Generalizing Power Transitions as a Cause of War
by
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ABSTRACT

In this thesis, I ask three questions about the nature of power transition theory. First, I ask whether power transition theory can be generalized beyond identification of great powers or regional hierarchies. Lemke and Werner introduce the concept of a multiple hierarchical order, in which mutually relevant regional powers can go to war over dissatisfaction with a regional status quo. I submit that this concept can be generalized into a continuous concept to include all states within the umbrella of the theory. Second, I ask how often status quo states initiate war in power transition cases. Jack Levy explains that status quo states have a motive to launch a preemptive war against a revisionist state, before it becomes too powerful to defeat. I submit that these motivations lead to a high incidence of status quo actor-initiated war in power transitions. Finally, I ask whether the rate of change of relative power matters during a transition period. I hypothesize that quick changes in the relative difference in power between two states would create a fast-closing window of opportunity. This closing window creates a crisis and motivates leaders to move quickly, leading to a higher probability of avoidable war. Incorporation of rate of power transition could explain war in power transition cases yet to achieve true parity, or even explain peace in a period of parity and revisionism. To test these questions, I create a large, inclusive (571,000+ N) dataset of nearly all dyads between 1821 and 2001, using the Correlates of War Composite Index of National Capabilities as the basis of power independent variables, and a composite of distance and power measurements to determine the relevance independent variable. I run a number of regressions of the power and relevance independent variables against the onset of war. I reach decisive conclusions about the nature of power dynamics in the international system, and propose their incorporation into the power transition literature. Generalized, continuous measurements of relevance, parity, and rate of change of power transition increase the explanatory power of the model; the revisionist state does not always or even usually provoke power transition war; finally, higher rates of power transition lead to a higher probability of war. The thesis ends with a number of shortfalls with the model I propose, and a number of further revisions and expansions of power transition theory.

Introduction

The purpose of this thesis is to better understand the causes of interstate war so that policymakers may predict and prevent future conflicts. To that end, this paper tests and develops the structural causes of war as proposed by power transition theory. A.F.K. Organski (1958)[1] introduces power transition theory as a challenge to the prevailing realist theory, balance of power. He hypothesizes that a balance of power does not lead to peace among international powers—to the contrary, power parity leads to war, especially when one great power overtakes the dominant power in the international system. Organski and Kugler (1980)[2] explain that the dominant power in the international system uses its might to create an international order, with which a rising challenger may be dissatisfied. If the challenger is dissatisfied, it is likely to try to unseat the dominant power and revise the international order once it has the capability to do so—that is, when it has achieved power parity. Mearsheimer contends that the very structure of the international system prevents all states from being satisfied (status quo) powers; for the sake of their own security, states will seek power or revisions in international structures.[3] William Reed (2003)[4] reasons that power parity is a particularly dangerous point in a power transition because information asymmetries are highest in this period, and states are thus unable to correctly measure each other's relative capability and will. Houweling and Siccama (1988)[5] re-analyze Organski and Kugler's work to show that power transitions happen among all great powers—not just the dominant state and a challenger—because all great powers influence the international order.

I summarize power transition theory in its current state as such:

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[1] A.F.K Organski, *World Politics,* 1958.

[2] A.F.K Organski, Jacek Kugler. *The War Ledger,* 1980.

[3] John Mearsheimer, *The Tragedy of Great Power Politics,* pp 42-53.

[4] William Reed, "Information, Power, and War," 2003.

[5] Henk Houweling, Jan Siccama, "Power Transitions as a Cause of War," 1988.

Power Transition* → *War
X
Relevance
X
Revisionism/Dissatisfaction,

which states that power transitions lead to war when the two states in the dyad are mutually relevant and one of the states is "revisionist," or dissatisfied with the status quo. Relevance and revisionism are antecedent conditions, meaning that they influence the probability of observing the dependent variable (war) but only when the independent variable (power transition) is significantly present. Relevancy is a concept that describes whether two states are important enough to each other such that their relative power matters—Germany and France are quite mutually relevant, Nicaragua and Madagascar are not.

A strong base of academic empirical support shows that power transition theory explains a significant proportion of great power interstate war over centuries in the entire international system. Examples include both World Wars, the Napoleonic wars, Franco-Prussian wars, the 100-years war, and more.[6] Various large-N and case studies have shown statistically significant effects of power transition on interstate war with many measurements of state power and many operationalizations of transition. Kim uses GNP as a measure of power to show that power transitions have led to war among great powers as far back as the 1600s.[7] DeSoysa, O'Neal, and Park show that power transition theory explains war using multiple alternative measures of power.[8] Tammen, et al. use GDP as a measurement of power over multiple case studies to show how power transitions caused the Franco-Prussian War, World Wars I and

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[6] Woosang Kim, "Power Transitions and Great Power War from Westphalia to Waterloo," 1992; Woosang Kim, James D Morrow, "When do Power Shifts Lead to War?," 1996; Suzanne Werner, Jacek Kugler. "Power Transitions and Military Buildups," 1996; Douglas Lemke, Suzanne Werner, "Power Parity, Commitment to Change, and War," 1996; Douglas Lemke, "The Continuation of History: Power Transition Theory and the End of the Cold War," 1997; Indra DeSoysa, John R. O'Neal, Yong-Hee Park, "Testing Power-Transition Theory Using Alternative Measure of National Capabilities," 1997; Tammen, et al, *Power Transitions,* 2000.

[7] Kim (1992)

[8] DeSoysa, O'Neal, Park (1997). The measurements used are GDP and the Correlates of War Composite Index of National Capabilities (available at http://www.correlatesofwar.org), the latter of which takes GNP, population, urban population,

II, the Iran-Iraq War, and the Cold War (in particular, its lack of eruption).[9] But does the theory in its current state correctly identify all or most cases of power transition war? I contend that power transition theory has much more explanatory power than has yet been shown, and that more wars in history were caused by power transitions than are currently understood.

To explore this, I ask three questions about the nature of power transition theory. First, I ask whether power transition theory can be generalized beyond identification of great powers or regional hierarchies. Lemke and Werner introduce the concept of a multiple hierarchical order, in which mutually relevant regional powers can go to war over dissatisfaction with a regional status quo.[10] I believe this concept can be generalized to include all states within the umbrella of the theory. Second, I ask how often status quo states initiate war in power transition cases. Jack Levy explains that status quo states have a motive to launch a preemptive war against a rising revisionist state, before the revisionist state becomes too powerful to defeat. The inclusion of these cases will increase the accuracy of our assessments of the causes of war.[11] Finally, I ask whether the rate of change of relative power matters during a power transition period. It seems reasonable that very quick changes in the relative difference in power between two states would create a quickly closing window of opportunity to act. The quickly-closing window creates a sense of crisis and motivates leaders to move quickly, leading to a higher probability of avoidable war. It seems also reasonable that slower power transitions will lead to longer periods in parity, and thus more opportunities to go to war—I explore exactly how rate of power transition affects war. Incorporation of rate of power transition could explain war in power transition cases yet to achieve true parity, or even explain peace in a period of parity and revisionism.

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[9] Tammen, et al (2000), pp 49-60, 76.

[10] Lemke, Werner (1996).

[11] Levy, Jack (1987)

The rest of this paper introduces the research question by describing the three hypotheses about the nature of power transitions that would increase the accuracy and scope of the theory as a tool. The paper continues by explaining the methodology behind a large-N empirical analysis of all three hypotheses, using restructured databases of state attributes between 1821 and 2001 as a case set. The next section uses the case set to test the validity of all three hypotheses. In these tests, I find that power transition theory has greater explanatory power than previously thought. Each hypothesis, when tested, successfully increases the explanatory power of the model, as well as the validity of the generalized power transition model as a whole. All three of these hypotheses expand the explanatory force of power transition theory and increase its accuracy in identifying the onset of interstate war. The final section concludes that power transition theory very accurately explains a large proportion of all wars—enough so to suggest that the theory could potentially be used to predict dangerous power transition moments in the future. Continued advances in scope and accuracy can make power transition theory an increasingly powerful tool for policymakers in predicting—and thus preventing—the potential onset of interstate war.

Regional Hierarchies and the Continuous Mutual Relevance Model

This paper's first question addresses the condition of relevancy in power transition theory. The Lemke and Werner (1996) inception of the multiple hierarchy model is a groundbreaking step in expanding the scope of the theory: the model shows that power transitions explain a significant proportion of war in great and middle powers, due to the existence of multiple regional orders over which states can fight. Lemke and Werner use literature on relevant dyads to identify regions where a group of states are mutually relevant. Relevancy, in general, refers to states that can influence each other's behavior through incentives—usually, the threat of force. In general, we tend to think of relevant states as large and proximal, constantly negotiating and jockeying to change each other's behavior and the structure of their international or regional system.[12] We can see immediately that such jockeying has the potential to lead to war, where states that have no such competition are unlikely to find conflicts to fight over. In 1995, Lemke introduces a new measurement of proximity (which goes beyond mere contiguity, as in the past) based on power projection capabilities to measure mutual relevance.[13]

To identify regions, Lemke and Werner use the methods of Lemke (1995) to measure the power projection capabilities of each state, based on the state's capabilities, the proximity of other states, and the terrain features of the region.[14] Where these spheres of power projection capability overlap, Lemke and Werner create a case set of local hierarchies (that are somewhat time-dependent) in South America, and Lemke (2000) creates a case set that encompasses most of the entire modern world (except for Europe and North America).[15] He tests power transitions as causes of war within these hierarchies, to great empirical success. The multiple hierarchy model also appears in Tammen, et al. to explain the Iran-Iraq war, the Korean peninsula conflict, the Vietnamese war, and the Indo-Pakistani wars.[16] By breaking the world into multiple small hierarchies, Lemke and Werner successfully expand the scope and accuracy of the theory.

The multiple hierarchy model suffers from a specific problem. By breaking the world into such parts, one creates a binary model of what is ultimately a continuous concept. The power projection capabilities of a state drop off in a continuous way over distance (logarithmically, according to Lemke), rather than instantaneously, and the mutual relevancy of states can be thought of as a continuous concept.

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[12] Lemke, Reed (2001).

[13] Lemke (1995).

[14] In Lemke, Werner (1996), the authors model power projection as capability logarithmically declining over distance, adjusted by the number of miles per day that could be travelled on that terrain at that time. They cite such documents as missionary records (See Lemke (1995)) to determine historical force movement speeds.

[15] Douglas Lemke, *Regions of War and Peace,* 2002, pp 90-91.

[16] Tammen, et al., 2000, pg 76.

Therefore, to break the world into multiple hierarchies requires creating thresholds of power projection: if the power projection is too low, the multiple hierarchy model decides simply that the states do not influence each other's regional orders, and therefore no revisionism can arise. But given that the drop-off of power projection is continuous, it seems logical that the mutual influence of two states on each other's regional orders drops continuously, rather than instantaneously. That is, we should not ask *whether* two states influence each other's regional orders, but *by how much*. In short, we do not want to measure whether two states are mutually relevant; we want a continuous measure of their mutual relevance. An example of where this binary distinction fails is between China and India: due to the existence of the Himalayas, Lemke places these two states into separate regional orders. But their 1962 war—long before either was a dominant world power—is explained by Sushil Kumar to be a power transition war; the two states entered war when they were near power parity.[17]

To avoid these failures, we must generalize the concept of the international order. Rather than choosing between one international order and many discrete ones, we must admit that regions "bleed"—in the Sino-Indian war example, war crossed the Himalayas because each state had sufficient power to influence and threaten the other. I contend that the international order should be reconceptualized. Generalizing upon the findings of Organski and Kugler: if a state is dissatisfied with pressures and rules imposed on its behavior (that is, the aggregate influences of the states most relevant to it; or the geographical order), it will pressure the states most relevant to those rules to change them. Lemke and Werner showed that the states most relevant to the pressures and rules imposed on another are not necessarily the dominant powers. Expanding on Lemke and Werner's regional hierarchy work, I contend that the states most relevant to those rules may not necessarily be within a discrete region. I hypothesize instead that each state influences another based on its power and proximity. Neighboring states tend to influence each other's behavior, and very powerful states influence many more states than less powerful

[17] Sushil Kumar. "Power Cycle Analysis of India, China, and Pakistan in Regional and Global Politics," 2003.

ones. I call this conceptualization of the international order "the continuous mutual relevance model." We can operationalize this idea by saying that, within a dyad, the influence of state A on state B is equal to the combination of state A's power and the proximity of A and B; state B's influence on state A is equal to the combination of state B's power and the same proximity of A and B. All states have *some* level of influence on each other (from anything as simple as a comparative advantage in textiles to a vote in the UN); for the purposes of predicting interstate war, we are concerned with how much.

Such a metric would scale to make states like France and Germany highly influential upon each other, while Oman and Venezuela would have almost no mutual influence. It would also explain why China and the United States could experience power transitions (due to overwhelming power), and why Iraq and Iran have in the past (due to very close proximity). This scalar concept causes a continuously scaling probability of war within the dyad, such that dyads of high mutual influence have a high probability of going to war during a power transition. States with very disparate levels of power will have disparate levels of influence on each other, but they also have an extremely low likelihood of going to war over power transition motivations.

There are specific cases that this model will correctly incorporate where other models have not; in the Sino-Indian war example, the multiple hierarchy model fell short. Additionally, the Russo-Japanese wars and Spanish-American war are likely power transition cases also missed by the multiple hierarchy model and potentially incorporated by the continuous mutual relevancy model. The multiple hierarchy model incorporates power transition wars that occur between regional powers that the original power transition model missed. The continuous mutual relevancy model incorporates cases where the proximity or power of a dyad alone are insufficient to fit in either of the previous models, but whose proximity and power together interact to cause a power transition war.

Status Quo Power-Initiated Preventative War

This paper's second question relates to the relationship between revisionism and war. According to Lemke (2000), the conventional wisdom of power transition theory predicts that the rising state will initiate war. Lemke states that the rising state does not always initiate or declare a power transition war, but indeed indeed usually provokes that war.[18] I contend that while the dominant state need not fight to change the status quo, it may nonetheless initiate a war in its own self-interest. Dominant states are not necessarily caught off-guard by a revisionist state—to the contrary, revisionist states often signal their revisionism and make claims in hopes of bullying some portion of their demands out of the dominant states.[19] Jack Levy describes the following calculus: given the strength of strategic considerations in any war, a dominant state may certainly decide that waging war early—while the rising state is still weak—is a better idea than waiting and risking a war when the rising state is much stronger. Even if war is not inevitable, fighting an easy war might well be better than submitting to the power of a state that grows to dominate the system. While war is terrible, declining states are often stuck in a crisis, choosing between two bad options, and observe a closing window of opportunity—the longer the declining state waits, the worse its war will be, and it thus feels a great deal of pressure to act quickly. This reduces the time necessary to reach a decision, and leads to more erratic decision-making—often, this leads to war.[20]

Examples of preventative war in power transition situations potentially include a number of the Arab-Israeli wars, and Germany's declarations of war against rising Russia in both World Wars. Given that declining states have a motivation to declare war on rising, revisionist states, this paper will seek to discover what proportion of the time that the rising state does declare war in a power transition. I intend to show that while power transition theory traditionally concentrates on wars initiated by the revisionist

[18] Douglas Lemke, *Regions of War and Peace,* 2002, pg 28.

[19] David C. Kang, "Getting Asia Wrong," 2003.

[20] Jack S. Levy, "Declining Power and the Preventative Motivation for War," 1987.

state, the theory's explanatory power would be increased by inclusion of dominant state-initiated preventative wars.

The paper will also explore whether it is possible to predict which state will initiate the war. If the war originator can be effectively predicted, then peacekeeping efforts can be better prioritized; if all peacekeeping efforts in power transition periods are spent on preventing the rising state from launching a war, then these efforts may in fact enable the dominant state to launch a lower-risk preventative war, thus increasing the risk of war overall. Policymakers should be armed with the tools necessary to avoid these kinds of mistakes.

Rate of Change of Difference in Power and Transitional Crises

The third question of this paper addresses the meaning of a power transition. Traditionally, a power transition was simply measured by power parity between two states, but I assert that this measurement is insufficient.

The literature on rate of power transition is scant; Alsharabati (1997) concludes that slower power transitions increase the probability of war because a dyad remains in parity for longer, and thus has more time for a spark to cause conflict[21]. Other literature has been similarly suggestive, but discussion and empirical evidence remain sparse.

I suggest that higher rates of power transition also provoke motivations for war; these two motivators may compete, and one may be dominant. I have already established that declining states have a preventative motivation to declare war to hedge against the risk of defeat or subordination later. Given that they have a closing window of opportunity to act—that declaring war later means a constantly-

[21] Alsharabati, *Dynamics of War Initiation,* 1997.

decreasing military advantage[22]—then we can also surmise that the faster this window closes, the greater the crisis to act. Such crises, even if they do not lead to war, may motivate a state to take great measures to prepare for war (by mobilizing, purchasing arms, moving troops toward the border, etc) that are likely to decrease the security of the revisionist state, who will respond in kind—a classic case of a security spiral[23]. Such crises to act are certainly influenced by the speed in which the balance of power shifts—a state that is rapidly expanding its army is more worrisome than a state more slowly expanding its army, and in the latter case, the threatened state has more time to think or negotiate before its security is completely compromised. When it has no time to reach decisions or negotiate with the rising power, it is driven to act—either by attacking (in preventative warfare) or by trying to rapidly bolster its own defenses. Slowing down one's expansion or mobilization will put it at a disadvantage if a war occurs, and states are thus unlikely to halt such military buildups on the mere promise of another state that it will do the same[24].

When states have less time to act, the magnitude of these crises increases, and the ability to negotiate decreases. The dominant state, confident that the revisionist state will meet it in power and challenge it in some way, rapidly builds its defenses and falls folly to a perceived closing window of opportunity to put down the rising state before it reaches parity. The revisionist state, aware that it will soon overtake the dominant state in power (and thus bargaining ability) will resist calls to negotiate, hoping always to negotiate later as its relative power grows, and constantly aware that the dominant state may preemptively strike[25]. The state of tension means that even a small spark of conflict could quickly

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[22] Van Evera, 1998.

[23] The security spiral is a behavior described by two states entering an unintended arms race by purely defensive motivations, as each state perceives the other's armaments to undermine its own security. See Robert Jervis, *Perception and Misperception in International Politics*, 1976.

[24] Jervis, Robert (1978).

[25] Kugler, Lemke (1996).

escalate into full-fledged war. In power transitions, as both states try to negotiate their positions, determine the capability and will of the other, and prepare to deal with the future, higher-speed transitions are more likely to lead to war. Such behavior would run parallel to the spiral of mobilization and perceived offensive advantage in the First World War that many scholars believe derailed negotiation efforts between Austria and Russia[26].

I study these competing hypotheses to determine precisely how the relative rate of power transition affects the probability of war. I intend to show in this paper that higher rates of change in the relative difference in power between dyads leads to a higher probability of dyadic war, overpowering the effect of a short period of parity. Including the rate of change of relative difference in power (or more simply, the speed of the power transition) will refine the accuracy of the theory—scholars will be able to better predict whether two states undergoing a power transition will experience war.

Impact

These theoretical developments will generalize power transition theory, suggesting both greater accuracy and scope in its ability to predict the onset of war. In particular, the use of a continuous measurement of relevance and difference in power will allow policymakers to choose dyads and assign a quantitative predictive value as to how likely the dyad is to go to war. In knowing the likely initiator of war, policymakers can make better use of resources: they may spend most of their diplomatic and peacekeeping policymaking resources on the state more likely to go to war, rather than splitting them evenly or otherwise arbitrarily (as using peacekeeping resources on the state more likely to prefer peace or defense seems a waste). Finally, the incorporation of second-order effects in power transitions, should these effects have a significant impact on the likelihood of war, will strengthen the ability of

[26] Van Evera, 1998.

policymakers to accurately predict the likelihood of war among a particular dyad. With greater scope, power transition theory can be used in more cases to determine the probability of dyadic war; with greater accuracy, the probabilities generated by the theory will be closer to the true probability of war in each case. With further theoretical developments in scope and accuracy, policymakers may find power transition theory a useful predictive tool. If policymakers can use the theory to reliably identify the probability of the onset of war in dyads across the international system, they will then be able to dramatically increase the efficiency and efficacy with which they use peacekeeping and diplomatic resources to prevent war. Much work remains to be done, but the efficacy of these theoretical revisions suggests that the theory is significantly more powerful than previously thought.

Methodology

Definitions

There are some useful definitions that should be spelled out carefully before proceeding.

Power: Power is the war-making capacity of a state, in the near-term and the long-term, and thus includes population, urbanization and industrialization, army size and spending. Power is implied to lend projection capabilities over a distance that scales based on the level of power.

Relevance: Two states are important to each other based on their relative power and their distance from each other. That is, the closer and more powerful they are, the more relevant to each other. Relevance means, in essence, how much one state can use pressure and leverage to influence the behavior of, and rules on, the other state. Thus, when we speak of the "relevance" of a dyad, we speak of the relevance of the larger state to the smaller.

Difference in Power: The difference in power is the opposite of the power parity. A very low difference in power means the two states are approximately in parity.

Proportional Difference in Power: The proportional difference in power; that is, the difference in power divided by the average power of the dyad. Using proportional rather than absolute power measurements accounts for the idea that the equivalent difference of ten tanks was little for the NATO-USSR standoff, but would be significant between Haiti and the Dominican Republic.

Power Shift: Short for the "rate of change of the difference in power," this is the second-order dynamic interesting to relative-power causal mechanisms. Power Shift is measured over five years, and is the yearly average absolute change in Power Parity over five years. If two states have a large difference in power five years ago and a small difference in the year of interest, then the Power Shift is negative with a relatively high magnitude.

Proportional Power Shift: Power Shift, divided by the average power of the dyad (the division occurs during both the year of interest and five years before the year of interest). Used to test the hypothesis that it is not the absolute change in power (say, the number of tanks added to an army) but the proportional change in power (the percentage change in difference in tanks) that is a more accurate description for a linear relationship between changes in power and risk of war.

Absolute Power Shift: Short for the "absolute value of power shift," the power shift is simply the absolute value function applied to Power Shift. This captures simply the magnitude (rather than the direction) of the power shift. The purpose of this measurement is to test whether simply the rate of change of the status quo—rather than the specific encroachment of relative power—has an effect on war.

Proportional Absolute Power Shift: The absolute value of Proportional Power Shift, meant for the analagous effects as Proportional Power Shift.

Case Selection

The cases for all tests in this thesis are ordered by dyad-year; that is, two countries and a year ("Nicaragua, Vietnam, 1895," for example). I include nearly all dyads and all years over the entire international system between 1821 and 2001, with a few notable exceptions. The first exception is the exclusion of very tiny states, including those that are not in the UN, like San Marino or the Holy See, because they are simply too small to participate in war in any interesting way (and that they are not listed in a number of key datasets, including Correlates of War). The second notable exception is unintended: states that have not existed for 5 years are not included. This is an artifact of a pivotal variable that requires a 5-year comparison of power of each state; any state that has existed for fewer than 5 years cannot be described by this variable. The omission is small; less than 0.1% of cases are lost in this fashion. But I note with resignation that these cases are certainly not random; new states may well be involved in more conflicts than their older counterparts due to the inherent instability of state formation—the Korean Peninsula conflict of 1949, the first Arab-Israeli wars, the American Revolutionary war, and the first Indo-Pakistani war are good examples. Given the naturally transitional nature of new state formation, I believe this case omission will cause my conclusions to be conservative—the proportion of wars in my tests that are caused by power transitions will be lower than the true proportion in the population.

Alternative case selection methodologies include utilizing a possibility analysis to eliminate cases where power transition war is "not possible"—as an extreme example, the case of Mexico and French Indochina in 1946. This methodology argues that flooding a case set with "impossible" cases leads to a highly over-conservative estimate of the effect of any independent variable on the dependent variable.

This study, on the other hand, utilizes strong antecedent controls to sort cases into high- and low-independent variable types. Any possibility analysis essentially uses controls and antecedent conditions to analyze and then throw out any cases that do not meet sufficient thresholds. This study instead uses those controls and antecedent conditions in the regression to push such low-possibility cases to the low-independent variable range. Throwing out cases due to arbitrary thresholds could mask some interesting cases—sometimes, plants do grow in the desert.

The Dependent Variables

War: The basic dependent variable is interstate war. I aggregate wars from the Correlates of War (COW) Militarized Interstate Disputes (MID)[27], which ranks interstate conflict on a 1-5 ordinal scale. I use scores 4 and 5 of the dataset to designate war in my study. The 4^{th} level denotes the use of force. The 5^{th} level a dispute that involves the use of force and 1,000 or more yearly battle deaths. This study incorporates all uses of force as wars in order to avoid differentiating between different cases based on magnitude of conflict (which this study makes no attempt to predict or explain). I prefer the Correlates of War dataset both for its completeness and its extensive use within the International Relations field of literature. The project has been in use for decades and has gone through a number of checks. The MID definition of war is reliable, and equally valid to most intuitively reasonable war death cutoffs. We drop all cases in which the dyad has been in war greater than 1 year, in order to capture only war onset (rather than duration).

Power Transition War: The meta-dependent variable is power transition war. A power transition war is defined in two arbitrary ways, at two levels. At the more restrictive level, wars that occur between states in the top 5% of relevance and top 5% of proportional power parity among all cases are considered power transition wars. At the less restrictive level, those wars among dyads in the top 10% of relevance and top 10% of proportional power parity are used.

[27] http://www.correlatesofwar.org/COW2%20Data/MIDs/MID310.html

The Explanatory Variables

Power: Power is measured using the CoW Composite Index of National Capabilities (CINC)[28]. The CINC measures power using 6 material properties of the state: electrical production, iron and steel production, total population, urban population, active military personnel, and military spending. The aggregate:

> *is generally computed by summing all observations on each of the 6 capability components for a given year, converting each state's absolute component to a share of the international system, and then averaging across the 6 components.*[29]

Therefore, power is relative in the international system. Interestingly, this combination of components takes a few useful properties into account. First, the relative values of military personnel and military spending are a rough proxy for the "mechanization" or technology level of the troops—more money per troop generally means better equipment. Electrical production is a rough proxy for all infrastructure—there is a correlation between large electrical production and extensive road/rail networks. Urban population and iron & steel production together are proxies for the industrialization of the country.

The CINC roughly measures the war-making potential of the state, by measuring both immediate force factors (military size and spending) and by long-term war potential (energy, iron & steel, population, and urbanization). De Soysa, O'Neal, and Park (1997) determine that it is a sufficient measure of power for the purposes of power transition[30]; the realist school of International Relations considers influential power in the international system to be based on the

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[28] http://www.correlatesofwar.org/COW2 Data/Capabilities/nmc3-02.htm

[29] From the National Material Capabilities codebook.
[30] De Soysa, O'Neal, Park (1997).

capability of the state to strike and sustain war, and the CINC measures such war-making power with high validity and reliability.

The most common alternative to power in related literature is GNP. GNP is unlikely to reflect influential power nearly as well—a state with a large GNP and no military is much less able to coerce and intimidate states into acting against their own best interest than a state with a smaller GNP and large army (Japan may serve as an excellent example: it is minimally influential in the international order despite decades as the second-largest economy in the world; it spends only 1% of its GDP on its military). Furthermore, while using economic bribes (like trade deals or sanctions) can influence state behavior, a growth of this influence is less likely to lead to war; a rising power with a small military is unlikely to worry its neighbors or try to militarily unseat them, and a rich state with a small military is unlikely to launch a losing war against a rising state with a mightier military. Military parity, on the other hand, is much more likely to lead to a war.

The passage of time undermines the reliability of the measurement of power—measuring over 200 years changes power dynamics significantly (armies can move quicker and hit with much more devastating force over time). To embrace this, I control for year and perform cross-sectional time analyses on the data.

Difference in Power: The difference in power is tested both as an absolute and a proportional term, to determine how close to parity a dyad is. Its validity is self-evident, and its reliability is as strong as that of power.

Power Shift: The power shift (or rate of change of difference in power) is the difference in power parity (at the year of measurement) and the power parity 5 years ago, divided by 5. It is a simple measurement of the rate in which the difference in power between two countries is increasing or decreasing. While 5 years is an arbitrary cutoff for this measurement, it makes some intuitive sense that states will consider the growth patterns of a country over the last few years or so—states are not so myopic to only consider the last year, nor are they generally concerned if another state has grown larger than it was some decades ago.

The measurement is insensitive to changes between the 5-year difference in power and the immediate difference in power; it assumes for simplicity that all 5-year changes in power are approximately linear. A sensitivity analysis would be able to get at the heart of these second-order effects (peaks, valleys, etc), but it is a measurement much too complicated to become one of a number of variables in a large-N dataset. For the purposes of simplicity, I look only at the first-order effects. Any inaccuracies here will be conservative, as well: my method pictures all second-order effects to be linear—that is, the any changes in power parity are constant over 5 years. This means I assume no shocks or sudden spikes during the 5-year period. Intuitively, the more shocks or sudden spikes in power parity, the more psychological tendency toward crisis—for largely the same reason that a high rate of power transition leads to a crisis mentality. Therefore, by ignoring second-order effects, I dampen these spikes or shocks, making any effects from erratic power transitions less pronounced.

Relevance: The relevance of a dyad is a measurement that incorporates a dyad's ability to mutually project influential power. It therefore incorporates measures of power and proximity. Relevance is a non-weighted combination of the normalized power of the larger state of the dyad, and a rough distance of measurement, itself a linear combination of the normalized distance between the population-weighted centers of each country, contiguity (already a binary measurement), and shared continent (a binary measurement determining whether the two states are on the same continent)]:

(norm.-weighted-distance + contiguity + same-continent)/3 + norm-power[of larger state],

where the power of the larger state represents the coercive ability of the larger state (determining how much the smaller state's behavior is influenced by the larger), and the first three variables are a crude measurement of proximity. Contiguity is taken from the COW MID dataset[31]; continent is self-coded (1-8, actually representing eight sub-continents, further described later). Each distance measurement is self-evidently valid—contiguity simply measures whether two countries share a border; same-continent measures whether two countries are on the same continent. While there is some debate over where one continent starts and another ends, the measurement remains quite reliable for most countries. Distance between weighted population centers is measured by the CEPII cartography project.[32]

This measure of relevance is much more crude than the use of decaying power projection in Lemke (1995) (though Lemke ultimately places binary distinctions within his measure of relevance), but I am unable to replicate his work for the span of this dataset. I argue that the validity of the measurement of relevance remains high; before Lemke (1995), relevance was measured primarily by contiguity alone. Intuitively, we can think of contiguity and continent as being two binary questions that set three "rings" of distance—contiguous and continental, contiguous and non-continental *or* non-contiguous and continental, and finally non-contiguous and non-continental; the first is the closest, the third the farthest. For each of these rings, the distance between capitals allows us to differentiate between the closer and farther of the countries within each ring of a country. This measurement does not take into account geographical features like mountains, swamps, thick forest, rivers, lakes, etc, that would obviously act as barriers (and thus decrease the ability of each state to coerce the other with military might). This measurement's results behave as if there were no terrain barriers between any country, and thus over-estimates the relevance of most dyads. That said, it seems unclear exactly how one might quantitatively incorporate these features in a very large-N study; even if it were clear, it would be difficult. Such

[31] http://www.correlatesofwar.org/COW2%20Data/DirectContiguity/DCV3desc.htm

[32] http://www.cepii.fr/anglaisgraph/bdd/distances.htm

shortcomings remind us that we should be modest as to what the results of this study suggest, but they also probably lend my conclusions more towards conservatism than to false positives.

Revisionism: The revisionism of a state is drawn straight from the COW MID dataset. It was coded by COW experts observing the apparent dissatisfaction of each state in the system; it is coded a 1 or 0, revisionist or not. There are some reliability and replicability problems with such an approach, though each coding was cross-checked by multiple researchers.

Interestingly, Lemke (1996) concludes that rate of military buildup is a proxy for relative commitment to change. Between two states, a quick military buildup by the smaller state is a sign of commitment to changing the status-quo (that is, revisionism), and a quick buildup by the larger state is indicative of a commitment to maintain the status quo. By coincidence, this paper's rate of power transition variable partially captures that effect (though military spending and personnel are only two of six components of the CINC). It is a useful hedge against this measurement of revisionism, when determining the power transition (explained next).

Controls

Regime Type: Regime type is taken directly from the Polity IV dataset.[33] The Polity IV project rates each country-year on a -10 to 10 scale of openness, with -10 being an absolute autocracy and 10 being an absolute democracy. The Polity IV convention is to call countries that score 6 or higher a democracy, and -6 or lower an autocracy. This study controls for both countries being democracies, both being autocracies, or one being a democracy and one autocracy to account for the interaction of different regime types. The Polity IV project is a highly respected and reliable measurement of regime type, and is used almost exclusively to measure regime type in relevant literature. In this study, I use Both

[33] http://www.systemicpeace.org/polity/polity4.htm

Democracies and Both Authoritarians as controls, equaling 1 when both states are democratic or authoritarian, respectively.

Diplomatic Exchange: The COW project keeps a dataset on the level of diplomatic exchange between two countries, called the Diplomatic Exchange dataset[34]. Different levels of diplomatic exchange include none, charge d'affairs, minister, and ambassador. The different levels of presence validly portray the basic communicative relationship within a dyad—it is easier to communicate and negotiate with an ambassador than no diplomatic presence at all. This control captures a dyad's ability to communicate, which presumably helps to avoid war. In this study, I use Mission to A and Mission to B as controls for whether state B has a diplomatic presence at A and vice versa, respectively.

Time: Time is controlled by year, to crudely account for changes in technology, population growth, and other time-correlated effects.

Ally: The COW project keeps a dataset on alliances[35] that simply describes whether two states are in a formal alliance at a given time. This control accounts for the notion that two states in an alliance are drastically less likely to go to war with each other than two states not in an alliance, all other conditions equal.

It should be noted here that this study does not consider the power transitions between alliance groups. While Kim (1989) and Kim (1991) both consider these cases, this study does not, for a number of reasons. The first is simplicity: aggregating a dataset both by states and by alliance groups is a daunting, unclear task. But more importantly, for this kind of large-N research, aggregating by alliance groups has serious problems of reliability. The US provides a key example: it has or has had bilateral pacts with dozens of countries (South Korea, Japan, Taiwan, etc), and group pacts with others (The Allies, NATO,

[34] http://www.correlatesofwar.org/COW2%20Data/Diplomatic/Diplomatic.html

[35] http://www.correlatesofwar.org/COW2%20Data/Alliances/alliance.htm

Rio, etc). How do these many alliances interact with a potential adversary, like Germany, Russia, and China? Clearly, not all states in pacts with the United States contribute with equal weight (based on their power) to the influential power of the US over a potential adversary. When the adversary also has many various pacts, the analysis becomes daunting to generalize to the scale of this study.

It should also be noted that trade, while available with the COW project[36], is not incorporated into this dataset, due to the data being very sparse and inconsistent over the time period of the study.

Dataset and Model

The master dataset was constructed by resorting any datasets in other formats into a dyad-year format, and then aggregating relevant columns using perl[37], python[38], and C++[39] scripts that are attached as appendices. All testing models are multiple linear or third-order regressions.

Data Analysis and Results

Variable Summary

First, I briefly qualitatively and quantitatively summarize the variables used in our regressions.

- **war:** equal to one if the dyad scored a 4 or a 5 in the Correlates of War MID dataset
- **norm. relevance:** normalized relevance

[36] http://www.correlatesofwar.org/COW2%20Data/Trade/Trade.html

[37] Thanks very much to Christian Ternus for this code.

[38] Thanks very much to Dennis Perpelitsa for this code.

[39] Thanks very much to Greg Eschelberger for this code.

- **norm. relevance^2:** relevance squared, then normalized
- **norm. relevance^3:** relevance cubed, then normalized
- **norm. diff. in power:** normalized difference in power at year of interest
- **norm. diff. in power^2:** difference in power squared, then normalized
- **norm. diff. in power^3:** difference in power cubed, then normalized
- **norm. prop. diff. in power:** normalized proportional difference in power at year of interest
- **norm. power shift:** the normalized 5-year rate of change of difference in power
- **norm. abs. power shift:** absolute power of powerchange, normalized (normalized power shift)
- **norm. abs. power shift^2:** the rate of change of difference in power squared, then normalized
- **norm. abs. power shift^3:** the rate of change in difference in power cubed, then normalized
- **norm. prop. power shift:** the normalized proportional 5-year rate of change of difference in power
- **norm. average power:** the normalized average power of the dyad at the year of interest
- **ally:** whether the dyad is in an alliance
- **both democracies:** whether both states in the dyad are democracies, according to PolityIV
- **both authoritarians:** whether both states in the dyad are autocracies, according to PolitIV
- **mission to A:** the ordinal level of diplomatic presence of countryb in countrya
- **mission to B:** the ordinal level of diplomatic presence of countrya in countryb
- **year:** the year of interest
- **norm. relevance * diff. in power:** the interaction effect between relevance and deltapower1, normalized
- **norm. relevance * abs. power shift**: the interaction effect between relevance and abspowerchange, normalized
- **norm. abs. power shift * diff. in power**: the interaction effect between abspowerchange and deltapower1, normalized
- **norm. full interaction**: the interaction effect between all three variables, normalized.

Additionally, I provide a brief quantitative analysis of the variables:

variable	N	Mean	Std. Dev	Min	Max
war	572474	.001	.033	0	1
norm. relevance	513818	.164	.122	0	1
norm. relevance^2	513818	.042	.066	0	1
norm. relevance^3	513818	.015	.036	0	1
norm. diff. in power	571201	.042	.101	0	1
norm. diff. in power^2	571201	.012	.053	0	1
norm. diff. in power^3	571201	.005	.035	0	1
norm. prop. diff. in power	572474	.660	.302	0	1
norm. power shift	571201	.405	.424	0	1
norm. abs. power shift	571201	.009	.032	0	1
norm. abs. power shift^2	571201	.001	.012	0	1
norm. abs. power shift^3	571201	.00003	.008	0	1
norm. prop. power shift	572474	.822	.042	0	1
norm. average power	572474	.040	.087	0	1
ally	572474	.083	.277	0	1
both democracies	572474	.093	.291	0	1
both authoritarians	572474	.155	.362	0	1
mission to A	572474	.694	1.182	0	3
mission to B	572474	.689	1.179	0	3
year	572474	1967.89	36.997	1821	2001
norm. relevance * diff. in power	513818	.013	.045	0	1
norm. relevance * abs. power shift	571201	.004	.0196	0	1
norm. abs. power shift * diff. in power	571201	.002	.0019	0	1
norm. total interaction	513818	.001	.0004	0	1

Table 1: Statistical Summary of Relevant Variables

Testing Continuous Mutual Relevance

We find a very large explanatory power in the use of a continuous mutual relevance measurement. Linear regressions (shown later) using the continuous relevance measurement show both that states with a higher mutual relevance go to war much more often, and also that the effects of power parity and rate of change of difference in power are both more pronounced and more significant when relevance is incorporated into the regression. This form of relevance has a compelling effect on the likelihood of war onset in all dyads (whether or not there are power transition effects).

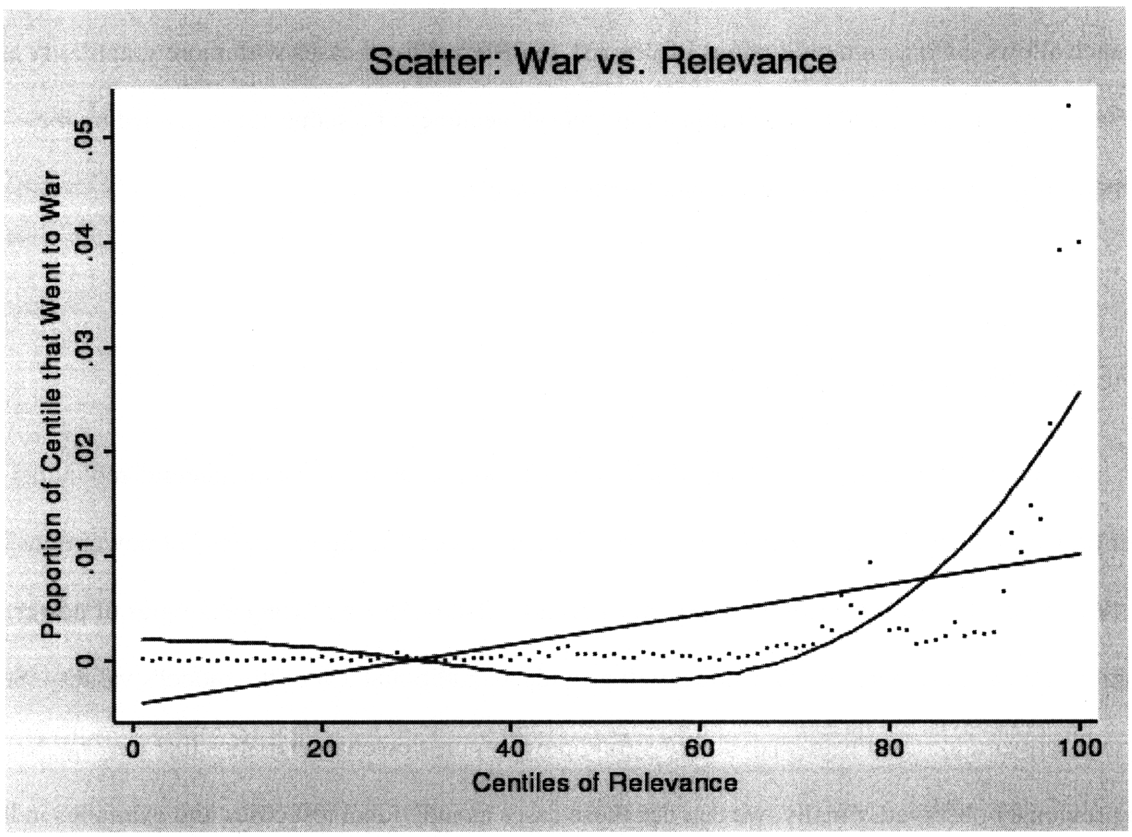

Figure 1: Proportion of War vs. Relevance (Centiles)[40]

[40]Each centile contains 5724 datapoints. Centiles are built by sorting datapoints by their consecutive value of the relevant explanatory variable, and then divided evenly into 100 sorted groups. The mean value of the explanatory variable (war) is found for each of these groups, and plotted in order, from 1 to 100. Curves are then drawn to match these values, rather than against a scattergram of all datapoints.

In figure 1 above, we observe a dramatic effect that relevance has on war. Across the range of relevance, we see very little activity in the lower three quartiles, and a significant spike in war propensity in the upper quartile. Interestingly, the highest centile group has an average war propensity of about 5%. We see here that the relatively exponential effects of continuous mutual relevance interact closely with power dynamic explanatory variables to determine war outcome.

It should be noted that the dramatic, nonlinear effects seen here give some credence to a binary definition of relevance, allowing a scholar to draw a distinction around the beginning of the final quartile and capture most of the interesting effects. Nonetheless, we observe that a continuous notion of mutual relevance allows us to assign predictions of war risk to different dyad cases with more granularity and more accuracy, suggesting that power transition theory's accuracy and scope are expanded by the incorporation of continuous mutual relevance measurements.

Testing the Explanatory Scope of the Theory

We are interested in discovering which wars are "well explained" by the generalized model of power transition theory; that is, which wars would be considered "strong examples" of power transition wars. We are interested in this for three primary reasons: first, observing strong examples of power transition wars as designated by this model will provide an additional test of the model's validity. Second, we can discover additional wars that exhibit strong power transition characteristics that may not have been previously observed. Finally, we can use these cases as individual test cases and examples in later analysis.

We must make arbitrary cutoffs in order to approximately identify what cases are "strong" cases of power transition. For thoroughness, we apply both a more restrictive and a less restrictive cutoff. In the more restrictive category, we take cases that are both in the top 5% of all cases in relevance and the bottom 5% of all cases in difference in power—this encompasses dyads that are both very much internally mutually relevant and very much in power parity: the classic binary definition of power transition. In the less restrictive case, we take dyads that fall both in the top 10% of all cases in relevance and bottom 10% of all cases in difference in power.

Using the broader definition, we are able to come up with a rough number of total power transition wars, the percentage of total wars that are strong power transition examples, and how power transition wars have varied over time.

In this study, we observe a total of 616 wars; war occurs in 0.11% of all cases. Out of 572,424 total cases, 4,564 are cases in the broader definition of strong power transition (0.80% of all cases); 1,152 are cases in the more restrictive definition of strong power transition (0.20% of all cases). In the broader definition, we observe 146 wars, meaning war occurs 3.2% of the time in this category (29 times more often than the average case). In the more restrictive definition, we observe 51 wars, meaning war occurs 4.4% of the time in this category (40 times more often than the average case).

"Strong" Power Transition Definition	% of all Cases	Proportion of Cases at War	Proportion of All Wars
(All Cases)	100%	0.11%	100%
Narrow	0.2%	3.2%	8.3%
Broad	0.8%	4.4%	23.7%

Table 2: Likelihood of War and Proportion of Wars in Strong Power Transitions[41]

[41]The "narrow" definition of a power transition example is a case in which the dyad is within the top 5% of all cases in terms of relevance, and the bottom 5% of cases in terms of difference in power (that is, in the top 5% of parity). The "broad" definition of a power transition is a case in which the dyad is in the top 10% in terms of relevance, and the bottom 10% in terms of difference in power.

Below, we observe the yearly proportion of power transition wars in all cases, both in isolation (figure 2) and alongside total wars (figure 3).

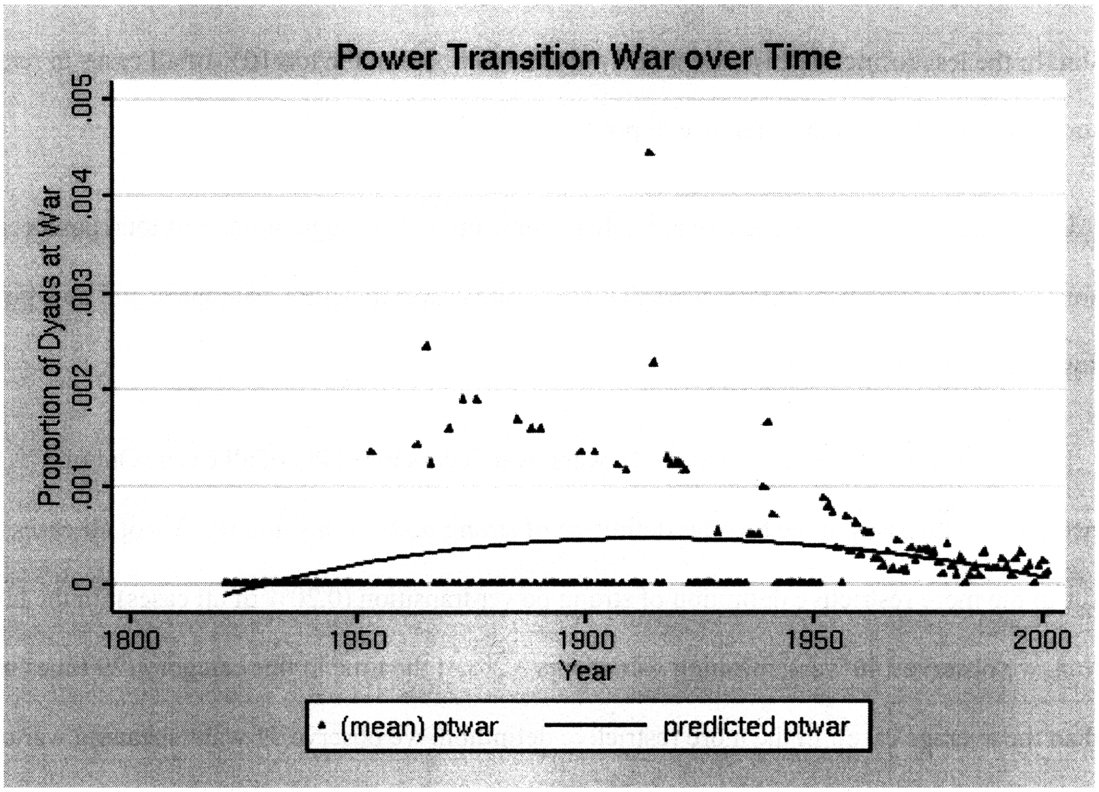

Figure 2: Yearly Proportion of Power Transition Wars in All Cases

In this figure, we observe a marked change before and after World War II. Before 1945, over a dozen years contain a proportion of power transition wars greater than 0.1% of all cases, but most years have no power transition wars at all. After World War II, most years contain some power transition wars, but the proportion of dyads involved is low. More than likely, this is due to the massive increase in the total number of states in the international system that came as a result of World War II. This is highly suggestive, though, that after World War II we observe power transition wars that are not between great powers (as great power war has largely been avoided since 1945).

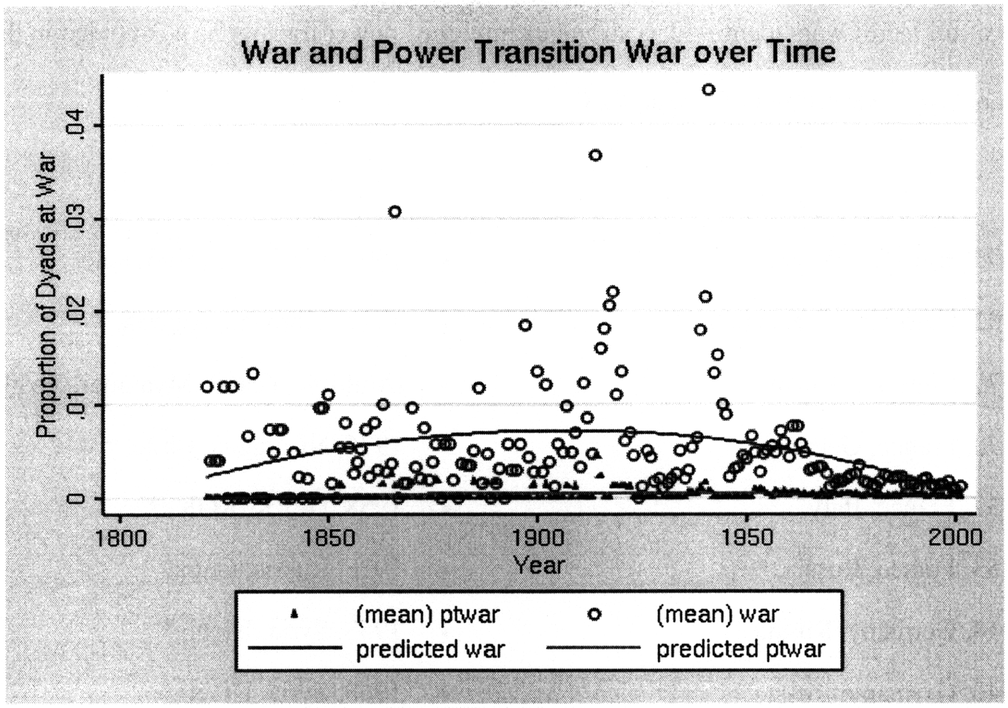

Figure 3: Yearly Proportion of Wars and Power Transition Wars in All Cases

As we can see, power transition wars are significantly less common than other wars in most years. In this figure, we observe a very similar change in trends in the pre-1945 and post-1945 periods. While power transition wars rarely make up the majority of wars in a given year, they are a significant percentage of wars over time. In the more restrictive definition of strong examples of power transition war, power transition wars make up 8.3% of the total population of wars; in the less restrictive definition, power transition wars make up 23.7% of all wars. We observe that, indeed, power transition wars account for large proportions of all war, and are not only rare great power clashes as previously imagined.

Finally, we explore which wars over time are strong examples of power transition war, and which ones aren't. This exploration will help us both to find cases of power transition war not previously known, and also to identify shortcomings in our methodology (that would lead to obviously strong cases of power transition war not being included in our definition). Very interesting examples are listed and discussed below, but a full list of wars identified as strong examples of power transitions is included in the statistical analysis code section of Appendix C.

- 1972, Burundi, Rwanda, *
- 1902, Colombia, Venezuela, *
- 1975, Ethiopia, Sudan
- 1870, France, Germany
- 1937, France, Italy
- 1853, France, Russia, *
- 1914, Germany, Russia
- 1940, Germany, Russia
- 1918, Honduras, Nicaragua, *
- 1929, Honduras, Nicaragua, *
- 1941, Hungary, Yugoslavia, *
- 1980, Iran, Iraq
- 1973, Iraq, Israel
- 1990, Iraq, Saudi Arabia
- 1973, Israel, Saudi Arabia
- 1991, Liberia, Sierra Leone
- 1979, Morocco, Algeria, *
- (Multiple Years), Myanmar, Thailand
- 1976, Nicaragua, Chile, *
- 1958, DPRK, ROK, *
- 1926, Russia, China
- 1953, Syria, Israel, *
- 1968, Syria, Israel
- 1982, Syria, Israel, *
- 1967, Thailand, N. Vietnam
- 1973, Uganda, Kenya
- 1899, UK, Germany
- 1914, UK, Germany, *
- 1939, USA, Germany
- 1958, USA, Russia

Table 3: Selected Power Transition Wars[42]

We see above a number of interesting cases both occurring and not occurring in the above list. We see many wars that we expect to see, given classical notions of power transition theory: World War I, World War II, the Franco-Prussian War, the Iran-Iraq War, the Korean War, a number of Arab-Israeli Wars, and the Gulf War. We see a number of interesting wars that have been largely undiscussed in the

[42]The format of these listings are: year, countrya, countryb, exclusivity, where exclusivity is identified with a * if the case is a case within the more restrictive definition.

power transition literature; largely, a number of African wars in volatile regions like the Great Lakes, the Horn of Africa, and the Western Coast. Lemke (2000) incorporates these regions into his hierarchy model, but in the above model, we observe wars between states that are very clearly not the dominant powers of their region (Uganda and Kenya, Sierra Leone and Liberia, Burundi and Rwanda, as examples), indicating that they are not fighting for supremacy of their region, but simply for increased control, and thus security, in their regions.

In this result we observe a number of improvements over previous models. First, we are able to incorporate both great powers and regional powers in a single generalized framework, rather than needing to draw a distinction and explore both separately. Second and most interestingly, we observe a number of cases that are strong examples of power transition wars that were not included in the Lemke (2000) model. To name a few: Nicaragua-Chile (1976), Russia-China (1926), Honduras-Nicaragua (1918 and 1929), Hungary-Yugoslavia (1941), Iraq-Saudi Arabia (1990), Israel-Saudi Arabia (1973), and any other European conflict (whether or not some of these countries were great powers or regional powers is debatable). These results suggest that the generalized model of power transition theory using continuous measurements of relevancy has significantly improved explanatory power over previous models. The incorporation of mutual relevancy not only seamlessly incorporates previously separate analytical frameworks for power transition wars, but incorporates wars that were otherwise missed by less granular measurements of relevancy.

A number of wars are absent in this list; these wars emphasize some of the shortcomings of the model. The Sino-Indian war of the early 1960s is absent because the two never reach power parity according to our definition of power. This may largely be due to China's massive population and iron production at the time that were largely not translated into projectable military power (due to internal conflicts and consolidation problems, the aftershocks of the Great Leap Forward, the low quality of iron being produced, the lack of advanced military technology at the time, and other problems that, when not incorporated, inflate China's measured level of power). Also absent are any wars between Japan and China, despite clear revisionism and expansionism in Japan during its military rise and China's Qing-era collapse; by my observations, the absence of Sino-Japanese wars during the 20^{th} century is due largely to similar inflations that lead to the absence of the Sino-Indian war. The first Arab-Israeli war, the Vietnamese civil war, and the Wars of German Unification are not included because some or all of the states involved had not existed yet for five years, leading to the unfortunate consequence of the dyads being dropped from the dataset. The Russo-Japanese war is not included for two primary reasons: first, the relevant power of the Russians at the time was largely limited to anything close enough to Vladivostok to be used—the Japanese did not need to contend with the entire Russian army. Second, our relevance measurement's use of weighted population centers puts a very large distance between Japan and Russia that does not correctly map reality—Russia and Japan were quite relevant despite Russia's population weight towards the West. These cases exemplify a number of shortcomings in the dataset that leave the analysis incomplete.

There are wars that should not fall into this measurement category that are indeed related to power transitions. Colonies may have experienced power transitions with the expeditionary forces of their colonial powers—the United States and South Africa are possible examples. Violent non-state actors may experience power transitions within a state, using asymmetric forms of power to equalize their relative might with the state—Somalia is an example. Finally, some wars may occur due to power transitions between strong defensive alliances—World War I may be an example. All such wars are not incorporated into the model as strong examples of power transition wars, though they may arguably be so. We will discuss these further in the final section of the paper.

From the strong examples of power transition war identified in this section, the next section will test the status quo state-initiated preemptive war hypothesis.

Testing the Status Quo State-Initiated Preemptive War Hypothesis

Of the 51 to 146 strong cases of power transition war, we consider how many were initiated by the rising, revisionist state as opposed to the dominant, status-quo state. In the broad definition of power transition wars, 49% of wars were initiated by the revisionist (as coded by CoW) state; in the more narrow definition of power transition war, 53% of wars were initiated by the revisionist state. It would seem that, contrary to popular belief, whether a state has revisionist tendencies or not has little to no effect on whether it will declare war in cases of power transitions. There are potentially three major flaws to such a conclusion. First, coding by the Correlates of War project may be incorrect in its designations of revisionism (indeed, a number of cases had two "status quo" states at war). Second, one may simply tautologically reject such a conclusion by stating that one cannot have a power transition war without the revisionist state declaring war—that is, it would be a fundamentally different war if the status quo power declared war, or if neither state involved was revisionist. There is some credence to this argument, though it depends on a binary definition of revisionism—whether a state is revisionist or not. I contend that, like other concepts, a state can be more or less revisionist, signaling more or less willingness to fight to change the status quo; thus, it is possible that two states would go to war even if the level of revisionism of both is relatively low (we will discuss this concept later in the final section of the paper). The final flaw in such a conclusion would be based in an objection to the set of cases called "strong examples" of power transition wars—one may argue that such a list is either too inclusive or simply incorrect. Given all three of these possibilities, we must admit that there is only so much to be learned from the above statistics. But a number of relatively compelling cases should make it clear that intuitive power transition wars can at times be initiated by the status quo state (even without excessive aggression and military provocation from the smaller, revisionist state). We discuss a few key cases below:

The 1948 Arab-Israeli War. In this case, it was Israel (and the West, in general) that sought to change the status quo (specifically, the territorial boundaries of Trans-Jordan and the existence of an Israeli Palestine). Arab states that initiated war against Israel were fighting to maintain the status quo, and were generally considered somewhat more powerful. It became clear that Israel and the Arab states had gone through an extremely high-speed power transition, as Israel's military coercive ability started out very small at its inception, but by the end of the war was high enough to drive out the Arabs and occupy large swaths of territory. This was clearly a power transition war initiated by the status quo powers.

World War I. While the German aspirations for territory strongly influenced decision-making in all involved states, it was forceful preservations of the status quo that led to the first two declarations of war in World War I. The Austro-Hungarian declaration of war against Serbia was designed to coerce the Serbian government into preventing Bosnian-Serb nationalists within Serbia from continuing operations against the Empire. The Russian declaration of war against Austria-Hungary, in turn, was intended to prevent Austria-Hungary from acquiring territory in the Slavic Balkans. Both initiations of hostilities were meant to enforce elements of the status quo important to each country, rather than significantly change the international order.[43]

The British declaration of war against Germany, 1939. While Nazi Germany had indeed severely provoked the Allies in the late 1930's by invading Czechoslovakia and Poland, the United Kingdom did not respond until the invasion of Poland, when Germany's total military might finally surpassed that of the United Kingdom. Specifically, Germany did not declare war on the United Kingdom: Germany was content to continue its conquest of smaller states until it had achieved much

[43] Van Evera, "The Cult of the Offensive and the Origins of the First World War," 1984.

greater strength. Britain's declaration of war against Germany was a status quo-initiated war in an attempt to maintain the continental status-quo.[44]

These are a few examples that illustrate the relatively muddled nature of revisionist initiation of war in power transitions. While this paper does not attempt to predict whether the revisionist state will declare war, nor does it predict what conditions lead to revisionism by a state, these issues are discussed in the final section of the paper.

Testing the Rate of Change of Power Hypothesis

Consideration of the final question this paper asks leads us to explore the paper's most novel hypothesis. Graphically, we observe a marked nonlinear effect of rate of power shift when other effects are not taken into account. In figure 4 below, we observe the approximate effects of power shifts on war propensity when other effects are not held constant.

[44]John Mearsheimer, *The Tragedy of Great Power Politics,* pp 260-266.

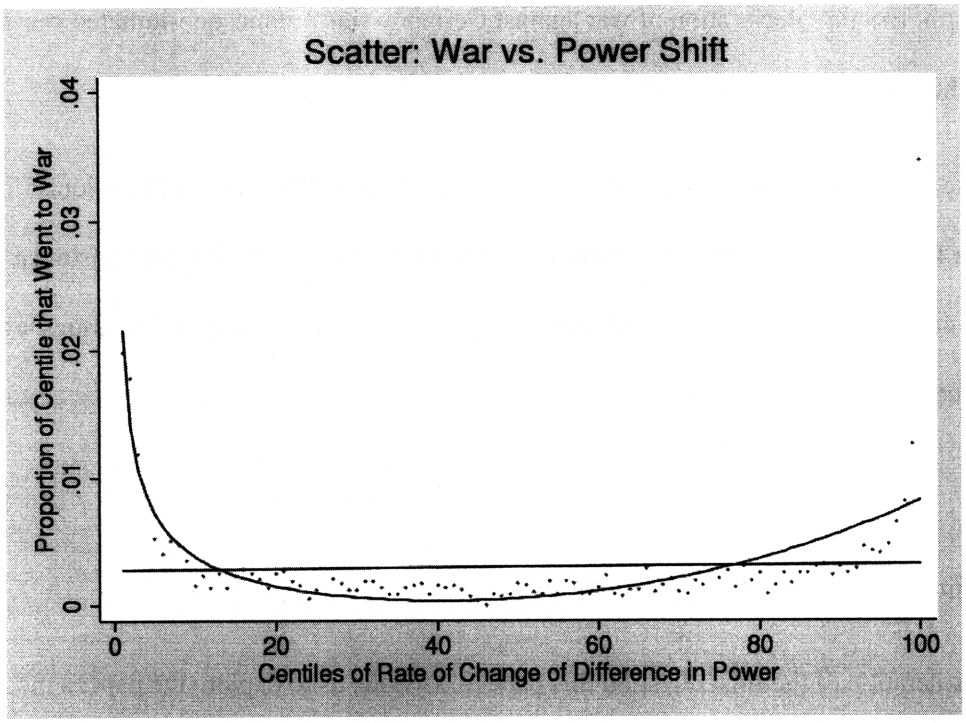

Figure 4: Proportion of War vs. Centiles of Rate of Power Shift[45]

The figure above describes exactly what was expected when power shifts were defined earlier in the paper. In the middle, where the magnitude of power shift is low, there is very low war propensity. At the ends, with high negative and high positive magnitudes of power shift, we observe very high probabilities of war. Figure 5 below presents the absolute value of power shifts.

[45] Similarly, all cases are included in centiles (that is, 100 groups) of 5724 datapoints each.

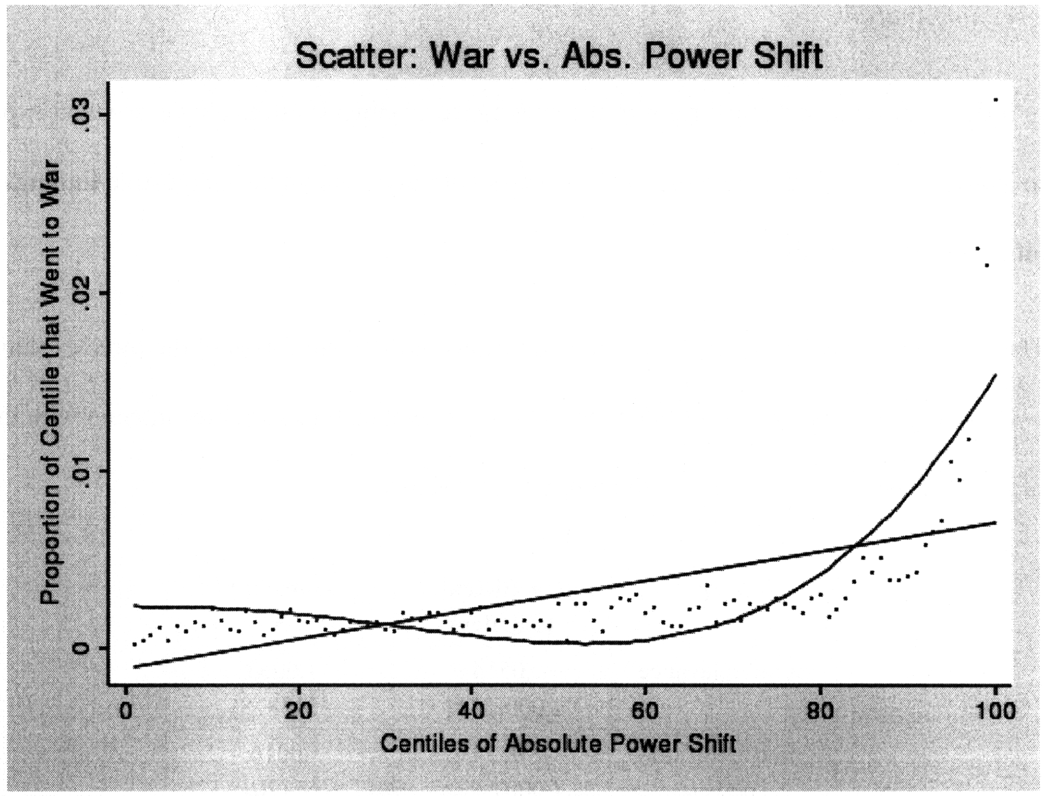

Figure 5: Proportion of War vs. Centiles of Absolute Value of Power Shift[46]

Here we observe the prominent effects of magnitude of rate of change of difference in power. Near zero, we observe very low propensity for war; in the top quintile, we observe a very quickly increasing propensity for war. This result suggests that many power transition wars go through a complete "crossover" before war onset; that is, the magnitude of power shift switches from positive to negative at the point of complete power parity, leading to the U-shaped curve observed in figure 4. The effect of the absolute value of power shift appears approximately exponential, suggesting that only very high magnitudes of power shifts are relevant to the onset of war.

Ultimately, we conclude that the rate of change of the difference in power has a significant effect on the onset of war that rivals the first-order difference in power at the year of interest. This effect should be incorporated into power transition models in order to increase their accuracy and scope.

[46] Similarly, all cases are included in centiles (that is, 100 groups) of 5724 datapoints each.

Basic Regression Analysis

In order to provide statistical rigor to the suggestive graphical results above, we next explore regression analyses of the data. The regression analyses not only confirm the suggestive findings from before, but also reveal new results.

The first regressions are basic bivariate regressions of different forms of the three explanatory variables. These regressions give us a basic idea of how the explanatory variables interact with the dependent variable, war. I briefly discuss the implications below.

War	**Coefficient (std. dev)**	**Constant N**
norm. relevance	.0514 (.0006)***	-.0053 513818
norm. diff. in power	.0324 (.0007)***	.0016 571201
norm. prop. diff. in power	-.0010 (.0003)***	.0036 571201
powerchange	.1909 (.0430)***	.0030 571201
norm. abs. power shift	.1221 (.0023)***	.0019 571201
norm. prop. power shift	-.0020 (.0017)	.0046 571201

Table 4: Separate Basic Bivariate Regressions of Various Explanatory Variables on War (* = p < .1, ** = p < .05, *** = p < .001)

Due to the size of the sample, it is unsurprising to see very low p-values; thus, the last result is decisively insignificant. The first result shows a positive effect of relevance on the likelihood of war, which we expect. The second result suggests that war is more likely when two states' power are more disparate, which is not particularly supported by power transition theory. The third result suggests a very slight increase in likelihood of war with greater proportional power parity. The fourth result suggests that an increase in difference in power over 5 years leads to a much higher likelihood of war; the fifth suggests that higher rates of change of difference in power (regardless of direction) lead to a higher likelihood of war.

These results have very limited explanatory power without any controls. Power transition theory hypothesizes that power parity leads to war only when states are relevant; testing random pairings of states for power parity and asking whether they go to war is not particularly useful. Therefore, the next regression to run is a regression of both difference in power and rate of change of difference in power, with relevance as a control.

War	Coefficients (std. dev)
norm. diff. in power	-.0078 (.0010)***
norm. abs. power shift	.0894 (.0029)***
norm. relevance	.0468 (.0007)***
Constant N	-.0051 513818

Table 5: Basic Linear Quadvariate Regression of Explanatory Variables on War (* = p < .1, ** = p < .05, *** = p < .001)[47]

We observe here results very consistent with the hypotheses of the generalized form of power transition theory. Smaller differences in power, when controlling for relevance, lead to a higher likelihood of war (though with a small coefficient). Higher rates of change in difference in power lead to a significant increase in war likelihood, as does higher relevance. These results are suggestive that the generalized form of power transition theory accurately increases the power of war onset. But to discover

[47]We observe a change in sign of norm. difference in power between tables 4 and 5. This is because in table 4, there are no controls; on its own, high differences in power increase the likelihood of war, because most wars are not power transition wars, and large states often go to war against smaller ones. When controlling for relevance, though, we see that relevant states go to war much more often when the difference in power is low, suggesting that power transitions are more likely to lead to war in cases of high relevance, as we'd expect.

whether or not the variables contribute to war in a stronger than linear way or not, we must explore regressions of the interaction effects of our variables against the likelihood of war. Below, we observe a regression with both linear and interaciton effects on the dependent variable, war, with controls.

war	Coefficient (std.dev)
norm. full interaction	-.3011 (.0401)***
norm. relevance * diff. in power	-.0317 (.0057)***
norm. relevance * power shift	.6329 (.0214)***
norm. diff. in power * power shift	-.1695 (.0302)***
norm. relevance	.0385 (.0008)***
norm. diff. in power	-.0855 (.0034)***
norm. abs. power shift	-.1011 (.0108)***
norm. average power	.1246 (.0032)***
ally	-.0013 (.0003)***
both democracies	-.0030 (.0003)***
both authoritarians	-.0002 (.0002)
mission to A	-.0002 (.0001)*
mission to B	-.0002 (.0001)***
year	.00003 (.000003)***
constant N RMSE	-.0555 513818 .0545

Table 6: Linear Regression of Interaction and Linear Effects on War
(* = p < .1, ** = p < .05, *** = p < .001)

In table 6, we observe coefficients much larger than the simple linear combinations of each pair of variables. In fact, we observe some rather impressive results. Let us first note that all variables with norm. diff. in power as a variable should have negative coefficients, given that it is a variable that we expect to be negative (given that smaller differences in power lead to a higher likelihood of war). Given that, we observe some particularly impressive effects. Particularly, the norm. full interaction shows a 30% increase in war likelihood over its entire range, and the interaction between norm. relevance and norm. power shift shows a full 63% increase in war likelihood over its entire range. These results are highly suggestive of the idea that a generalized form of power transition theory, in which the first-order and second-order power dynamics of a dyad interact with the bilateral relevance of the two countries to produce particularly large effects on war, is a more inclusive and more accurate model than previous models have been. Such findings are powerful evidence in favor of the conceptual changes to power transition theory submitted earlier in the paper.

The next regression is a linear cross-sectional by time and cross-sectional by space analysis with year and dyad fixed effects[48] (which measures the change within dyads) using proportional measurements of difference in power and rate of change of difference in power. This tests the effect of proportional first- and second-order power dynamics on war, controlling for variation across time and across dyads. The following controls are introduced: norm. average power, which controls for the power of the states involved (under the common assumption that larger states go to war more often); ally, which controls for whether the two states are allied (assuming that allied states should go to war less often than those not allied); both democracies, which controls for both countries being democratic (assuming that democracies go to war less often); both authoritarians, which controls for both countries being authoritarian (assuming that authoritarian states go to war more often); mission to A and mission to B, which control for countries

[48]That is, I use "xtreg" in STATA with year and dyadnum (a dummy variable of unique numerical identifications for each dyad) as cross-sectional controls, and the "fe" (fixed-effects) option.

having sent diplomatic missions to each other (assuming that states with diplomatic missions can defuse conflicts more easily than those without); and finally year, controlling for time.

war	Coefficient (std.dev)
norm. relevance	.0289* (.0120)
norm. prop. diff. in power	.0002 (.0007)
norm. prop. power shift	-.0035* (.0020)
norm. average power	.0262** (.0083)
ally	-.0051*** (.0005)
both democracies	-.0032*** (.0004)
both authoritarians	.0006** (.0003)
mission to A	-.0003** (.0001)
mission to B	-.0008*** (.0001)
year	.0001*** (.0000)
constant	-.1185***
N	513818

Table 7: Linear Cross-Sectional Regression of Proportional Power Dynamics on War (* = p < .1, ** = p < .05, *** = p < .001)[49]

There are a few points worth noting. The first is that the proportional difference in power does not have any effect in this regression, suggesting that the use of absolute difference in power may be a better measurement of the effect (assuming that previous studies have sufficiently validated basic power transition theory). We observe that relevance causes about a 3% increase in likelihood of war over its entire span, and that the proportional rate of change has a very slightly negative effect.

[49]The regression is cross-sectional with time and dyad as fixed effects.

The next regression is a linear cross-sectional by time and cross-sectional by space analysis using absolute (rather than proportional) measurements of power dynamics. Additionally, the absolute value of power shift is used to account for crossover effects[50].

war	Coefficient (std.dev)
norm. relevance	.1287*** (.105)
norm. diff. in power	-.0775*** (.0067)
norm. abs. power shift	.0636*** (.0030)
norm. average power	.0417*** (.0085)
ally	-.0047*** (.0005)
both democracies	-.0031*** (.0004)
both authoritarians	.0006** (.0003)
mission to A	-.0003** (.0001)
mission to B	-.0008 (.0001)***
year	.0001*** (.0000)
constant N	-.1357*** 513818

Table 8: Linear Cross-Sectional Regression of Absolute Power Dynamics on War
(* = p < .1, ** = p < .05, *** = p < .001) [51]

[50]"Crossover effects" refer to an artifact of the power shift measurement, which fails under the following circumstances: if two states are experiencing a swap in power dominance (that is, the smaller power is overtaking the larger one), the power shift measurement indicates that just before power parity, the two states are experiencing a very negative power shift, and just after power parity, they experience a very positive power shift. Taking the absolute value of the power shift measurement ensures that the derivative of difference in power on both sides of the point of crossover approach the same value. This measurement has its own failings: two dyads, neither of which are near parity, are virtually indistinguishable between their difference in power increasing or decreasing over time.

[51]The regression is cross-sectional with time and dyad as fixed effects.

This regression yields much more convincing results. Over the range of relevance, we observe a 13% increase in likelihood of war, with extremely high significance, though this is expected given our very large number of cases (over 513,000). Additionally, we observe an 8% drop in war propensity over the range of difference in power, which is precisely what power transition theory predicts—lower differences in power lead to higher risk of war. Finally, we observe a greater than 6% increase in the risk of war over the entire range of the absolute value of the power shift. All of these coefficients have p-values of less than .001, again suggesting high significance. These results are a strong positive result for testing the validity of the generalized model of power transitions.

There are a few other points of note from this regression. We observe a 4% increase across the range of average dyadic power, suggesting that larger states engage in warfare (either with other larger states or smaller states) more often than small states with other small states. States in an alliance are only very slightly less likely to go to war, which suggests either a problem with coding or an extremely high correlation with another variable. Democracies go to war with each other slightly less often than when the dyad is not both democratic, but the difference is small. The presence of diplomatic missions between states, as well as the year, have small effects as well.

The final regression of interest is a third-order cross-sectional by time and cross-sectional by space analysis using absolute measurements of power dynamics. The third-order regression adds squared and cubed terms of relevance, difference in power, and power shift, in order to test whether the linear regression captures well or poorly the effects of these three explanatory variables on the likelihood of war.

war	Coefficient (std.dev)
norm. relevance	.0545 (.0342)
norm. relevance^2	.1461** (.0740)
norm. relevance^3	-.1178** (.0560)
norm. diff. in power	-.1099*** (.0125)
norm. diff. in power^2	.2230*** (.0307)
norm. diff. in power^3	-.2539*** (.0254)
norm. abs. power shift	.1376*** (.0068)
norm. abs. power shift^2	-.1533*** (.0179)
norm. abs. power shift^3	.0859*** (.0141)
norm. average power	.0531*** (.0087)
ally	-.0047*** (.0005)
both democracies	-.0030*** (.0004)
both authoritarians	.0006** (.0003)
mission to A	-.0003** (.0001)
mission to B	.0008*** (.0001)
year	.0001*** (.0000)
constant N	-.1371*** 513818

Table 9: Third-Order Cross-Sectional Regression of Absolute Power Dynamics on War (* = p < .1, ** = p < .05, *** = p < .001) [52]

It is difficult to look at the coefficients of the third-order explanatory variables and intuit the actual effect over the range of the variables. For this reason, we provide three figures below that track the

[52] The regression is cross-sectional with time and dyad as fixed effects.

changes in war risk over the range of these variables, when all others are held equal[53]. It should be noted first that these are approximate; second, that these figures are normalized such that a zero on the y-axis is equal to the mean propensity for war, and that other values are changes from this mean propensity based as affected by the changes in the explanatory variable.

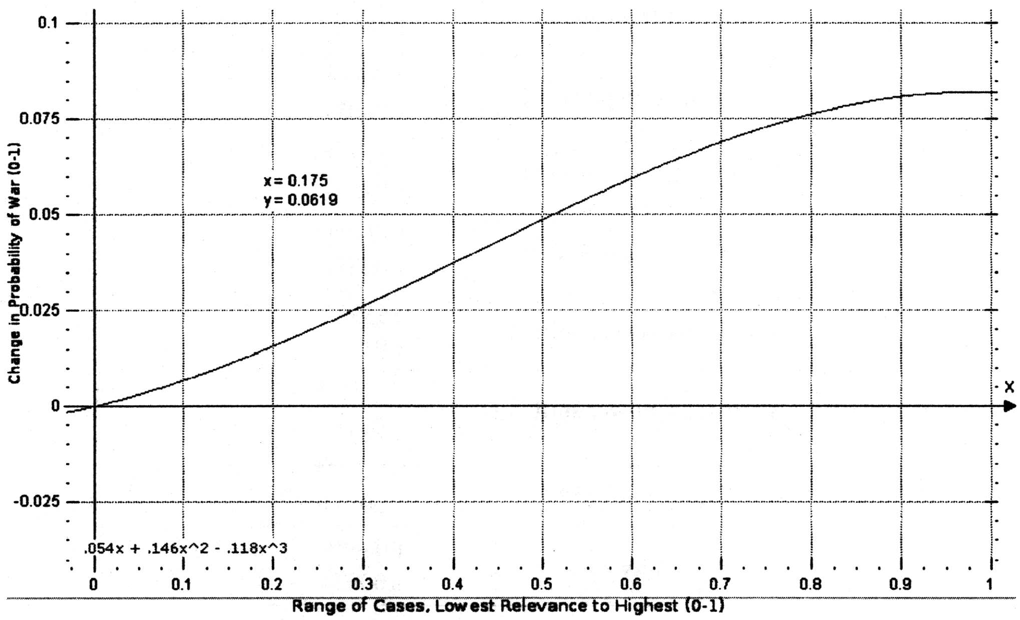

Figure 6: Third-Order Curve of the Effects of Relevance on War (Other Effects Held Equal)

In this figure, we observe that relevance has a relatively linear effect on war, when other effects are held equal. The total effect is an 8% increase in risk of war over the entire range of relevance, which is less than the 13% seen in the linear regression.

[53]That is, these figures are simply graphs of the curves, from x = 0 to x = 1, traced by the three coefficients of each variable. They approximate the changes over the range of each explanatory variable with more accuracy than a simple single-order regression, though they are, of course, not perfect.

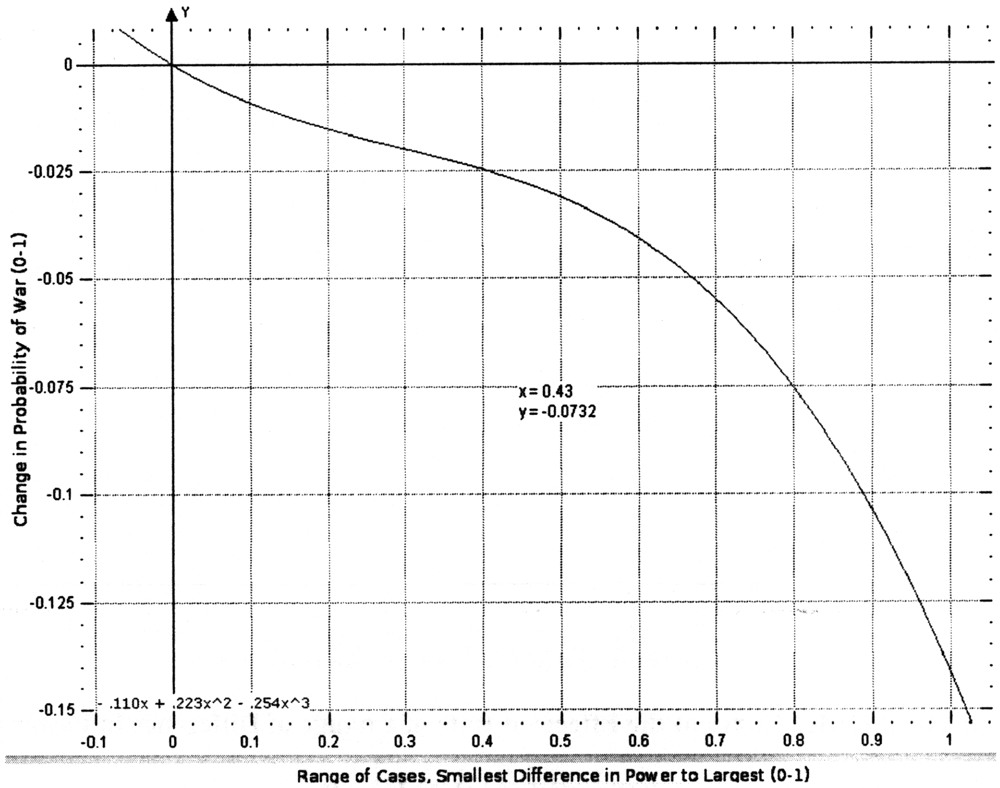

Figure 7: Third-Order Curve of the Effects of Power Difference on War (Other Effects Held Equal)

Here we observe a less-linear effect. As in the linear regression, the total effect over the range of the explanatory variable results in a 15% decrease in war propensity, which is significantly larger than the 7.8% decrease in war propensity observed in the linear regression. Interestingly, the curve is "slow" to drop off—that is, the effects of increases in power difference near parity are very low, suggesting that "parity" (as defined in a binary theoretical framework) may encompass a relatively wide subset of cases.

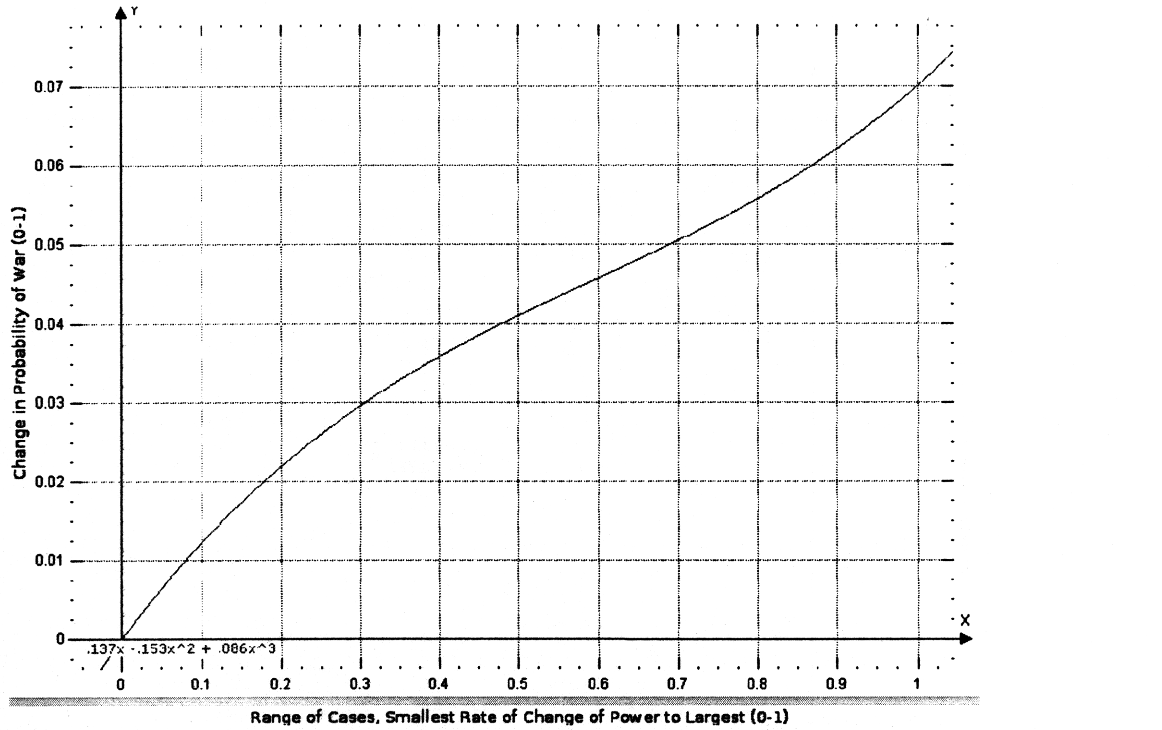

Figure 8: Third-Order Curve of the Effects of Rate of Change of Difference in Power on War (Other Effects Held Equal)

In the power shift curve, we observe a more linear effect again. We seen an 8% increase in propensity for war over the entire range, with little variation over the length of the range.

A result of note is from the linear and third-order regressions at the beginning of the analysis section. In the linear regression, we observed a 6.4% increase in war propensity over the entire range of the power shift variable (compared to a 7.8% decrease in war propensity over the range of difference in power). In the third-order regression, we observe an approximately 8% increase in war propensity over the entire range of the power shift variable (compared to an approximately 15% decrease in war propensity over the entire range of difference in power). From these regressions, we see that the rate of change of difference in power has a large and significant effect on the onset of war even controlling for difference in power. We conclude that these is an effect from rate of change in addition to effects from difference in power. We also conclude that while the effects of the second-order power dynamics, while not as strong as first-order effects, are more than half as strong, and must be taken into account in models of power transition war.

We see, as a whole, significant and large correlations in the regressions run, as predicted by the hypotheses of each explanatory variable. We have shown that the absolute (rather than the proportional) power dynamics model predicts the onset of war consistently. From these results, we can draw decisive conclusions as to the nature of the international system and the conditions that lead to high risk of war in power transitions.

Alternative Explanation

There are legitimate concerns of reverse causality in some cases of power transition war. If one state is bent on declaring war on another, the other state (particularly if it is weaker) has an incentive to quickly build up its military force to try and deter the threatening force. Such a defensive buildup may lead to a perceived power transition, even though it was domestic politics in the aggressor country that led to war. There are two responses to this. The first is that the realist school of international politics assumes that while domestic politics have some effect on war, their effect is much smaller than the logical realist motivations that tend to generate foreign policy. Further, such cases may not be explanatory under the umbrella of power transition theory, but they remain predictive. If there is such an alternative cause that leads to both a power transition and a war, then the model remains predictive, if not completely explanatory.

Conclusion

A number of interesting conclusions may be drawn from the results from above. The generalized model of power transition theory predicts war better than the null hypothesis with great significance and strength; we are confident that the explanatory variables have a real effect on the onset of war. Additionally, we confirm our three hypotheses:

- A continuous measurement of relevance not only incorporates cases that a binary measurement would not, but also explains greater variation among dyads that do and do not go to war when in power transitions. We see very strong and consistent effect of continuous mutual relevance on the onset of war when controlling for other power transition explanatory variables.

- Revisionist states do not always initiate war in a power transition moment. Status quo states indeed have a preventative motivation to declare war on a revisionist state in order to assert the status quo or preempt a more destructive war in the future. We observe a number of examples, as well as systematic accounting to strongly suggest that this is the case.

- The second-order power dynamic—the rate of change of difference in power, or the power shift —is a significant and important explanatory factor in the onset of war. When controlling for other variables, we see strong and significant effects on war from higher magnitudes of rate of change of difference in power. We conclude that the power shift is a measurement that must be incorporated into power transition models in order to achieve accuracy and breadth.

As a whole, we conclude that the generalized model of power transition theory expands both the accuracy and explanatory scope of power transition theory by removing, as much as possible, the need to make arbitrary binary distinctions in what are ultimately continuous concepts. Further generalizations of power transition theory may ultimately allow policymakers to create a probabilistic formula that would take structural conditions (differences in power, rates of change of difference in power, proximity, etc), and determine the approximate risk of a power transition war occurring. With increases in explanatory accuracy, such a model would allow greater and greater confidence in predictions of risk, allowing policymakers to more accurately and correctly allocate peacekeeping and diplomatic resources.

We conclude finally that this highly quantitative and inclusive model of power transition theory allows us to directly use the model as a predictive tool. In table 6, we observe very strong coefficients on our linear and interactive effects on war. Additionally, we observe a very low Root Mean Squared Error (RMSE), of less than .06. This has significant implications. Using these coefficients, we could create a linear predictive model, in which we take the explanatory variable and control values of a particular case, multiply each of these values by its coefficient, and add them; this sum would give us the probability that the case (dyad) would go to war, a value between 0 and 1. The RMSE of less than .06 means that, on average, our answer would be less than .06 from the real value (or less than 6% wrong) if historical trends correctly predict the future. This means that, despite significant shortcomings of this model and a great deal of further research that needs doing, the current form of the model has a strong predictive value for policymakers, and can relatively accurately predict the likelihood that a particular dyad will go to war in the future, given that the explanatory values of the correct variables can be obtained. This should make policymakers and scholars alike particularly optimistic about its value as a critical part of the peacekeeping toolkit.

But it should be noted that this model has a few particular shortcomings that should tend us towards some modesty in our conclusions. We have observed that an attempt at capturing strong examples of power transition wars led to a number of cases failing to be included that probably should have been. The use of a "use of force" standard for war led to the inclusion of some odd cases in both total wars and power transition wars, but it is unclear what cutoff for war initiation is ideal, if it is above this cutoff. We observe some specific problems with both our measurement of power and our measurement of relevance that may lead to inaccuracies in results. But I contest that, overall, these inaccuracies are small enough that they do not undermine the basic conclusions of the paper. Indeed, the strength and significance of our findings indicate that any systematic biases from erroneous coding or analysis would need to be relatively large to undermine the results, and there is little evidence that this is the case. Nonetheless, there are multiple considerations for future research that should be discussed briefly in the last section of the paper, below.

Further Research

While this paper is a compelling first step in generalizing power transition theory, there is a great deal of research that could be done to potentially improve the accuracy of results, and to further expand the explanatory scope of the model. This section explores some of those considerations for future research.

Future research should better operationalize some of the cruder measurements of power and rate of change of power used in this model. First, we see that this model's measurement of coercive power is imperfect; the case of China is a good example. A further and more compelling example is the case of nuclear weapons. Many scholars have argued that nuclear weapons have changed warfare by acting as a new form of power (that is very difficult to quantitatively compare to conventional power). This criticism is legitimate; nuclear weapons (and other forms of non-conventional power) interact with conventional power in a way that is difficult to measure and to understand. A better measurement of power should be striven for, and it has been extensively sought. But its importance cannot be overemphasized. An accurate measurement of coercive power can have a significant impact on the accuracy of power transition predictions by the model. Additionally, the relatively crude five-year measurement of rate of change of power difference has self-evident problems that are also difficult to remedy. Correctly describing rates of change in difference in power in a way that is relevant to policymakers and state actors is extremely difficult, but worth pursuing for the same reasons as those listed for pursuing a more accurate portrayal of power.

Future research should consider further generalizing the concept of revisionism in power transition war. Currently, revisionism suffers from two major problems as a measurement: first, it is a binary measurement, even though it is clearly not a binary concept. Lemke, Werner (1996) provides an excellent measurement of relative commitment by the revisionist power to change the status quo, versus the commitment of the status quo power to maintain it, by measuring relative power buildup. More research should be done to explore this concept. Revisionism's second problem is that it is treated as an independent variable, when it is more likely an intermediary variable. Structural conditions in the international system, as well as the state's domestic politics, interact to cause revisionism. A structural approach to revisionism as an intermediary variable would allow policymakers to predict *when* a state is likely to show revisionist tendencies, and what magnitude these may be. An effective realist theory of power transition should be able to predict when revisionism is likely, making it a variable dependent on international structural conditions, rather than simply an arbitrary independent variable. Presumably, whether a state should tend towards revisionism is something that should be predictable given the security situation that the state faces. Such knowledge would be invaluable to policymakers in peacekeeping and diplomacy. Furthermore, revisionism (in any form) should be a part of our explanatory variable. Two states going through a power transition are much more likely to go to war if one or both of the states is a revisionist power than if neither of them are. Unfortunately, the Correlates of War coding for revisionism only applies to dyads that actually went to war, as opposed to those that didn't, which prevents its use as a predictive explanatory variable. Finding and utilizing a predictive revisionist variable will be key to completing this model of power transition theory. The model, frankly, suffers greatly without it.

Work should also be done to better measure relevance between dyads. Lemke (1995) uses a compelling method of power projection, proximity, and terrain that seems to measure relevance well, but it and later papers then go on to use it to create binary distinctions between relevant regions. Such work should be converted into a database of dyadic relevance for future researchers.

Future research should also include alliance formation and inter-alliance transitions in a generalized model of power transition theory. Kim (1989) and Kim (1991) conclude that alliance formation and inter-alliance war often follow power transition dynamics, but most of the work in power transition theory is limited to dyads. This is a shortcoming that should be resolved, but the task is daunting and unclear. A fully generalized model would be able to seamlessly incorporate dyads and their relative alliance frameworks; predictions of war would become greatly more accurate. But Organski and Kugler justify ignoring alliances for the vast majority of wars. They argue that alliances are flexible and fickle, and cannot be depended upon for security in the long-term. Therefore, the power of alliance members is highly discounted in power calculations by major states considering war. Further, Organski and Kugler argue that most wars with alliances typically include two primary states going to war as a dyad, and that most other states within the alliance are, to some extent, tagging along (that is, they have a relatively minimal effect on the calculus to go to war). In special instances, like the spider alliances of World War I, allied states have a much larger effect on the war calculus of the primary states involved. But these multipolar wars make up a small proportion of all wars in recent history.

We note also that raw power is not always an effective estimator of the impetus to go to war. Many realists contend that certain periods of history are offensive-dominant (or at least are perceived by the actors at the time to be offensive-dominant), and some are defense-dominant. Such technological periods (which would be relatively global in a given period of time) may have a significant effect on the likelihood of war in power transitions. Such a measure of technological advantage should be taken into account in future measurements of power transition models.

Finally, power transition theory, if it is to remain relevant in the 21st century, should explore non-traditional power transitions, particularly those between colonies and imperial expeditionary forces, and between violent non-state actors and states. Asymmetric uses of power, democratization of light arms, the internet, asymmetric sensitivity to casualties, and other factors can allow non-states or colonies to meet or overcome the coercive power of a state, and it is likely that wars of independence or insurgencies depend on the revisionist tendencies of the colony or non-state actor, as well as their power relative to the state. Power transition theory has the potential to explain formation and conflict dynamics in these cases, and should do so to achieve greater scope.

Annex A: Full Codebook (as variables appear in the dataset)

variablename: description of variable (data type, source [direct or indirect])

year: the year of interest (integer, CoW)

countrya: 3-letter country code of first country in the dyad (string, CoW)

countryb: 3-letter country code of second country in the dyad (string, CoW)

powera1: Correlates of War CINC score of countrya in year of interest (continuous, CoW)

powerb1: Correlates of War CINC score of countryb in year of interest (continuous, CoW)

powera5: CINC score of countrya 5 years before the year of interest (continuous, CoW)

powerb5: CINC score of countryb 5 years before the year of interest (continuous, CoW)

missiontoa: level of diplomatic presence at countrya from countryb (ordinal, CoW)

missiontob: level of diplomatic presence at countryb from countrya (ordinal, CoW)

ally: whether the dyad is in an alliance in the year of interest (binary, CoW)

politya: the polity score of countrya (ordinal -10 -> 10, PolityIV)

polityb: the polity score of countryb (ordinal -10 -> 10, PolityIV)

democa: whether countrya is a democracy in the polity scale (binary, PolityIV)

democb: whether countryb is a democracy in the polity scale (binary, PolityIV)

contiguity: whether countrya and countryb are contiguous (binary, CoW)

yearstart: the year that the dyad entered the current conflict, if a current conflict exists (integer, CoW [Mouz])

yearend: the year that the dyad ended the current conflict, if a current conflict exists (integer, CoW [Mouz])

conflictlevel: highest level of conflict reached during the year of interest (ordinal 0 -> 5, CoW)

revisiona: whether countrya portrays revisionist tendencies (binary, CoW [mouz])

revisionb: whether countryb portrays revisionist tendencies (binary, CoW [mouz])

originatea: whether countrya initiated the current conflict, if it exists (binary [if conflict], CoW [mouz])

originateb: whether countryb initiated the current conflict, if it exists (binary [if conflict], CoW [mouz])

distancew: the distance between the population-weighted geographic centers of the dyad (continuous, cepii)

continenta: the continent or sub-continent of countrya:

1) South America, 2) Central America, 3) North America, 4) Europe,

5) Africa, 6) Middle East, 7) Asia, 8) Oceania

continentb: continent or sub-continent of countryb

deltapower1: the dyadic difference in power in the year of interest (continuous, CoW)

deltapower5: the dyadic difference in power five years before the year of interest (continuous, CoW)

powerchange: the rate of change over five years in the difference of power in the dyad; the difference of deltapower1 and deltapower5 (continuous, CoW)

averagepower1: the mean of dyadic power in the year of interest (continuous, CoW)

averagepower5: the mean of dyadic power five years before the year of interest (continuous, CoW)

propdeltapower1: the proportional difference in power during the year of interest; deltapower1 divided by averagepower1 (continuous, CoW)

propdeltapower5: the proportional difference in power five years before the year of interest; deltapower5 divided by averagepower5 (continuous, CoW)

proppowerchange: the rate of change over five years of proportional power in the dyad; the difference between deltapower1 and deltapower5 (continuous, CoW)

nconflict: normalized conflict (normalized continuous, CoW [mouz])

npropdeltapower1: normalized propdeltapower1 (normalized continuous, CoW)

npropdeltapower5: normalized propdeltapower5 (normalized continuous, CoW)

nproppowerchange: normalized proppowerchange (normalized continuous, CoW)

war: whether the dyad is in war during the year of interest; dropped if yearslong > 1

0) conflict is 0, 1, 2, or 3

1) conflict is 4 or 5

bothdemoc: if both countries are democracies; politya > 6 and polityb > 6 (binary, CoW)

bothauth: if both countries are autocracies; politya < -4 and polityb < -4 (binary, CoW)

powerinteract: the interaction effects between the difference in power and the rate of change of the difference in power; powerchange * deltapower1 (continuous, CoW)

continentdiff: equal to 1 if the dyad are in separate continents (binary, CoW)

samecontinent: equal to 1 if the dyad are in the same continent (binary, CoW)

ndistancew: normalized distance (normalized continuous, cepii)

ncloseness: the reverse of the the normalized distance; 1 – ndistancew (normalized continuous, cepii)

npowera1: normalized range of powera1 (normalized continuous, CoW)

npowerb1: normalized range of powerb1 (normalized continuous, CoW)

relevancetoa: a linear combination of the normalized weighted dyadic distance, continent similarity, and the normalized power of countryb, measuring the relevance of countryb to countrya; (ndistancew + samecontinent + npowerb1) (continuous, CoW and cepii)

relevancetob: a linear combination of the normalized weighted dyadic distance, continent similarity, and the normalized power of countrya, measuring the relevance of countrya to countryb; (ndistancew + samecontinent + npowera1) (continuous, CoW and cepii)

relevance: the larger of relevancetoa and relevancetob (continuous, CoW)

nrelevance: normalized relevance (normalized continuous, CoW)

yearslong: the total length of the conflict, if there is currently a conflict; yearend – yearstart (integer, CoW)

dyad: a dummy appending of the 3-letter code of countryb to the end of countrya; this is transitively unique [that is, if AUHRUS exists, RUSAUH does not] (string, CoW)

dyadnum: a conversion of dyad into a unique numerical value for each dyad (integer, CoW)

nmissiontoa: normalized missiontoa (normalized ordinal, CoW)

nmissiontob: normalized missiontob (normalized ordinal, CoW)

naveragepower1: the normalized averagepower1 (normalized continuous, CoW)

revisionism: whether one of the states in the dyad is revisionist (binary, CoW)

abspowerchange: the absolute value of power shift [that is, negative values appear positive—this is to show the magnitude of a shift in power over time] (continuous, CoW)

nabspowerchange: normalized abspowerchange (normalized continuous, CoW)

ndeltapower1: normalized deltapower1 (normalized continuous, CoW)

propabspowerchange: proportional absolute value of powerchange; abspowerchange divided by averagepower1 (continuous, CoW)

npropabspowerchange: normalized propabspowerchange

deltapower1sq: the squared term of deltapower1; deltapower1 * deltapower1 (continuous, CoW)

deltapower1cu: the cubed term of deltapower1; deltapower1sq * deltapower1 (continuous, CoW)

relevancesq: the squared term of relevance; relevance * relevance (continuous, CoW)

relevancecu: the cubed term of relevance: relevancesq * relevance (continuous, CoW)

powerchangesq: the squared term of powerchange; powerchange * powerchange (continuous, CoW)

powerchangecu: the cubed term of powerchange; powerchangesq * powerchange (continuous, CoW)

ndeltapower1sq: normalized deltapower1sq (normalized continuous, CoW)

ndeltapower1cu: normalized deltapower1cu (normalized continuous, CoW)

nrelevancesq: normalized relevancesq (normalized continuous, CoW)

nrelevancecu: normalized relevancecu (normalized continuous, CoW)

npowerchangesq: normalized powerchangesq (normalized continuous, CoW)

npowerchangecu: normalized powerchangecu (normalized continuous, CoW)

ptcase55: a dummy cutoff of whether a dyad is "in a power transition;" whether a dyad falls within the top 5% of relevance and bottom 5% of deltapower1 (binary)

ptcase105: a dummy cutoff of whether a dyad is "in a power transition;" whether a dyad falls within the top 10% of relevance and bottom 5% of deltapower1 (binary)

ptcase1010: a dummy cutoff of whether a dyad is "in a power transition;" whether a dyad falls within the top 10% of relevance and bottom 10% of deltapower1 (binary)

ptwar55: a dummy that determines whether a dyad is "in a power transition war;" a variable that equals one when a ptcase55 dyad is at war in the year of interest (binary)

ptwar105: a dummy that determines whether a dyad is "in a power transition war;" a variable that equals one when a ptcase105 dyad is at war in the year of interest (binary)

ptwar1010: a dummy that determines whether a dyad is "in a power transition war;" a variable that equals one when a ptcase1010 dyad is at war in the year of interest (binary)

pwar: a dummy predictor value for the likelihood of a dyad to go to war based on a linear regression (continuous)

nlpwar: a dummy predictor value for the likelihood of a dyad to go to war based on a nonlinear regression (continuous)

revisionistwar: a war in which the revisionist state was also the originator (binary, CoW)

statusquowar: a war in which the originator of the war was not the revisionist state (binary, CoW)

nrelevanceXdeltapower1: the interaction effect between relevance and deltapower1, normalized (continuous)

nrelevanceXabspowerchange: the interaction effect between relevance and abspowerchange, normalized (continuous)

nabspowerchangeXdeltapower1: the interaction effect between abspowerchange and deltapower1, normalized (continuous)

Appendix B: Data Collection and Aggregation Code

Data collection code has been generously released to the academic community by its authors. There are three pieces of code that, in stages, reorganize data into dyad-year form and then aggregate it into a master database. The code is available at the following locations:

Python by Dennis Perepelitsa: http://web.mit.edu/efogg/Public/Thesis/processyear.py

Perl by Christian Ternus: http://web.mit.edu/efogg/public/Thesis/parsesql.pl

C++ by Greg Eschelberger: http://web.mit.edu/efogg/Public/Thesis/master.cpp

If you'd like to rebuild the master dataset from scratch using the above code, please contact the author, at fogg.erik@gmail.com.

Alternatively, the fully aggregated master dataset (without variables added during analysis) is available at the following location:

http://web.mit.edu/efogg/Public/Thesis/thesis-master.dta

The dataset with a full variable set (all those added during analysis) is available at the following location:

http://web.mit.edu/efogg/Public/Thesis/thesis-progress.dta

Appendix C: Statistical Analysis Code

The code used to analyze the aggregated master dataset is available at the following location:

http://web.mit.edu/efogg/Public/Thesis/thesis.do

The code is to be run in STATA with the master dataset from Appendix B. The code is not a single script that outputs all relevant results, but instead a series of scripts with instructions to output different results. The instructions are a bit particular, but should be navigable.

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