying years for major powers were the same as those defined by Small and Singer (1982) and used by many other analysts. Applying these criteria across the entire spatial-temporal domain yielded the following breakdown: 2,267 major-major dyad-years, 36,907 major-minor dyad-years, and 163,604 minor-minor dyad-years.

#### ALLIANCE

To distinguish those dyads that are allied from those that are not, I have used the Correlates of War formal alliance data set (Small and Singer 1969) as amended and modified by Alan Sabrosky.<sup>23</sup> In that data set formal alliances among nations are divided into three types: mutual defense pacts, neutrality agreements, and ententes. Using this data set, I was able to classify each dyad-year as falling into one of four groups: defense, neutrality, entente, and none. The total number of dyad-years this produced were 11,176; 647; 3,531; and 187,424, respectively.

#### DEMOCRACY

Defining and measuring democracy is difficult, and especially so when a dichotomous measure is desired. Therefore, in this study I will draw on two different efforts to classify political systems. The first is the dichotomous division of states done by Steve Chan<sup>24</sup> (Chan 1984) in which a state is classified as democratic if its chief executive is directly or indirectly elected in a popular fashion and its legislative branch is also elected and able to constrain the executive in an effective manner (see Chan 1984, 629-31 for further details). Using this data set, which covers the period from 1816 to

23. These data were supplied to me by Alan Sabrosky, to whom I express my gratitude.

24. I would like to thank Steve Chan for supplying me with these data.

1980, I was able to assign each of the dyad-years to one of three groups: both states democratic (21,644), one democratic state (78,349), and both states undemocratic (99,580). In addition, data were missing for 3,205 dyad-years, and these were assigned to the missing group.

The second data collection I use to assess whether or not states are democratic is Ted Robert Gurr's Polity II data set (Gurr, Jagers, and Moore 1989), which contains, among other things, a variable reflecting the degree of "institutionalized democracy" found in a state in a given year. Like Chan's measure, this index is based on the competitiveness of leader selection processes and constraints on executive authority. In its raw form, this index varies from 0 to 10 (undemocratic to democratic). I dichotomized the variable by classifying states as democratic that had a value of 5 or greater on Gurr's index and otherwise as undemocratic.<sup>25</sup> Using the Gurr-based index I found 22,859 dyad-years in which both states were democratic, 80,668 with one democratic state, and 80,801 with neither state democratic. This left 18,450 dyad-years coded as missing when values were missing for one or both states.

## DEVELOPMENT

Given the paucity of macroeconomic time-series data for years prior to World War II, any effort to differentiate more advanced economies from less advanced economies based on, for example, GNP or GDP per capita would suffer from serious design deficiencies.<sup>26</sup> Rather than abandoning the effort to consider the relationship between development and war, I derived an index based on the Correlates of War material capabilities data set that may capture some of the economic differentiation between states that is sought.

It will be recalled that in deriving the composite index of national capability, two component indexes assessing the economic and demographic dimensions were used. In a general sense, these component indexes reflect the share of system-wide economic and demographic capabilities that a state possesses in any given year. A more economically advanced state should be characterized by possessing a share of system-wide economic capability that

25. To assess the agreement between the Chan and Gurr classification of states, I compared the state-year dichotomous codings in those 6,675 cases where values were present in both collections. The Yule's Q coefficient of correlation between the two data sets was +0.93, suggesting that they are highly similar but not identical.

26. Under the most optimistic assumptions about data availability, I would estimate that the number of dyad-years for which the relevant data could be assembled would be less than 20% of the total dyad-years under consideration. A more realistic estimate might be as low as 10%. Clearly, our ability to test a generalization when 80% to 90% of the needed data are missing is very limited, and especially so in this case, because the missing data would be concentrated heavily in the pre-World War II era and less advanced states.



is greater than its share of system-wide demographic capability. Hence, in years when this was found to be true, I classified a state as more advanced; otherwise, less advanced.<sup>27</sup> The next step involved examining each pair of states in each year and assigning it to one of three groups: both more advanced (7,160 dyad-years), one more advanced (61,823 dyad-years), and both less advanced (128,939 dyad-years). The remaining 4,856 dyad-years had to be assigned to the missing group because data were not available for one or both of the relevant states.

### MILITARIZATION

As with measuring development, assessing whether states are more or less militarized over the century and a half under study is difficult, given the lack of historical data. Ideally, one would wish to measure what is sometimes referred to as defense effort (i.e., the ratio of defense expenditures to GNP), but this is not a viable measure for most states in most years over the century and a half under consideration due to the insufficiency of macroeconomic data. Instead, I relied on the material capabilities data set discussed above, and classified a state as more militarized if its share of system-wide military capabilities was greater than its share of system-wide demographic capabilities. I classified it less militarized if this was not true. The classification of each dyad-year was then based on whether both, one, or neither of the two states making up the dyad were more militarized in that year. This produced 29,366; 87,720; and 76,467 dyad-years, respectively, leaving 9,225 dyad-years as missing due to the absence of data for one or both sides.

### BIVARIATE RESULTS

To begin the assessment of the relative merit of the seven propositions stated in the introduction, I use a simple and straightforward method. I calculate and compare the conditional probabilities of war in a dyad-year given the presence of the conditions specified by each proposition. The degree to which the conditional probabilities relevant to a proposition vary from one another is then used as evidence for the proposition. The relevant information is found in Table 1. For each dyad type, the first column in this table shows the observed number of war onsets, together with the expected number of onsets (in parentheses) if the type distinctions are ignored. The latter are the products

27. I believe this procedure for identifying economically advanced states errs more on the side of excluding "truly" more advanced states than of including "truly" less advanced states.

TABLE 1  
 Conditional Probabilities of War by Dyad Type, 1816-1965

<i>Dyad Type</i>	<i>War Dyads</i>	<i>Total Dyads</i>	<i>pr(War)*</i>	<i>Z</i>	<i>pr(Z)</i>
Proximity and war					
Land contiguous	48 (4.4)	10,542	4.55	20.74	<.0001
Sea contiguous	13 (1.3)	3,019	4.31	10.43	<.0001
Not contiguous	24 (79.3)	189,217	0.13	-6.21	<.0001
Power difference and war					
Large difference	27 (31.3)	74,620	0.36	-0.77	.22
Medium difference	28 (23.7)	56,432	0.50	0.89	.19
Small difference	29 (26.0)	62,055	0.47	0.59	.28
Missing	1	9,671			
Power status and war					
Major-major	5 (1.0)	2,267	2.21	4.16	<.0001
Major-minor	42 (15.5)	36,907	1.14	6.75	<.0001
Minor-minor	38 (68.6)	163,604	0.23	-3.69	.0001
Alliance and war					
Defense pact	20 (4.7)	11,176	1.79	7.08	<.0001
Neutrality treaty	2 (0.3)	647	3.09	3.32	.0004
Entente	1 (1.5)	3,531	0.28	-0.39	.35
No alliance	62 (78.6)	187,424	0.33	-1.87	.031
Democracy and war (Chan)					
Both democratic	1 (9.1)	21,644	0.05	-2.68	.0043
One democratic	14 (32.8)	78,349	0.18	-3.29	.0005
Both not democratic	70 (41.7)	99,580	0.70	+4.37	<.0001
Missing	0	3,205			
Democracy and war (Gurr)					
Both democratic	2 (9.6)	22,859	0.09	-2.45	.0071
One democratic	25 (33.8)	80,668	0.31	-1.52	.0643
Both not democratic	36 (33.9)	80,801	0.45	+0.37	.3557
Missing	22	18,450			
Development and war					
Both advanced	6 (3.0)	7,160	0.84	+1.73	.0418
One advanced	25 (25.9)	61,823	0.40	-0.18	.4286
Both not advanced	54 (54.0)	128,939	0.42	-0.01	.496
Missing	0	4,856			
Militarization and war					
Both more militarized	38 (12.3)	29,366	1.29	+7.32	<.0001
One more militarized	30 (36.8)	87,720	0.34	-1.12	.1314
Both less militarized	16 (32.1)	76,467	0.21	-2.84	.0023
Missing	1	9,225			

\*To facilitate reading all probabilities have been multiplied by 1,000.

of the unconditional dyadic probability of war (85/202,778) and the number of dyad-years each dyad type was observed, which is given in the second column. The third column contains the conditional probability of war,  $\text{pr}(\text{War})$ , for each dyad type, which is the observed number of war onsets divided by the total dyad-years. These probabilities have been multiplied by 1,000 to facilitate reading. To help distinguish large and small effects, I include as well in the table standard normal ( $Z$ ) values and their associated probabilities. These are derived from a difference of proportions test where each group is posited to be a random sample drawn from a known population. The  $Z$  and  $\text{pr}(Z)$  values reflect, then, the likelihood of obtaining a conditional probability of war this or more different from the unconditional probability of war if the distinction used to define the group was truly irrelevant to war propensity.<sup>28</sup>

*Proximity and war.* The top of Table 1 reveals the probabilities of war in a dyad-year when the 202,778 dyad-years are segregated by geographical proximity. It is obvious that the presence of land or sea contiguity significantly increases the probability of war occurring in a dyad, with land contiguous dyads being slightly more war prone than sea contiguous ones. Ignoring the latter distinction yields a probability of war per dyad-year, given either land or sea contiguity, of .0045. Because this value is 35 times greater than the probability of war when contiguity is absent, there can be little doubt that the effect of state-to-state contiguity on the occurrence of war is quite strong.<sup>29</sup> The large  $Z$  values and their small associated probabilities strongly reinforce this conclusion.

*Power difference and war.* The conditional probabilities of war onset given large, medium, or small power differences are the next shown in Table 1.

28. The exact formula used to derive the  $Z$  values was

$$Z = \frac{(P_c - P_u)}{\sqrt{P_u(1 - P_u)/N_c}}$$

where  $P_c$  and  $P_u$  are the conditional (group) and unconditional (population) probabilities of war and  $N_c$  is the number of dyad-years the relevant group is observed. See Blalock (1972, 193-97) or any other basic statistics text for more information.

29. The reader may wonder why there are as many as 24 cases of noncontiguous war dyads. A quick check of these cases reveals that many are characterized by indirect contiguity, an effect that cannot be assessed with the available data. The problem, of course, is not assessing whether indirect contiguity was present in those 24 instances, but rather of determining which of the 189,193 observations of no war with no direct contiguity are really instances of no war with indirect contiguity.

The first impression conveyed by these results is that, relatively speaking, the three probabilities do not differ all that much from one another. The  $Z$  values are all within the +1 to -1 range, suggesting that the power difference distinction is not much better than a random split. Together, these values lead to the conclusion that the effect of power difference is, at best, small. The effect that is present, however, is in the direction postulated; that is, war is about one-third more likely in dyads characterized by small or medium power differences than in those with large power differences.

*Power status and war.* The next set of conditional probabilities in Table 1 are obtained when the whole set of dyad-years is divided into subsets based on the power status of the states involved. Major-major dyads have the highest probability of war, whereas minor-minor dyads have the lowest probability of war, and, because the probability of war in the former is about 10 times larger than the latter, the proposition that major-major dyads are more war prone seems to have considerable merit. In addition, because the probability of war in dyads that include one major power is about 5 times greater than those that contain no major power, it appears that the effect of power status may be additive rather than interactive. The absolute  $Z$  values are all greater than three, which confirms the conclusion that the power status of a dyad has a major impact on its war propensity.

*Alliance and war.* The conditional probabilities of war onset when members of a dyad are linked by different types of formal alliance bonds are shown next in Table 1. Both the defense pact and neutrality treaty categories show significantly higher than expected war probabilities, whereas the opposite is true for ententes. However, due to the small number of war dyads in the neutrality and entente categories, a better estimate of the impact of alliance on war may be obtained by collapsing some of the categories. If the three types of alliance are merged, the conditional probability of war given any alliance is .0015 ( $Z = +6.53$ ) versus .00033 when no alliance is present, a likelihood ratio of about 4.5 to 1. If instead, because of their low relative frequency of war, ententes are combined with the no alliance category, then the corresponding probabilities are .0019 ( $Z = +9.88$ ) and .00033, yielding a likelihood ratio of 5.6 to 1. Hence, regardless of how ententes are coded, the likelihood of war in allied dyads is about 5 times greater than that in nonallied dyads. These results confirm the paradoxical proposition that alliances encourage war between members rather than inhibiting it.

*Democracy and war.* Proposition 5 stated that war between undemocratic dyads is more likely than between democratic dyads, and the results obtained

using Chan's data shown in Table 1 support this assertion. The probability of war onset between democracies is much smaller than between states that are not democratic, or, stated in the direction specified by the proposition, war onset between pairs of undemocratic states is about 14 times as likely as between pairs of democratic states. Because war onset in undemocratic dyads is about 4 times as likely as between mixed (i.e., one democratic, one undemocratic) pairs of states, it appears that the contention of some that both states must be democratic before the war-inhibiting effect of democracy is felt is unsupported. If the latter were true, then the probabilities of war onset when one or neither state was undemocratic should both be about .00047 rather than .00018 and .00070 respectively. The large  $Z$  and small  $pr(Z)$  values indicate that the presence of a democracy in a dyad significantly reduces its war propensity. Shifting over to the Gurr-based index of democracy yields similar but not identical results. As shown in Table 1, the probability that two undemocratic states will begin a war is much greater than the probability that two democratic states will do so. But, unlike the Chan-based results, we do not find a significant difference in the probability of war between dyads containing one or no democratic states. In these results, then, we find evidence only for what has been called the "joint democracy" effect.

Due to the attention that the democracy and war question has received of late, a somewhat more extended discussion of the joint democracy effect may be in order. Some (e.g., Babst 1972) assert that democracies do not (ever) fight one another. Using the Chan data, we find one such war onset (the Franco-Thai war of 1940), whereas the Gurr data reveal two (the Spanish-American war of 1898 and the Second Kashmir war of 1965). The first of these poses a problem because the onset of this war (December 1, 1940) followed the establishment of the Vichy regime in France, which certainly was not a democracy. Because democracy (and the other six factors) are measured in the year *prior* to the war onset year, this change is not recorded. The same is true for the Second Kashmir war—according to Gurr's data Pakistan was moderately democratic (6) in 1964, but moderately undemocratic (4) in 1965. However, the date of measurement has no impact on the Spanish-American war case because Spain has a value of 7 on the Gurr index and the United States a value of 10 for both 1897 and 1898. A reanalysis using the year of the war onset rather than the year prior to war onset as the measuring point for democracy led, as expected, to the elimination of the Second Kashmir case but not the other two cases. It did not call for any change in the conclusions reached from the first analysis.

Those who contend that democracies *never* go to war with one another may wish to question whether Spain was really democratic in 1898 or insist on fine-grained temporal distinctions in order to "save" their proposition.

I have no basic quarrel with such efforts as long as they are done dispassionately and systematically,<sup>30</sup> but we should not forget that it is not possible to “prove” that the probability of any event is zero. Indeed, in the present analysis, if we assume no wars between democracies and substitute zeros for the observed war onsets during the 21,644 (Chan 1984) and 22,859 (Gurr et al. 1989) joint-democratic dyad-years, the resulting Z values are  $-3.01$  and  $-3.10$ , respectively. The probabilities associated with these values are .0013 and .001, indicating that, although unlikely, it is far from impossible to observe zero wars during the period of observation if democratic dyads were truly not different from other dyads. The object of this discussion is not to denigrate the importance of our finding—the evidence is quite strong that democracies *very rarely* initiate war against one another—but rather to point out that it is fruitless to debate the question of whether democracies *never* or only *very rarely* fight one another.

*Development and war.* The sixth proposition stated that war was more likely to occur between states that are economically advanced than between those that are not, and the results shown in Table 1 lend support to it. Dyads containing two advanced states are twice as likely to begin wars as those that contain one or fewer advanced states, but the Z values indicate that this effect is quite weak.

*Militarization and war.* The last part of Table 1 reveals the conditional probabilities of war when dyads are grouped according to whether both, one, or neither of the states involved are more militarized. Pairs of more militarized states are about six times as likely to begin a war in a given year than pairs of less militarized states, and, based on the small size of the probability of war in mixed dyads, one might conclude that the effect of militarization is largely interactive. Naturally, the argument that this relationship between militarization and war is spurious, due to the tendency for states preparing for war to become more militarized in preparation for the coming war, cannot be refuted. However, regardless of whether the proposition is causal or merely descriptive in nature, the assertion that militarized pairs of states are more likely to begin wars finds support here.

All seven propositions set forth at the beginning of this article have found support in the simple bivariate analyses, but some of the relationships found

30. By this I mean that the democratic measurement of *all* states is reviewed and not just of those cases that are seen as “deviant,” and that *all* changes in democracy are measured with the same temporal precision, not just exceptional cases. A comprehensive analysis is required, of course, because recodings may generate another set of “deviant” cases.

are stronger than others. From strongest to weakest, I would rank the various effects as follows.

- 1 Proximity
- 2 Power status
- 3 Alliance
- 4 Militarization
- 5 Democracy
- 6 Development
- 7 Power difference

It is interesting that the factor that has received perhaps the greatest amount of theoretical attention, power difference, is found here to be the weakest predictor of war onset. If subsequent analyses bear out the weak effects of relative power, the potential implications for international relations theory may be truly profound. But such a judgment must await the results of more complex analyses such as those presented below.

### MULTIVARIATE RESULTS

There are a variety of reasons for suspecting that the bivariate analyses reported above do not provide a sound basis for identifying types of dyads that are particularly war prone. Chief among these is the suspicion that the seven factors dealt with here are not uncorrelated with one another. Under this condition, apparently strong relationships with war may be spurious and weak relationships with war may become strong when the effects of other factors are removed. And, of course, not only the strengths of association may be affected, but also their direction as well. For example, the bivariate results suggest that both contiguity and alliance increase the likelihood of war onset in a dyad, but an analysis of the joint effects of both factors reveals that the existence of an alliance between a pair of contiguous states *decreases* their likelihood of war, and the conclusion that alliances make war more likely is not fully warranted.

In order to assess the joint and individual effects of the seven factors under consideration on war onset, all dyad-years were recoded to reflect the most war prone conditions revealed by the bivariate analyses. For example, the contiguity variable was assigned a value of one if the dyad was contiguous by land or sea (as defined above) and zero if not. The classification rules for all factors are given in Table 2.

Because each of the seven variables in Table 2 is now binary in nature, they jointly define  $2^7$  or 128 possible dyad types. In the analyses to be reported

TABLE 2  
Value Assignment Rules for More War-Prone Dyads

<i>Variable</i>	<i>Assignment Rule</i>
Contiguous	1 if land or sea contiguous, 0 otherwise.
No large power difference	1 if small or medium power difference, 0 otherwise.
At least one major	1 if major-major or major-minor, 0 otherwise.
Allied	1 if any alliance, 0 otherwise.
Both not democratic	1 if both not (Chan) democratic, 0 otherwise.
Both more advanced	1 if both more advanced, 0 otherwise.
Both militarized	1 if both more militarized, 0 otherwise.

below, a case is defined as one of these dyad types, and the dependent variable of interest then becomes the number of war onsets that that particular dyad type experienced. Because some of these dyad types have been more common in history than others, *ceteris paribus*, one would expect them to experience more war onsets than rarer dyad types. Therefore, the number of dyad-years for each dyad type is also recorded. Defining cases in this fashion and not counting those dyad-years in which data are missing for one or more variables yield 118 dyad types that collectively account for 193,106 dyad-years.

The question to be addressed here is the relative contribution of each of the seven factors under consideration to the likelihood of war beginning within dyads. Because the dependent variable, number of war onsets, is bounded (*i.e.*, may not be less than zero) and discrete (*i.e.*, only integer values are possible) the standard regression model is not appropriate (King 1989). However, the Poisson (or Exponential Poisson, as King refers to it) regression model is, because it assumes that the dependent variable has precisely those characteristics mentioned above. The general functional form of this model is

$$E(Y_i) = \exp(X_i B)$$

When the number of observations varies from case to case, as they do here, the recommended modified functional form is

$$E(Y_i) = \exp(X_i B + \ln(N_i))$$

where  $N_i$  is the number of observations (*i.e.*, dyad-years) for the *i*th case.<sup>31</sup> Estimating the parameters of this model requires the use of a maximum

31. Further information about this method may be found in King (1989, 121-26), Maddala (1983, 51-54), and Greene (1990, 707).



likelihood technique and involves numerical rather than analytical solutions. Although these methods are not yet widely used, King (1989) makes a persuasive argument that they should be, and in this particular case, the Poisson regression model would seem to be well suited to the problem at hand.

Estimating an exponential Poisson model with the 118 dyad types as cases yields the coefficients reported in Table 3. The log-likelihood value for the entire model is  $-97.438$ . Although a value of zero would indicate a perfect fit between the model and data, the log-likelihood value has no lower limit. Hence, to interpret this value an explicit alternative model must be stated and estimated. In this instance the alternative (or null) model is based on the assumption that the only factor that accounts for different numbers of wars is  $N$ , the dyad-years of observation. Estimating this model yields a log-likelihood value of  $-156.84$ . Because the log-likelihood value is the log of the probability that the particular set of observed values would have been generated if the assumed model were true, the probability of obtaining the observed values if the null model were true is  $e^{-156.84}$ , which is approximately  $7 \times 10^{-69}$ . Adding the seven independent variables to our equation raises this probability to  $e^{-99.438}$ , or approximately  $5 \times 10^{-43}$ . Both of these are incredibly small numbers, because the probability of obtaining any particular result in this instance is extremely low, but what interests us is the relative size of the probabilities. Because the probability that the full model (if true) would have generated our observed values is about  $6 \times 10^{25}$  times greater than the comparable probability for the null model, we may safely conclude that the full model is more credible. For those who wish to evaluate such results in more conventional terms, a test statistic,  $c$ , which is chi-square distributed with  $k - 1$  degrees of freedom, can be computed (King 1989, 84-87) as follows

$$c = 2(LL_{Full} - LL_{Null})$$

where  $LL$  represents the log-likelihood values. The  $c$  value in this instance is approximately 118, far, far beyond the .001 level of significance.

An examination of the coefficients<sup>32</sup> in Table 3 reveals that the majority of our expectations stemming from the bivariate analyses are confirmed, but

32. The intercept and log (Dyad Years) terms in this table have no substantive importance and will not, therefore, be discussed. It should be noted that, in theory, the coefficient of the latter term should be 1.0, but divergence from this value is harmless (King 1987, 381). I report in this and the following table the standard errors,  $t$  values, and associated significance levels of the coefficients because some readers may consider them important. Because the "sample" here encompasses 95% of the "population," my own judgement is that they are of marginal value.

TABLE 3  
Multivariate Poisson Regression Analysis of Dyadic War Onset, 1816-1965

<i>Variable</i>	<i>Coefficient</i>	<i>Standard Error</i>	<i>t Ratio</i>	<i>Significance</i>
Intercept	-5.468	1.206	-4.53	.00001
Log (dyad-years)	0.471	0.130	3.62	.0003
Contiguous	1.780	0.362	4.91	< .00001
Both not democratic	1.285	0.295	4.35	.00001
Both more advanced	-1.275	0.507	-2.52	.01184
At least one major	0.658	0.263	2.50	.01239
No large power difference	0.619	0.243	2.54	.01098
Allied	-0.397	0.287	-1.38	.16641
Both militarized	0.098	0.240	0.41	.683

a few are not. Because the seven variables were coded in such a way that values of one were assigned to the more war-prone condition identified in the bivariate analyses, the naive expectation is that the signs of the seven coefficients will be positive. The strongest predictor of the seven is contiguity, and, as expected, its presence significantly increases the likelihood of war in a dyad. Second in importance is the absence of democracy in a dyad, which also increases a dyad's likelihood of war. The third most important factor, both more advanced, does not have the expected positive effect, however. The next two factors, which measure the presence of a major power and overwhelming preponderance in a dyad, both have a similar, positive impact on the likelihood of war. The existence of an alliance within a dyad slightly *decreases* the likelihood of war starting within that dyad. The final condition, both militarized, has a very weak positive effect and adds virtually nothing to the explanatory power of the equation. This lack of any significant relationship between militarization and war is surprising because readiness for war is seen by some as a dangerous condition in and of itself, and by others as an early warning indicator of war. Joint preparedness, as measured here, does not seem to constitute either of these.

The failure to find any significant effect of militarization on war led to some experimentation with the possible interaction of this factor with the six others. Only one combination proved noteworthy, and that was the condition of both militarized and allied. Substituting the product of these two variables in place of the militarization term yields the results shown in Table 4. The log-likelihood value increases to -92.555, suggesting a notable improvement in the model, and, more importantly, the contributions of the seven factors

TABLE 4  
 Revised Multivariate Poisson  
 Regression Analysis of Dyadic War Onset, 1816-1965

<i>Variable</i>	<i>Coefficient</i>	<i>Standard Error</i>	<i>t Ratio</i>	<i>Significance</i>
Intercept	-4.950	1.077	-4.60	<.0001
Log (dyad-years)	0.425	0.118	3.61	.0003
Contiguous	1.683	0.342	4.92	<.0001
Both not democratic	1.273	0.294	4.33	<.0001
Both more advanced	-1.412	0.498	-2.83	.0046
At least one major	0.545	0.257	2.12	.0342
No large power difference	0.607	0.243	2.50	.0123
Allied	-1.464	0.539	-2.72	.0066
Both militarized and allied	1.541	0.557	2.77	.0056

become clearer and stronger. In particular, the alliance coefficient now shows a strong, negative association between being allied and the likelihood of war, and the interaction term shows a strong positive association with war. Hence, by itself, the existence of an alliance reduces the chances of war in a dyad, but this effect is nullified if the parties to the dyad are both more militarized.

In order to understand better the relative importance of the seven factors, let us consider a hypothetical dyad and its expected number of war onsets over a 100-year period. To begin, I will assume that the dyad has the predicted characteristics of a least war-prone one; that is, it is composed of noncontiguous, allied minor powers, at least one of which is democratic and one of which is less militarized, and one state has overwhelming preponderance over the other. The expected number of wars that would originate in such a dyad over 100 years is about 0.003, based on the coefficients of the revised model.

Table 5 summarizes how the stepwise alteration of each factor transforms the dyad from least war prone to most war prone. It is readily apparent that contiguity has the strongest impact, followed closely by economic status and alliance. The presence or absence of joint democracy is next in importance, with relative power and power status having significantly less of an impact. As expected, the interaction term makes only a small contribution to the expected number of wars because its main effect is reflected in the alliance term. The third column in Table 5 shows the proportionate increase in the expected number of wars that each factor makes; the reader can readily assess the relative importance of the seven factors.

TABLE 5  
 Expected War Onsets per Dyad in a Century

<i>Action</i>	<i>Expected Wars</i>	<i>Proportionate Increase</i>
Start with least war-prone dyad	0.003	
Add contiguity	0.015	5.4
Remove alliance	0.066	4.3
Make one or both less advanced	0.300	4.6
Make one or both not democratic	0.963	3.2
Remove overwhelming preponderance	1.767	1.8
Give one or both major power status	3.048	1.7
Add alliance and make both militarized	3.290	1.1
Result: most war-prone dyad	3.290	

## IMPLICATIONS AND CONCLUSIONS

In closing I will consider some implications for theory and research, beginning with the individual factors and concluding with the overall pattern they reveal.

The importance of contiguity in accounting for the onset of interstate war argues that it should be commonly included in almost all studies of war, if only as a control variable. Whether it is only a measure of opportunity for war, or whether it taps something deeper that reflects the willingness to engage in war as well, is unclear, but its importance is not, and the argument for its inclusion applies to all levels of analysis. These results suggest that Diehl's conclusion that "although geography may not be the most important factor in international relations, its significance justifies increased and more careful attention from scholars of international conflict" (1991, 24) is true, but understated, for in this competition between many purportedly important preconditions for war, contiguity finished first.

Alliances have been found to reduce significantly the likelihood of war between allies, except under the special condition where both are more militarized, in which case they have almost no impact. Thus our theoretical expectations are generally confirmed and the bivariate finding that alliances promote war between allies is shown to be essentially spurious. There is nothing in this finding inconsistent with the argument that alliances promote the spread of war, once it breaks out, however (Siverson and Starr 1990).

In the economic sphere, these results suggest that the likelihood of war starting between "have" states is considerably lower than between "have"

and “have not” or between “have not” states. This could reflect a mutual recognition among advanced economies that war is, in Mueller’s words, “abhorrent—repulsive, immoral, and uncivilized—and methodologically ineffective—futile” (1989, 217), or, less charitably, it may indicate the presence of cartel-like collusion among richer states to avoid war between themselves in order to maintain their exalted economic positions. More conclusively, the (neo)-Leninist notion that competition between advanced economies is a major determinant of war has found little support. However, more research is certainly needed on this factor before any definitive conclusions can be drawn.

Democracy has once again shown itself to be a war-reducing factor, and its effect is readily apparent even after the effects of many other factors have been removed. It would not appear that the bivariate relationship between democracy and war is spurious, as some have contended; on the contrary, democracy is once again shown to be a quite powerful inhibitor of war. More studies are needed like that of Morgan and Campbell (1991) and Morgan and Schwebach (1991) to ascertain more precisely what it is about democracy that serves to inhibit war.

The results obtained in these analyses clearly support the position that power preponderance is more conducive to peace in a dyad than the lack thereof. Although its effect is not as strong as others considered here, and certainly weaker than hard-core realists would have us believe, the existence of overwhelming preponderance is, *ceteris paribus*, a “pacifying condition.” It should be noted that these are precisely the dyads where one side should perceive itself to have a high probability of winning any war, based on relative capabilities. According to expected utility theory (Bueno de Mesquita 1981), the decision for war is based on this probability times the utility of victory. If we can assume that the utility of victory is independent of the probability of victory across our 200,000 dyads, then, if this theory is true, we should observe that dyads with large power differences are the more war-prone ones, precisely the opposite of what has been found here. This suggests that some reexamination of a basic premise of expected utility theory may be in order. At the very least, the way in which the probability of victory is typically operationalized should be questioned.

I have long felt that the designation of some states as major powers was an overly subjective classification and somewhat ad hoc. With respect to war, there is also the distinct possibility that the well-established propensity for major powers to engage in war is tautological (i.e., states are considered major powers because they fight many wars). In view of this I would have preferred to find *no* significant association between power status and war

after controlling for other factors like power difference. Yet, under this condition, the major power effect remains and is found to be about as influential as power preponderance. This suggests to me that there is another important characteristic, for which the major power designation serves as a proxy, that remains to be identified.

Perhaps the most important contribution of this study is that it provides, for the first time, a direct assessment of the relative importance of more than a few factors that are alleged to promote or inhibit the outbreak of war. In order of declining importance, the conditions that characterize a dangerous, war-prone dyad are:

1. presence of contiguity
2. absence of alliance
3. absence of more advanced economy
4. absence of democratic polity
5. absence of overwhelming preponderance
6. presence of major power.

The first four of these are each over twice as important as each of the last two. If the order of this list were compared to that of the implicit research priorities that have guided war and peace research, the correlation would not be positive. This leads to the rather sobering conclusion that our priorities may be seriously distorted.

Taken together these results give a stronger endorsement to the idealist prescription for peace than to the realist one. Core components of the Wilsonian recipe for a more peaceful world were: establish collective security alliances, spread democracy, promote economic progress, and reduce armament levels. All of these save the last have been found to reduce strongly the likelihood of war at the dyadic level, and even the last factor is not discredited given that nothing in these findings suggests that high levels of military preparedness reduce the likelihood of war. In contrast, some of the primary concerns of realists, that is, relative power and power status in this analysis, have been shown to be less important than the above. Moreover, realists generally dismiss domestic factors as unimportant, yet these results suggest that they have a greater impact on the likelihood of war than others which they consider far more important. Certainly the results reported here do not constitute a head-to-head test of idealism versus realism (perhaps such a test is not possible), but they do suggest that a deeper examination of the idealist position might bring us closer to understanding the conditions that foster peace. We now have neorealism; perhaps it's time to seriously entertain neoidealism.

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