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Charles J. Koch

United States Army, charlesjkoch@icloud.com

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Testing the Power Transition Theory with Relative Military Power

Abstract

This article tests the power transition theory using relative military power within a dyad pair. The author hypothesizes that when a dyad pair achieves relative military power parity, the two states are likely to initiate war. Furthermore, when a dyad pair no longer maintains relative military power parity, the probability of war between the two states decreases. Although the sample population used to test this hypothesis is small ($n=3$), the mixed-method analysis indicates support to the power transition theory. Furthermore, results are more substantial when using military expenditure and surplus domestic when compared to results using military personnel and surplus domestic product. No statistically significant difference exists ($p=.99$) when comparing military expenditure and surplus domestic product with a combination of military expenditure, military personnel, and surplus domestic product. These results indicate that relative military power possesses the potential to provide researchers an additional quantitative measure to test the power transition theory. Although these initial results are promising, further research is required to test a larger sample population of dyads.

Introduction

Since the publication of *World Politics*, the power transition theory remains one of the most prominent and convincing models of state interaction.¹ Significant data and literature support much of the original theory proposed by Organski over sixty years ago. However, prominent political scientists such as Douglas Lemke, Woosang Kim, Suzanna Werner, and Jacek Kugler improved the theory over time by making significant contributions to the power transition theory. Contributing to the power transition theory provides researchers a better understanding of the conditions necessary for both war and peace.

One of the earliest tests of power transition theory measured power utilizing gross national product (GNP).² Other published tests of the power transition theory included measurements from the Correlates of War (COW) Project, gross domestic product (GDP), or, most recently, surplus domestic product (SDP). Most measures of power support the power transition theory, but no measure of power is without its flaws. Some power measurements accurately identify power transitions, while other power measurements fail to identify when some power transitions occur. Even an accurate measure of power that identifies some power transitions does not always identify all power transitions. Therefore, the task of accurately measuring power remains a prominent topic of discussion amongst power transition theorists. Combining both new and well-established measurements of power, this article aims to build upon these discussions to determine the probability of two states engaging in war using relative military power.

Literature Review

The power of a state is a difficult concept to measure; yet, for power transition theorists, measuring power is necessary to test the theory. Despite the difficulty of the task, many scholars continue to discover various, and often ingenious, methods of measuring a state's power. Measuring power, after all, is more than just an exciting idea for those in academia. Measuring power is essential for politicians, strategists, and those who engage in international politics. To measure power accurately is also to have insight into how and why states decide to initiate war.

This literature review analyzes influential works regarding the power transition theory and how various researchers measure power. The literature review covers four critical components: a review of the power transition theory, hierarchy, status quo, and power measurement. Reviewing these components of theory contribute to determining the probability of two states engaging in war using relative military power.

Power Transition Theory—A Basic Review

Organski's theory on power transition emerged from a dissatisfaction with the balance of power theory being the dominant theory of international relations. Organski did not believe the balance of power theory provided an accurate model of the world that explains how states interact.³ According to the balance of power theory, states seek to maximize their power, but some powerful states may serve as a balance to ensure that an alliance or a single state does not become too powerful and consequently disrupt the balance of power within the international order.⁴ According to the father of the power transition theory, the balance of power theory did not accurately represent how states interacted within the international system.

Organski critiques the balance of power theory through a historical analysis and arrives at two conclusions. First, a balance of power amongst states does not yield peace whenever powerful states abstain from siding with a particular state during disputes.⁵ Second, a preponderance of power yields peace whenever a powerful state, the "balancer," participates in disputes and chooses to side with other states.⁶ Organski's insight into the fallacies of the balance of power led to the development of a new theory, the power transition theory, that focuses on power preponderance leading to peace.

Unlike other theories that attempt to create models explaining the interaction of all states, the power transition theory created by Organski in 1958 was, at the time, narrow in scope. Instead of attempting to explain the interactions of states across history, the power transition theory narrowed its scope by attempting to explain the interactions of states within the "period of the industrial revolution."⁷ However, at least one researcher, Woosang Kim, tested the premise of this theory and noted that the power transition theory can explain state interaction in pre-industrial parts of history.⁸ By widening the scope to include states from other parts of history,

Kim's research indicated that the power transition theory may provide a better understanding of the interactions of states across all time.⁹

Notably, the power transition theory identifies the potential for war whenever two rivaling states achieve parity. When two rivaling states achieve parity, an opportunity for a power transition becomes possible where a rising dissatisfied state becomes more powerful than the declining dominant state. Thus, war is more likely to occur whenever two states achieve parity. Conversely, peace is more likely to occur than war whenever a dominant satisfied state maintains a preponderance of power.

Some aspects of the power transition remain the same as they did in 1958, while other aspects significantly changed over time. Regardless of the changes, the contributions of Organski and other researchers strengthen and develop the power transition theory's understanding of state interaction. Additional research and critique may improve the power transition theory's ability to not only explain state interaction, but also determine the likelihood of war between two states.

Expanding the Hierarchy

A fundamental premise of the power transition theory is that the world is not anarchic. Thus, the power transition theory breaks away from one of the most basic premises of realism and liberalism (and diverges further from the balance of power theory). Instead of an anarchic world, Organski creates a model of the world that is hierarchical. In a hierarchical model of the world, the dominant state is the one "that controls the existing dominant international order" on top of a power pyramid.¹⁰ Below the dominant state include great powers, middle powers, and small powers. Within the power pyramid, states are either satisfied or dissatisfied with the international system. However, the status quo is always to the satisfaction of the dominant state. Initially, the power transition theory's model of the world only described states vying for power at the top of the power pyramid. Additional research now includes states not necessarily competing for world hegemony.

One of the earliest published articles arguing for expanding the power transition theory to include smaller powers occurred in 1976. That year, Erich Weede published an influential article demonstrating a

preponderance of power that led to peace amongst forty-one observed Asian dyads (these dyads include small and middle powers) from 1950 through 1969.¹¹ Weede's research revealed that the power transition theory explains more than just the interactions of the most dominant states; it also explains the interactions of smaller states not vying for hegemony. Since the publication of Weede's article in 1976, several other scholars found that the power transition theory is a valuable model to demonstrate that the interactions of smaller states are similar to powerful states.¹²

Douglas Lemke contributes significantly to improving the hierarchical model concept within his chapter in *Parity and War*. Lemke claims that there are multiple hierarchies within the international system and proposes a multiple-hierarchical model.¹³ In the multiple-hierarchical model, each hierarchy nests within a larger hierarchy. States within smaller hierarchies act similarly to the most powerful states operating at the top of the hierarchy.¹⁴ However, smaller hierarchies cannot typically extend their power beyond their immediate region.¹⁵ For example, Belgium may involve itself in the affairs of Sweden, but it may not necessarily meddle in the affairs of Dubai. However, how Belgium interacts with Sweden is similar to how the United States may interact with China. In other words, "power distributions and war follow the same pattern regardless of the size of a country."¹⁶ Although Lemke's analysis for his multiple-hierarchical model limits itself to just South America, additional evidence from other researchers suggests that the power transition theory can describe the interactions of smaller states with regional hierarchies because they are similar to states at the top of the hierarchy. Dominant regional powers cannot influence the larger global hierarchy, but dominant global powers may interact in the affairs of regional powers.¹⁷

Despite the growing popularity of the multiple-hierarchical model, one researcher found evidence that suggests it is possible to improve Lemke's multiple-hierarchical model to include all states within the international system that are dissatisfied with the status quo but not vying for regional hegemony.¹⁸ Another enterprising researcher considers the multiple-hierarchical model as an arbitrary system that is part of the dyadic effect of the power transition theory.¹⁹ The dyadic effect is a method of modeling the international system by using the power transition theory to explain the interactions of any set of dyads who experience a power transition.²⁰ While this concept is exciting and significantly expands the power transition

theory to explain the interactions of all states, more research is required to make the dyadic effect part of the power transition theory.

Understanding the hierarchical system helps to identify which dyads to observe when testing the power transition theory with a new measure of power. Examining states that experience war due to parity within their specific hierarchy should yield similar results to all states who engage in war due to parity regardless of where they exist within the international hierarchy. Comparing both middle powers and great powers likely yields evidence that supports Lemke's multiple-hierarchical model of the power transition theory and the idea that all states behave similarly within the international system.

Understanding the Status Quo

Peace occurs whenever a preponderance of power exists amongst the states that are satisfied with the status quo.²¹ However, as dissatisfied states grow in power, they may eventually acquire a preponderance of power sufficient to challenge the dominant state and the status quo of the international order.²² However, power transition theory typically observes rivaling states as dyads. Therefore, only states who achieve parity with a dominant state within the hierarchical system may challenge the status quo. Organski argues the conditions for war include the following:

[T]he challenger is of such a size that at its peak it will roughly equal the dominant nation in power; if the rise of the challenger is rapid; if the dominant nation is inflexible in its policies; if there is no tradition of friendship between the dominant nation and the challenger; and if the challenger sets out to replace the existing international order with a competitive order of its own.²³

Understanding that the world is peaceful only when one dominant state maintains a preponderance of power reveals the need to measure power and to measure it accurately. To mismeasure power is also to misunderstand the relations of states.

Dissatisfaction with the status quo does not always mean that two states will go to war. The opportunity for a dissatisfied power to challenge a dominant state occurs when the two states achieve parity. According to Organski and

Kugler, parity occurs when one state's power is eighty percent or more of another state's power.²⁴ Similarly, two states may achieve parity if they are within twenty percent of perfect parity. Perfect parity occurs when two rivaling states (or a dyad pair) achieve equal power relative to one another.

Parity remains a critical aspect of the power transition theory because it indicates the likelihood of conflict between two states if they are dissatisfied with the status quo. Huowleing and Siccama build upon this concept through their observations of rates of change during power transitions. The two researchers found that "differential growth rates and specifically power transitions among great powers are indeed a potent predictor of consecutive outbreaks of war."²⁵ The rate of change in growth amongst two rivaling states is a critical aspect of the power transition theory because it can influence the status quo of states and the probability of war.

As previously mentioned, the probably of war increases whenever states achieve parity with one another. Therefore, the rate of growth of a rising state may also influence the probability of war.²⁶ Thus, the rate of change of difference in power and economic growth rate may also indicate the probability of war between a dyad pair.²⁷ In other words, the faster the rate of growth, the probability of war increases; the slower the rate of growth, the probability of war decreases. Observations into the relative rate of growth between two states may indicate whether a state is satisfied or dissatisfied with the status quo.

By observing arms buildups and war, it is possible to also determine whether a state is satisfied or dissatisfied with the status quo. According to Werner and Kugler, it is possible to assume that a challenger of the status quo may increase its growth rate of military expenditures to exceed the military effort of the dominant state.²⁸ In such an instance, an opportunity to challenge the status quo occurs when three conditions are satisfied: A rival state achieves parity with the dominant state, a willingness to challenge the dominant order refers to a military buildup, and, finally, a commitment to challenge the dominant order.²⁹ If all three conditions to challenge the status quo are met, the probability of war increases if the following conditions are also met: Parity within a dyad, a military buildup, and the "average growth rate of military expenditures by the challenging nation exceed[s] that of the dominant nation."³⁰ Werner and Kugler's insight into arms buildup and war indicates that it is possible to examine

the military power of states over time to determine if they are at a higher probability of going to war.

However, examining only military power is not sufficient to understand the status quo. Rivalry is also an essential part of understanding the status quo of states.³¹ Frequent disputes stemming from a shared border or conflicting interests are just a few of the factors that contribute to rivalry amongst states.³² However, rivalry alone does not explain why a state may initiate war. For instance, Japan initiated war with the United States despite the two states not sharing a common land border. Rivalry is just one of many variables used to determine the probability of war between two countries.

Although rivalry and parity contribute to a state's satisfaction with the status quo, the amount of information a state maintains on its competitors may also influence a state's satisfaction within the international system. Reed suggests that the distribution of information is an equally important aspect of power-centric theories because information may determine whether a state overestimates or underestimates its rival.³³ A common source of information for state rivalry is each other's military because it indicates a state's capability, resources, and technology.³⁴ Over or underestimating a rival's capabilities may determine how a state interprets its relative power compared to its adversary. In other words, misunderstandings about relative power due to insufficient information may influence whether a state decides to go to war if they falsely believe they have achieved power parity or not.

Empirically determining whether a state is satisfied or dissatisfied with the status quo eludes researchers. However, additional research into the status quo to examine two competing state's relative military power may indicate their degree of dissatisfaction and their opportunity to challenge the status quo. The probability of two rivaling states moving towards war increases as they achieve relative military power parity. Furthermore, because a state can never know for sure the power of its adversary, it is reasonable to assume that a state may interpret its adversary's power capability by its military personnel and military expenditure.

Power Measurement—Different Methods

Measuring the power of different states is not an easy task. There are numerous factors, both quantitative and qualitative, to determine power. However, some factors are more reliable than others, while other factors are too complex. Organski initially speculated on potential determinants that may help researchers measure power. First, he defined power as the ability to influence others.³⁵ Initially, the most critical determinants of power included: Population size, political structure, economic development, national morale, resources, and geography.³⁶ However, those determinants of power have not held up well to research. For example, it is exceedingly challenging to operationalize national morale. As the power transition theory evolved, so too did the determinants of power.

Some determinants of power include external factors, such as alliances, while others focus more on internal factors, such as military capability. The debate on whether allies strengthen a state's capabilities and, thus, a state's power continues to this day. Kugler and Lemke suggest that allies may improve the outcome of war but do not influence the probability of war nor influence a state's power capability.³⁷ Despite Kugler and Lemke's research, Kim believes that "external means such as alliance formation" does augment a state's power.³⁸ Although the literature indicates a healthy debate on the value of external and internal factors contributing to the measurement of state power, both factors have value.

Military capability, an internal factor to determine power, indicates promising results towards providing accurate power measurements. When utilizing military capability to analyze power transitions, one study proposes that the conditions for war suffice when two rival dyads achieve equal power.³⁹ This study compliments the status quo literature that suggests parity is one of the conditions for war. Although this study on power measurement focused primarily on internal factors, there are other studies that do incorporate external factors.

One study used both internal and external factors considered alliances to determine state capability. Kim's study used army size, population, and sea power to analyze war.⁴⁰ The raw data from these state capabilities

contributed to the creation of four independent variables that include external and internal factors (alliance transition, alliance growth rate, alliance equality, and dissatisfaction) to measure the likelihood of war in the two centuries before 1815.⁴¹ Kim's measurement of state power also found support for the power transition theory.

One of the first attempts to test the power transition theory used an internal factor that focused on the economy and population: Gross National Product. Although research suggests that GNP supports the power transition theory, it is not the best measurement of power.⁴² GNP focuses on the output produced by a state's citizens but does not consider any additional output from other people residing in the state. Additionally, larger populations may produce a higher GNP, but if not fully industrialized, the state's production immediately returns to the subsistence of its population. Other issues with GNP include exchange rates amongst states and difficulty controlling for inflation.⁴³ Despite its shortcomings in the early studies, Organski and Kugler chose to use GNP due to the reliability of the data.⁴⁴ Thus, GNP served as an essential benchmark for measuring power for the power transition theory. However, the development of more advanced power measurements caused GNP to fade away as a useful variable to test the power transition theory.

One of the more popular measures of power is the composite index of national capabilities (CINC), which is a compelling measurement of power used by many researchers to evaluate the relative power of different states. Studies using CINC found substantial evidence to support the power transition theory. Composite index of national capabilities is a robust measure of power because it examines state capability through three dimensions: Demography, industry, and military.⁴⁵ These variables include the following: Total population and number of people living in large cities (demographic dimension), energy production and iron and steel production (industrial dimension), and, finally, military expenditure and the size of its military personnel (military dimension).⁴⁶

However, a common critique of CINC is that it is not possible to determine if a single state is improving or declining, or if the aggregate data is improving or declining.⁴⁷ This issue with CINC is due to the relative nature of the measurement; CINC fluctuates based on the capabilities of all the

states in the world.⁴⁸ Nevertheless, CINC remains an influential measurement of power used by many political scientists.

Although CINC is not perfect, researchers continue to improve the power measurement to account for some of the common critiques. The geometric indicator of national capabilities, a variation of CINC, accounts for fluctuations that derive from the growth of other states and can allow political scientists to minimize the number of “artificial, masked, magnified, minimized, and mistimed transitions” that occur due to CINC.⁴⁹ Heckman modified CINC by multiplying “likely external sources of power” and the traditional CINC representing internal sources of power to determine the overall power of a state that accounts for all sources of power.⁵⁰ The “likely external sources of power” refer to the S-score developed by Signorino and Ritter in 1999 that indicates alliances and similarities between states’ policies.⁵¹ The modified CINC score provides a new method to evaluate power capability by combining a well-established measurement of power with a less-utilized measurement of alliances. Additional research utilizing well-established and less common power measurements may lead to the discovery of new measures of power to understand the interactions of states.

The most promising measurement of power is the SDP developed by Anders, Fariss, and Markowitz in 2020. The SDP “estimates the upper bound on the resources a state can sustainably extract” after accounting for the needs of its population.⁵² The inventors of SDP compiled enough data to cover a period that ranges from 1800 to 2018. Utilizing their data, the researchers found that some states are not nearly as powerful as other measures of power indicate.⁵³ SDP is promising because it focuses on the surplus capabilities of a state by accounting for the needs of its population. Just because a state is large does not mean that it is also powerful. Research analyzing military capabilities combined with SDP may yield valuable discoveries that reveal new aspects of measuring power.

Hypothesis

The literature review highlights three critical components of the power transition theory. First, the rate of change of growth is critical in determining whether a dyad may or may not go to war. Second, the hierarchical model of the power transition theory extends to all states, not

just the great powers. Third, SDP and military capability are potential measures of state power that, when combined, could provide an accurate representation of relative power amongst states.

The author hypothesizes that two rivaling states (one dissatisfied with the status quo and the other satisfied with the status quo) who achieve relative military power parity are more likely to go to war unless the two states escape their relative military power parity. This hypothesis assumes that wars are more likely to occur when rivaling states achieve parity. The hypothesis combines two of the three critical components of the power transition theory to test. The hypothesis does not incorporate rates of change over time.

The hypothesis is unique because it introduces and analyzes relative military power. Relative military power is the power of a state compared to a rival. However, any attempt to measure power exclusively through the lens of the military fails to account for all aspects of state power. Therefore, it is necessary to combine a state's economic, demographic, and military power to account for almost all aspects of state power. Thus, the author uses SDP because it represents the economic potential and demography of a state by considering the resources required to sustain its population. To account for military power, the author tests whether using military expenditure and military personnel or just one of the two variables is a better determinant of relative military power.

Methodology

This article measures power by combining SDP with one of two variables from the COW Project to create an equation that measures relative military power. The hypothesis assumes that state interactions include multiple hierarchies. This assumption increases the potential sampling populations to test the power transition theory. However, this study only uses a total of three sample populations ($n = 3$).

The variables from the Correlates of War Project used to determine relative military power include military expenditure and military personnel.⁵⁴ The author compares military expenditure and military personnel to one another to determine if one variable is more useful than the other. The following equation measures discrete relative military power utilizing one military capability variable:

$$b_{ijt} = \frac{SDP_{jt}}{(SDP_{jt} + SDP_{it})} + \frac{MR_{jt}}{(MR_{jt} + MR_{it})}$$

This equation expands on Anderson, Fariss, and Markowitz's equation on relative SDP by introducing military capability.⁵⁵ This equation incorporates relative military expenditure alongside relative power resources from SDP. However, it is possible to substitute the military capability variable, military personnel ratio, *MPR*, with military expenditure ratio, *MR*. It is necessary to test the military expenditure and military personnel ratios separately to analyze the similarities and differences between them. It is important to note that this equation is discrete; it only reveals relative military power between two states within one year. Plotting the values of b_{ijt} over time can reveal fluctuations in relative military power and the likelihood of two states being engaged in war. A mixed-methods analysis may reveal differences between the two variables and whether one variable is more valuable than the other.

Although measuring one military capability variable at a time between rivaling powers may prove helpful to analyze differences within the variables, combining the variables may also yield interesting results. Aggregating the two military capability variables may provide better insight into overall relative military power because it accounts for military expenditure, military personnel, and SDP. The following equation represents discrete relative military power utilizing both military capability variables:

$$c_{ijt} = \frac{SDP_{jt}}{(SDP_{jt} + SDP_{it})} + \frac{MR_{jt} + MPR_{jt}}{(MR_{jt} + MPR_{jt}) + (MR_{it} + MPR_{it})}$$

This equation is likely more useful than the previous discrete equation because it incorporates military personnel and military expenditure. However, more is not always better. It is necessary to analyze the findings to determine which one proves more useful to determine relative military power. One may reasonably expect that this equation does provide a more accurate representation of relative military power because it includes both variables of military capability

Next, it is necessary to operationalize military power parity. Understanding that perfect parity possesses a value of one and that parity exists within twenty percent of a rival, it is possible to determine relative military power parity. If b_{ijt} or c_{ijt} equals a relative military power value between 0.8 and 1.2, it is reasonable to assume that the observed state possesses relative military power parity with its competitor. This operationalized definition of relative military power parity comes from understanding that parity occurs when a state is within twenty percent of another state's power.⁵⁶

Based on the discrete relative military power equation, if two states are perfectly equal, the observed country will have a relative military power value of one. A value of one thus indicates perfect parity between two rivaling states. The following proof represents perfect parity:

$$b_{ijt} = \frac{SDP_{jt}}{(SDP_{jt} + SDP_{it})} + \frac{MR_{jt}}{(MR_{jt} + MR_{it})}$$

Using two fictional states, state A and state B, it is possible to find the relative military power of state A with its competitor, state B. In this model, the two states have an equal SDP (value of two) and an equal military expenditure ratio (value of six).

$$\begin{aligned} b_{ijt} &= \frac{2}{(2 + 2)} + \frac{6}{(6 + 6)} \\ b_{ijt} &= \frac{2}{4} + \frac{6}{12} \\ b_{ijt} &= 1 \end{aligned}$$

This proof demonstrates that perfect parity equals a value of one. However, it is important to keep in mind that parity lays between a relative military power value of 0.8 and 1.2. This range in parity exists due to the upper and lower bounds having a value of zero and two, respectively. Furthermore, it is possible to know that the parity range is 0.4 because it is twenty percent of the upper bound. If perfect parity possesses a value of one, parity ranges from a relative military power value of 0.8 to 1.2. Therefore, a state does not obtain parity with a competitor until it falls into the relative military power range of 0.8 to 1.2.

If b_{ijt} , or c_{ijt} , equals a relative military power value between 0.0 to .79, the observed state is relatively stronger in military power or capability than its competitor. Therefore, the opposite must hold (the observed state is weaker than its competitor) if the value is greater than 1.2. Figure 1 provides a visual representation of parity to help understand this concept:

Figure 1. Relative Power and Parity Chart

Source: Author.

Figure 1 graphically depicts how relative military power correlates to a state being stronger, weaker, or equal to a competitor. that the closer two states move towards an equal relative military power, the more perfect the parity (represented by the relative military power value of 1), the more likely war is to occur between a dyad pair. Lastly, Figure 1 depicts those stronger states have lower relative military power values compared to weaker states.

Research Design

The author tests their hypothesis using a limited population size ($n = 3$). The experiment will utilize three dyad pairs: United States and Japan, United States and Russia, and Iraq and Iran. The United States and Japan represents a great power dyad pair who went to war. United States and Russia represents a great power dyad pair who never formally went to war. Iraq and Iran represents a regional power dyad pair who went to war.

Furthermore, the dyad pairs come from both great powers and middle powers vying for hegemony.

The author uses the relative military power equations to determine the likelihood of war between sample dyads. The author expects the United States and Japan dyad to reach military power parity shortly before 1941 when Japan attacked Pearl Harbor. The author also suspects the United States and Russia dyad to achieve relative military power parity shortly between 1945 and 1947. The Cold War between these two states begins to take shape during these years when most of Eastern Europe becomes soviet satellite states, and George Kennan pens his famous Long Telegram that influences the foreign policy of the United States. The author also expects Iraq and Iran to achieve relative military power parity in 1978, the year of the Iranian Revolution. The author expects Iraq's relative military power to improve and, thus, create an opportunity to challenge Iran's regional hegemony in 1980.

Using the equations for relative military power, the author analyzes each of the dyads to test the power transition theory. Based on the original hypothesis, the author expects the probability of war to increase whenever a dyad pair achieves relative military power parity. However, because the author is developing a measure of relative military power, they will also compare which data set (military expenditure and SDP, military personnel and SDP, or military personnel, military expenditure, and SDP) best aligns with known wars amongst rivaling states from history and brief case studies. Thus, this article intends to use a mixed-methods analysis approach to test the power transition theory.

Findings

The data from the experiment provide promising support to the power transition theory. Each dyad observed supports the power transition theory's claim that peace occurs whenever a state maintains a preponderance of power. Conversely, the data indicates a higher probability of war when a dyad pair achieves relative military power. The best data set to support the power transition theory and aligned with historical events incorporated SDP and military expenditure.

Military Expenditure Performs Better with SDP

Figure 2. United States and Japan Dyad's Relative Military Power Using MILEX and SDP

Source: Author.

The first dyad pair analyzed is the United States and Japan from 1920 to 1945. This range in time provided the author with plenty of data points to test the hypothesis. According to Figure 2, the United States was militarily more powerful than Japan until 1937; therefore, the probability of war was relatively low. However, Figure 2 indicates that Japan and the United States achieved relative military power parity from 1937 until 1941. Figure 2 indicates that Japan possessed greater relative military power from 1938 to 1940 than the United States. The data indicates that Japan also possessed the capability and opportunity to challenge the status quo as a rising dissatisfied state. Japan seized the opportunity by bombing Pearl Harbor in 1941. However, the bombing of Pearl Harbor in 1941 likely accelerated the United States to utilize more of its state capabilities and resources and direct them towards the development of its military power capabilities because this event drew the United States into WWII.

Although Japan maintained an early advantage possessing greater relative military power, United States took the lead in 1941 as the dominant military power. Although the war between Japan and the United States did not end in 1941, the results from Figure 2 indicate the United States quickly becoming much more powerful compared to Japan through 1945. These results indicate that although the probability of war initiation increases when two states achieve parity, war termination does not immediately occur when one states achieves greater relative military power over the other. Although these initial findings are promising, Figure 3 does not provide the same results.

Figure 3. United States and Japan Dyad's Relative Military Power Using MILPER and SDP

Source: Author.

Figure 3 tells an entirely different story about Japan and the United States. Although the two states achieve relative military power parity, it shows that Japan is stronger than the United States for nearly two decades. During that time, Japan was at war with China, whereas the United States withdrew from the world after WWI and shrunk its military. Therefore, it is not beyond reason to conclude that this chart aligns with historical events. Furthermore, when Japan became relatively stronger than the United States

in 1939, it likely motivated the attack in 1941. The second period of power parity closely aligns with some of the deadliest battles in the Pacific Theater during World War II. However, the third period of parity appears random. The United States defeated Japan in 1945, but this figure indicates that the two states achieve relative military power parity during that time. Although certain aspects of this figure appear convincing, it does not align with historical events, nor does it accurately capture war initiation and termination when analyzing parity.

The first dyad pair analyzed indicates that military expenditure performs better than military personnel when combined with SDP. However, how well does military expenditure and SDP perform compared to the other two dyad pairs, United States and Russia and Iraq and Iran? Figures 4 and 5 represent the United States and Russia dyad pair and reveal more differences between military expenditure and military personnel. These two figures extend from 1925 to 2010 to provide enough data points to understand the relationship between these two states.

Figure 4. United States and Russia Dyad's Relative Military Power Using MILEX and SDP

Source: Author.

Figure 4 depicts some of the more dangerous moments of the Cold War as the two states moved towards perfect parity. In 1962, both states achieved nearly perfect parity. Coincidentally, this is also when the Cuban Missile Crisis occurred, arguably one of the most dangerous moments of the Cold War when Russia deployed missiles just miles away from the United States.

These two figures tell different stories about the Cold War. First, when evaluating both Russia and the United States' relative military power capability using only military expenditure, the two states briefly achieved relative military parity in 1941 before the United States quickly became the more powerful state. The two states re-achieve relative military parity in 1947. Although numerous factors influence why the two states achieve relative military power parity during this time, the most logical connection stems from George Kennan's Long Telegram sent to Secretary Brynes in 1946. In this telegram, Kennan claims that Russia cannot maintain a peaceful coexistence with capitalism and that the United States' hegemony, society, and way of life may irrevocably change if Russia's power becomes secure.⁵⁷ The next year, in 1947, Russia and the United States achieved relative military power parity and the two states quickly became locked into a cold war that lasted for over forty years.

Furthermore, Russia became stronger than the United States based upon their relative military power in 1970. Although the two states still existed in relative military power parity, Russia remained the stronger of the two states. This long period of relative military power parity ended in 1989 with the collapse of the Berlin Wall and the beginning of the dissolution of the USSR. The parity resumed the next year and lasted until 1991, when the USSR formally dissolved. From 1991 to 2010, the United States and Russia never achieved parity again, with the United States remaining the dominant state.

Figure 4 also appears to support Organski and Kugler's conclusion that nuclear weapons do not change how powers interact with one another.⁵⁸ Other power transition theorists found that the likelihood of war is lower when two nuclear-armed rivals achieve parity compared to similar situations involving rivals with only conventional weapons.⁵⁹ Furthermore, peace is more likely to occur when one state maintains a preponderance of nuclear power over another.⁶⁰ Figure 4 supports these claims and indicates that the United States was much stronger than Russia after 1991.

Figure 5. United States and Russia Dyad's Relative Military Power Using MILPER and SDP

Source: Author.

Figure 5 reveals a different story about the United States and Russia dyad pair. It reveals that the United States and Russia maintained parity from 1940 to 2010, except in 1950 when the dyad pair did not achieve parity. Furthermore, Figure 5 depicts the USSR as the stronger of the two states during the majority of the Cold War until 1992. It is not until after the dissolution of the USSR that the United States becomes more powerful, but still within parity, in 1992. This chart does not represent a common understanding of the Cold War between the two states. Although one may argue that the two states did achieve parity during World War II, it is difficult to argue that Russia and the United States remained close competitors in terms of relative military power after the dissolution of the USSR. However, Figure 5 and Figure 4 represent similarities displaying nearly perfect parity in 1962 during the Cuban Missile Crisis. This evidence suggests that military expenditure combined with SDP better explains the Cold War than military personnel and SDP.

Figure 5 does not provide the indicate the same level of support to the power transition theory as Figure 4. After 1991, the United States maintained a relatively long period of peace throughout the world as the dominant state. The United States undoubtedly possessed a nuclear preponderance that contributed to this period of relative peace after 1991. However, Figure 5 observed that Russia and the United States still maintained relative military parity after 1991. Knowing that the relations between the two states significantly changed after 1991, it is difficult to defend military personnel and SDP as a viable measure of relative military power to test the power transition theory.

Although the United States and Russia maintained long periods of military power parity for most of the Cold War, the two states never engaged in direct war. One may conclude that it was neither in the United States' or Russia's interest to go to war due to a lack of political willpower to commit to war or the fear of upending their economy for war. In either case, other variables not observed contributed to restraining the two states from going to war. Additional research to explore why two rivaling states achieve relative military power parity but do not go to war appears necessary.

Figure 6. Iraq and Iran's Relative Military Power Using MILEX and SDP

Source: Author.

Figure 7. Iraq and Iran's Relative Military Power Using MILPER and SDP

Source: Author.

Figures 6 and 7 represent the relative military power of Iraq and Iran using military expenditure and military personnel. As previously mentioned, this dyad pair is important to analyze because the power transition theory applies to all powers, regardless of size, who compete over regional or area domination. Similar to the previous dyad pairs analyzed, Iraq and Iran's military expenditure appears to represent the two rivaling powers moving towards war better than military personnel and SDP.

However, both figures depict Iraq and Iran achieving relative military power parity during the Iranian Revolution (1978 to 1979). This similarity indicates that both variables do well to represent a correlation between relative military power parity and war initiation for this observed dyad power. However, where the two variables diverge is at the end of the Iraq-Iran War in 1988. The nearly eight-year war ended in a stalemate, and both figures depict the two states maintaining relative military power parity after 1988. However, with the destruction of the Iraqi military by the United States-led coalition in 1991, the two figures diverge. The first figure depicts Iran becoming more powerful shortly after the Gulf War. Figure 7 does not depict Iran becoming more powerful than Iraq; instead, it maintains close

parity with Iraq. This difference indicates that military expenditure is a better indicator of depicting war initiation and war resolution.

Combining Military Expenditure, Military Personnel, and SDP

From the mixed-methods analysis of this limited data, enough evidence appears to support military expenditure performing better supporting the power transition theory and aligning with historical events than military personnel. However, it is also necessary to identify how both variables perform when combined with SDP. After computing the data and combining the three variables, it became evident that the combined data shared strong similarities with military expenditure and SDP. The author chose to analyze military expenditure combined with SDP and military expenditure and military personnel combined with SDP to determine if it is possible to reject the null hypothesis (no statistical difference exists amongst the two data sets). The author conducted a t-test using data sampling from one state within each of the three dyad pairs. The author chose to use only state because the relativity of the data between the observed state and competitor yields similar results.

The author chose to use the data for the relative military power of Iraq, Russia, and Japan to conduct the t-test. The results indicate that it is not possible to reject the null hypothesis. Each t-test conducted yielded a p-value greater than ninety-nine percent. The mean and the variance for the three data sets are nearly identical as well. Therefore, graphing the data set that used military expenditure, military capability, and SDP appears identical to the figure using the data set for only military expenditure and SDP. Furthermore, this indicates that the mixed-methods analysis used to explain state interaction with the military expenditure and SDP dataset can apply to the military expenditure, military personnel, and SDP dataset.

Conclusion

The results from testing the hypothesis prove promising. The mixed-methods approach to analyze the data suggests that relative military power supports the power transition theory. When analyzing the three dyad pairs from this article, military expenditure combined with SDP adequately indicated that likelihood of war increased as rivaling states achieved relative military power parity. However, military personnel combined with SDP did

not perform nearly as well. Russia could not compete with the United States in the mid-1990s after the dissolution of the USSR, but military personnel combined with SDP indicates that the two states maintained relative military power parity through 2010. It seems reasonable to reject military personnel as a sole variable when analyzing relative military power. Furthermore, the lack of any statistical difference between combining military personnel with military expenditure and SDP compared to military expenditure and SDP indicates that military personnel does not significantly contribute to determining the relative military power of dyads.

Future research to improve upon the author's hypothesis may include the following equation to analyze the relative military power of dyads:

$$b_{ijt} = \frac{SDP_{jt}}{(SDP_{jt} + SDP_{it})} + \frac{MR_{jt}}{(MR_{jt} + MR_{it})}$$

This equation combines military expenditure and SDP. Although there is no statistical difference when combining military personnel with military expenditure and SDP compared to just military expenditure and SDP, it is unnecessary to include a variable that does not provide any statistical difference when aggregated. Therefore, the author suggests using only military expenditure and SDP to evaluate relative military power. However, additional research into other case studies may find that combining military personnel with military expenditure and SDP may yield better results compared to using only military expenditure and SDP.

Overall, these results are promising. However, this article does contain flaws that can improve with further research. One major issue with the design of the experiment is the lack of a control variable. However, no measurement currently exists that focuses exclusively on measuring relative military power amongst dyads. The lack of a control variable required a mix-methods approach for this article.

One critical population missing from this test is a power transition between a dyad pair who is satisfied with the status quo. Testing a peaceful power transition may provide additional support to using relative military power as a useful test of the power transition theory. Furthermore, this article examined only discrete changes of power of time. Incorporating rates of change over time can improve how researchers analyze how quickly an

observed power improves or diminishes its military power relative to a competitor. Lastly, additional research into rival powers' economic and political interests may yield additional insight into whether two rivaling states go to war even if they achieved relative military power parity.

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