*My word is unable to use .svg pictures, instead used the inferior .png

Country Capabilities and its Effect on the Outcome of Inter-State conflicts

Principal Investigators: Peter Yang (pjyang4@wisc.edu)

Introduction

The fundamental relationship that this study will examine is how the result of inter-state disputes can be affected by each sides social, economic, and military capabilities. Rosen of MIT explains that wars are not won without a strong economy and a stable social structure. Economically developed states tend to possess more sophisticated and reliable equipment as well as more skilled military personnel. Furthermore, unstable social states can result in reduced combat effectiveness because military personnel will identify themselves with "social structures in ways that can create divisive loyalties within the political unit. This can create fissures in the unit that reduce the effective military power of the unit as a whole" (Rosen, 95). This relationship is incredibly interesting to investigate because if we can statistically identify which factors most substantially determine winners and losers of war, this could potentially identify shortcomings in resource allocation.

As part of my analysis, I used a probit model to estimate the effect that various social, economic, and military covariates will have on the likelihood of a side winning a war. The probit model had two statistically significant discoveries. First, a one million increase in urban population leads to 1.5% increase in the likelihood of winning a war. Second, a .1 increase in Composite Index of National Capability (CINC) score leads to a 11.6% increase in the chance of victory. We corroborated the statistical analysis with graphs and maps that further identify a causal link between urban population, CINC score and war outcomes.

Analysis

Data

This study mainly uses data from the Correlates of War project which was started by Kenwick, Lane, Ostick, and Palmer of Penn St. University. We use two main datasets. Our first data-set is the inter-state war data set which encompasses all inter-state wars fought between 1819 and 2010. In order to be considered a war, the Correlates of War project defines that "an

inter-state war must meet the same definitional requirements of all wars in that the war must involve sustained combat, involving organized armed forces, resulting in a minimum of 1,000 battle-related combatant fatalities within a twelve-month period". Furthermore, both sides of the conflict must be capable of "effective resistance" which allows wars to be differentiated from massacres, one-sided state killings, and general riots. This data set contains one row per state per conflict. This data set also has crucial information such start month, start year, end month, end year of the war as well as who initiated the conflict, where the war occurred, how many battle deaths per side, and the final outcome of the world.

The other data set we will use also comes from the Correlates of War project and it's called the National Military Capability (NMC). The NMC contains one row per country per year and each row contains useful information such as military expenditure and personnel, total/urban population, and metal/energy consumption. The Correlates of War project uses these six components to calculate the Composite Index of National Capability (CINC) which is a statistical measure of national power created by J. David Singer for the Correlates of War project in 1963. The CINC score is often used in modern day state power studies because it "focuses on measures that are more salient to the perception of true state power" beyond GDP (Heckmen, 2007). This project will merge these two data sets together. Table 1 below will describe the key variables in this merged dataset.

Table 1:Data Description

WarNum	The number assigned to the war
ccode	The System Membership number (or Country Code) for the state participant
Outcome	Coded as: 1 = Winner 2 = Loser
Side	Coded as: 1 = Fought on winning side 2 = Fought on losing side
milex	Military Expenditure (For 1816-1913: thousands of current year British Pounds. For 1914+: thousands of current year US Dollars)
milper	Military Personnel(thousands)
pec	Energy Consumption (thousands of coal-ton equivalent)
irst	Iron and Steel Production (thousands of tons)
tpop	Total Population (thousands)
upop	Urban Population (thousands; pop living in cities greater than 100,000)

cinc	Composite Index of National Capability score
stateabb	Three Letter Country Abbreviation
year	Year of observation/year the war started

Probit Model

In this project, we are only concerned with wars that have clearly defined 'winners' and 'losers'. That is why probit regression was chosen in this project because our outcome variable 'Outcome' is dichotomous and thus our probit model will best be able to predict the probability of winning a war given the covariates. If instead, we used a linear probability model, most of the predicted probabilities from an LPM might have sensible values (between 0 and 1), some predicted probabilities may have nonsensical values that are less than 0 or greater than 1. Table 2 will show the result of a probit regression of binary variable 'War Outcome' on the covariates military expenditure, military personnel, energy consumption, iron/steel production, total population, and urban population. Table 3 will show the results of a probit regression of binary variable 'War Outcome' on the covariate Composite Index of National Capability score (CINC). CINC is a statistical measure of national power constructed on the previous six covariates. Since CINC can be directly created from the other six covariates, it was not included in the previous probit regression.

Table 2: Outcome probit regression on urban populations and other covariates.

	War outcome on Urban pop.
milex/1000000	-0.0033 (0.005)
milper/1000	-0.0315 (0.041)
irst/1000	-0.0065 (0.012)
pec/1000000	0.2344 (0.829)
tpop/100000	-0.0899* (0.047)
upop/1000	0.0150*** (0.005)

Standard errors in parentheses. (p<.1, ** p<.05, ***p<.01)
**As suggested by professor, created table by hand
***Scaled covariates in order to better demonstrate the effects they have on war win percentage

Table 3: Outcome probit regression on CINC score

	War outcome on CINC

CINC	0.1113*** (0.042)

Standard errors in parentheses. (p<.1, ** p<.05, ***p<.01)
**As suggested by professor, created table by hand
***Scaled covariates in order to better demonstrate the effects they have on war win percentage

As these two tables suggest, we have two statistically relevant correlations. First, in table 2, we found that when holding all other covariates constant, the probit regression model proposes that a one million increase in urban population leads to a 1.5% increase in the likelihood of winning a war. Table 3 argues that a .1 increase in CINC score leads to a 11.6% increase in the chance of victory. All other variables were not statistically significant at the 5 percent level. These results strongly demonstrate the impact that large economies could have on the outcome of a conflict.

Plotting

We will provide further evidence of this impact by looking at various plots and maps. To better understand the effect that urban population and CINC scores could have on the outcomes of war, I used matplotlib and geopandas to depict the data in several different ways. Since our probit model suggested that urban population and CINC score were two of the main contributing factors, we will concentrate on these two independent variables.

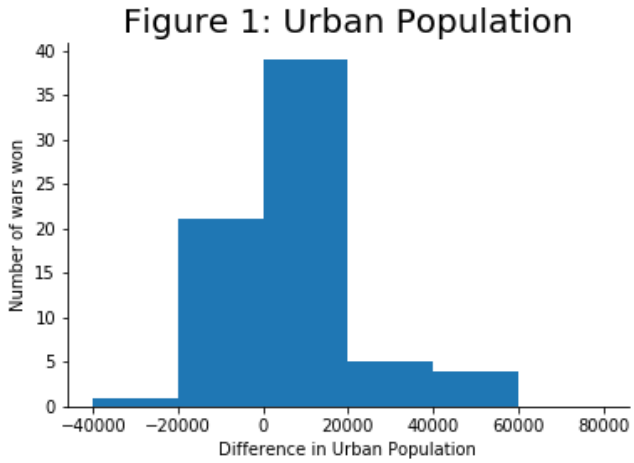

Figure 1: Wars won vs difference in urban population (Thousands)

A large urban population generally suggests a strong economic and military base. This should translate to strong military capabilities. Figure 1 agrees with this assumption and finds that sides with large urban populations do tend to have an upper hand in wars.

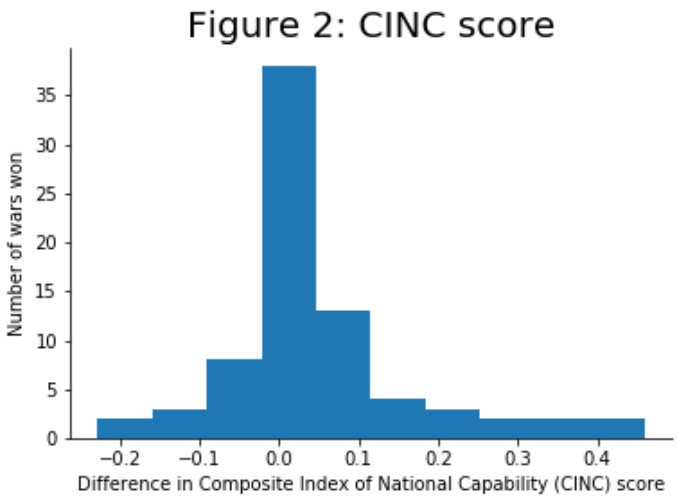

Figure 2: Wars won vs difference in CINC score

Remember that the CINC score was developed in order to measure national power. It is of no surprise then that the side with the larger aggregate CINC score ends up more likely to win wars. Figure 2 corroborates finding that CINC is a good indicator as to which side would end up winning.

To further demonstrate this point, we used geopandas in order to map out net wars won by country. We will then compare this to urban population by country and CINC score by country in order to further illuminate the relationship between the three.

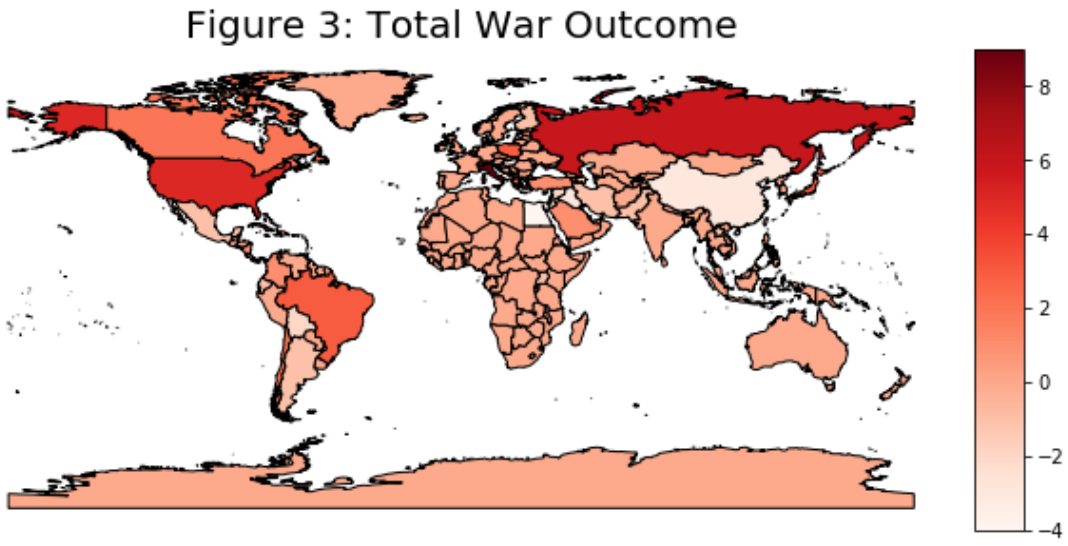

Figure 3: Net wars won by country

Figure 3 shows the net wars won by country. As expected large western countries like USA, Russia, Canada, and Germany were net war winners over the last 200 years.

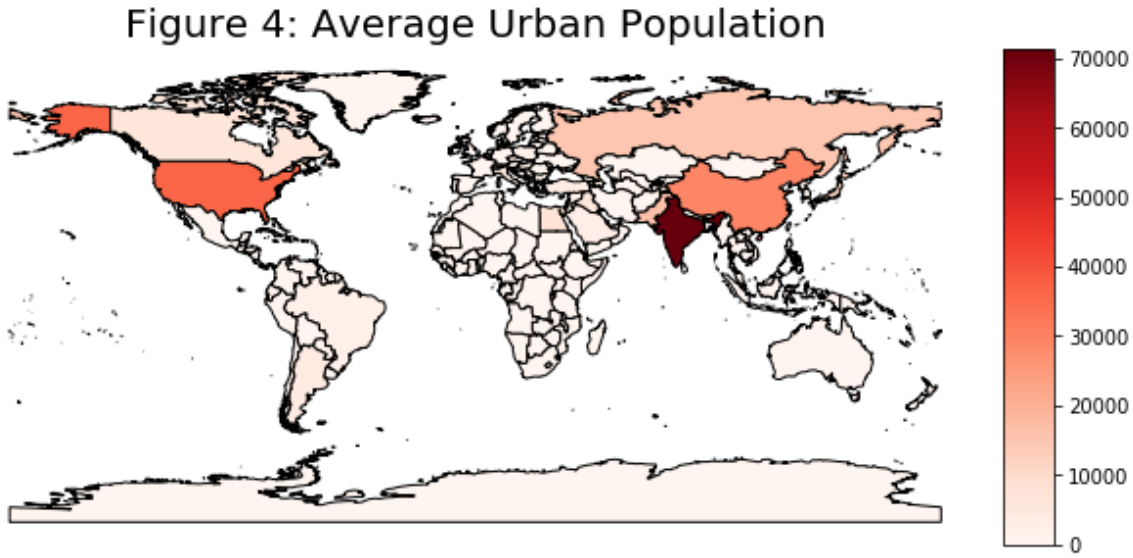

Figure 4: Average Urban Population by country

Figure 4 shows the average urban population by country. We averaged the urban population for each country using urban population at the start of each war. The largest net war winners also had significant urban populations. This could be because they are more likely to both win and start wars in order to take advantage of their national power.

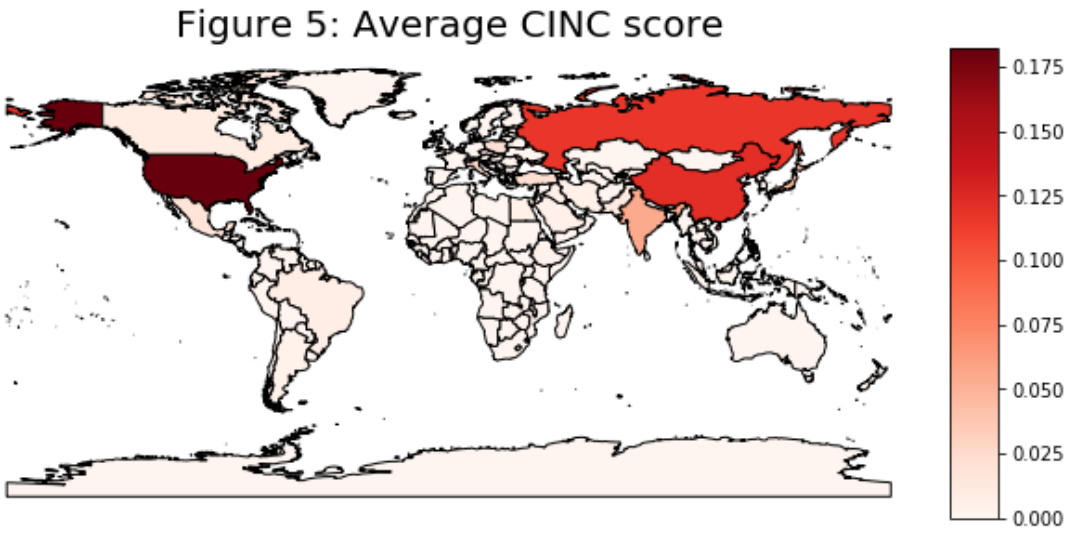

Figure 5:Average CINC score by country

Figure 5 shows the average CINC score by country. We averaged the CINC score for each country using the CINC score at the start of each war. Much like the map for urban population, the largest net war winners also had large CINC scores. This again suggests that strong national power will lead to both military aggression and high armed force capabilities.

Conclusions and directions for future research

Overall, we found that having strong economic and military capabilities positively influences the probability of winning an inter-state war. This project had two main statistically significant findings. First, a .1 increase in Composite Index of National Capability (CINC) score leads to a 11.6% increase in victory chance. Second, a one million person increase in urban population leads to 1.5% increase in the likelihood of winning a war. These two conclusions were corroborated graphically by a bevy of histograms and choropleths.

If I had more time and more space, I would have looked more deeply at two things. First, the original inter-state war dataset includes wars that were drawn or transformed into other wars. This project for simplicity sake decided to remove these wars from statistical and graphical analysis. This could be a key area for future exploration. Second, another interesting question could have been the reverse of the one studied in the project. How much does war increase or decrease national power? Answering this question could have major implications on the military industrial complex at large.