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The People's Republic of China (PRC) has an economy that is import dependent on key resources such as petroleum and food. An interruption of these imports would cause severe stress on the PRC economy and the citizens of the PRC. The PRC would expect limitations placed on access to these resources in an environment of escalated tensions and will take diverging actions to protect these vulnerabilities as a strategic competitor and in preparation to armed conflict .

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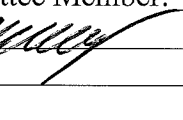
Approved: 
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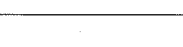
Approved: 
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Executive Summary

Title: Predictive Economic Indicators for the People's Republic of China

Author: Lieutenant Commander Kevin Henderson, United States Navy

Thesis: The People's Republic of China (PRC) has an economy that is import dependent on key resources such as petroleum and food. An interruption of these imports would cause severe stress on the PRC economy and the citizens of the PRC. The PRC would expect limitations placed on access to these resources in an environment of escalated tensions and will take actions to protect these vulnerabilities in preparation to armed conflict.

Discussion:

The economic reforms the People's Republic of China (PRC) instituted starting around 1978 caused the PRC to enter the world economy. The PRC is integrated into the world economy in that it depends on imports and exports to maintain its economy, but the PRC economy is also insulated from world trade by using State Operated Enterprises (SOE). The trade practices of the PRC and the intricacies of managing its economy are not going to be explored due to the scope of this paper; however, the depth that the PRC depends on resource imports will be explored. The resources explored are energy, petroleum, coal, capital, food, and water resource. A strategic analysis will be conducted to determine how much access the PRC has to the resource internally, how much the PRC needs to import that resource, and the consequences of a shock to the supply for each of these resources on the PRC economy. There are studies that have done quantitative analysis on the PRC dependence on some of these resources. These studies are detailed in the bibliography.

There are two courses that the PRC will most likely follow. The first is expanding its competition with the United States (US). The second is preparing to weather potential embargoes, sanctions, blockades, and/or armed conflict with a world power capable of affecting their economy.

Additional Research:

Additional research can be conducted in this area using quantitative analysis methods using a more expansive list of the resources that the PRC consumes to determine other resources that have strategic significance to the PRC. There are some data shortfalls that could merit additional study.

Conclusion: There are several ways that the PRC could experience a trade shock, but the most arduous and longest shock would be caused by a protracted war with a power capable of disrupting the PRC economy. The PRC economy is extremely dependent on petroleum imports that it uses throughout its economy, so it relies on coal for most of its energy because it has ample coal reserves within its borders. An interruption of 5-10% of its petroleum imports would be equivalent to the oil shock in the US in 1973. A sharp increase in its strategic oil reserves would be a leading indicator that the PRC is expecting a trade interruption.

The PRC has hundreds of millions of people living in areas of water scarcity. These areas are also where most of its food is produced. The size of the PRC population requires the use of this land, so the PRC moves large amounts of water using the South North Water Transfer Program (SNWTP). A severing of this water transportation system would quickly cause shortages in the northern provinces. The PRC will add security along this water way if there is an expectation that it would be targeted.

DISCLAIMER

THE OPINIONS AND CONCLUSIONS EXPRESSED HEREIN ARE THOSE OF THE INDIVIDUAL STUDENT AUTHOR AND DO NOT NECESSARILY REPRESENT THE VIEWS OF EITHER THE MARINE CORPS COMMAND AND STAFF COLLEGE OR ANY OTHER GOVERNMENTAL AGENCY. REFERENCES TO THIS STUDY SHOULD INCLUDE THE FOREGOING STATEMENT.

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Preface

This work discusses the People's Republic of China's (PRC) economic and military reforms over the past few decades. It also explores their economic vulnerabilities of key resource that it must import to maintain its population and economy. These vulnerabilities are assumed to be known to the Chinese Communist Party (CCP), so this work attempts to predict actions by the CCP to protect those weaknesses in both a strategic competition and an armed conflict. There could be other resource vulnerabilities, but this analysis focuses on energy, oil, coal, capital, water and food. The effect of the recent tariffs on trade were ignored because they are ongoing, and the effects are not known.

I would like to thank the staff at Marine Corps University and the Gray Research Center for their assistance building the background to this work. Dr. Michael Baskin and Dr. Clare Metelits provided valuable material for this work. Ms. Christi Bayha helped me locate references amongst the vast amount of references accessible to the Gray Research Center. Dr. Christopher Yung provided excellent mentorship and has a great understanding of the PRC. He was a great sounding board to help narrow this topic into a coherent work and kept it from meandering down one of the many tangents that I found in my research.

One of the largest difficulties in this research was finding accurate data. There was more than one time I found conflicting data. In these cases, I favored the data from international organizations over PRC self-reported data, but some of that data is based on PRC self-reporting, which seems to under sell problems and over sell successes. This is human nature, but in an authoritarian government there is no requirement for transparency or accuracy. I feel the area with the worst misreporting regarded water pollution, but the data is accurate for this work.

Brief History of Economic Policies in the PRC (1978-2018)

Mao Zedong founded the People's Republic of China (PRC) as a one-party state controlled by the Chinese Communist Party (CCP). The PRC started as a communist government following the Soviet model using a centralized economy. Mao Zedong's death in 1976 started a power and policy shift within the CCP.[1] Most academic works discuss the PRC economic change starting in 1978 when the CCP was stable enough to begin economic policy changes. Part of this reason is the economic isolation of the PRC that caused economic stagnation.[2] The agricultural sector of the 1970's economy produced the same amount of food as the 1930's economy produced.[3] Inefficiencies exist in government-controlled markets because of multiple factors with one of those being rewards for productivity.[4]

One of the first reforms was in the agricultural sector where households were able to keep any crops that they grew beyond the government quota.[5] This experiment in capitalist type rewards for productivity improved productivity in the agriculture sector with the benefit of improved support for the government. Albeit the agricultural sector retained most aspects of a planned economy, but the addition of this small rewards system paid huge dividends to the CCP. The CCP expanded the capitalist reward system to other State Owned Enterprises (SOEs) where workers could be convinced to improve productivity with output-based rewards. To prevent this reward system from flooding the market and causing a large oversupply the CCP expanded this reward system into a dual price system that allowed market forces to dictate the value of the additional production.[6]

The dual price system allowed the CCP to begin to adjust the planned sector's size to expand the free market sector to slowly take over the entire market. This allowed for the shift to be gradual enough to allow people to adjust and removed instability in the lives of the citizens of

the PRC.[7] This shift to a free market economy system to set prices for goods made labor more valuable. While the dual system expanded markets individually the CCP did not consider opportunity costs. The CCP was interested in communities being self-sufficient, so each region had to provide a certain amount of subsistent farming regardless of its location.[8] This means that the area best suited for growing a certain type of crop had to grow a certain amount of a staple crop first.[9] This move prevented areas from exploiting their strengths and greatly dropped the production of crops that were not considered staples. This campaign eventually was rolled back but shows that not every step by the CCP was towards a free market model.

The expansion of markets allowed for the CCP to open parts of its economy to foreign markets, so it could trade its excess goods.[10] One of the things that the PRC needed from the global markets was to expand its intellectual base because of its "war" on intellectuals during the Great Proletarian Cultural Revolution.[11] Affluent PRC citizens sent their children to overseas universities, where they interacted with entrepreneurs, engineers and other professionals. to gain knowledge on global standards in areas like manufacturing.[12] Foreign entrepreneurs were able to invest in the PRC economy to open firms to capitalize on its reserve market strength.[13]

This slow exposure of the PRC economy to the global system of free markets began the process of globalizing the economy, which laid the foundation for the PRCs rapid growth in Gross Domestic Product (GDP) that started in the 1990's because of the expansion of the industrial base, access to foreign markets and inexpensive labor.[14] One sector that has not been opened up is the PRCs petroleum industry, which largely consists of five State Owned Enterprises (SOE): (China National Offshore Oil Corporation, China National Petroleum Corporation, China National Refinery Corp, and Sinopec.[15] These government run oil companies control the drilling, importing, refining and distribution of all petroleum products in

the country. It is not uncommon for a state with a large surplus of crude oil to use SOE to manage it, but it is uncommon to use SOE to manage an import-dependent petroleum economy. The most likely reason for the CCP to regulate this industry is because of its strategic interest in petroleum.

The growth in the Chinese economy has caused a large generation of wealth that is concentrated on its eastern half where most of its population is located.[16] Based on PRC census data over 90% of its population lives east of the "Heihe-Tongchang" line that splits China roughly in half between east and west.[17] Most of the PRC manufacturing plants have been built near population centers. The *hukou* system encourages citizens to not move by preventing them from receiving government services outside of their designated communities.[18] These limitations were not enough to prevent the exodus of hundreds of millions of workers to sell their labor at higher rates in the PRC cities.[19] The reason laborers were able to relocate was because the expansion of these free markets allowed them to pay for goods and services instead of relying on their government rations.[20] This has exacerbated the skewing of the population centers because it has caused workers to migrate away from their homes in rural areas to work in the cities. This work is transitory in nature, and the workers can only afford to accept squalid living conditions in areas that are effectively shanty towns.[21] Their families stay in the rural areas where they can receive schooling, medical care, etc. while the migrant worker is saving as much cash as possible. PRC officials have estimated that there are approximately 287 million migrant workers in the PRC.[22] This makes up a significant amount of the PRC work force. The fact can be supported because migrant workers tend to return home during the Chinese New Year festivities. The huge masses of people traveling stresses the public transportation system as shown in the documentary "Last Train Home".[23] This large population of transitory workers almost by

definition has low incomes and poor living conditions and is possibly why the CCP is worried about internal security.[24] A revolt by this large of a population would be an almost unstoppable force.

The IMF 2018 report on the PRC indicates the growth in the PRC economy has slackened, is export dependent, and has a growing credit sector.[25] These exports are generally manufactured goods that are mainly produced in the PRC because of inexpensive labor. The GDP of the PRC was 150 Billion USD in 1978, broke one trillion USD in 1998, and was 12.2 Trillion USD in 2017.[26] The International Monetary Fund (IMF) indicated "China should urgently address macroeconomic data gaps to further improve data credibility and policy making."[27] This statement indicated that the PRC does not have a fully matured economy and that some aspects of the presented economic data could be falsified by using aspects of the planned economy to marginalize the presented data's accuracy.

The PRCs Road to war

Before exploring the PRC economy to locate indicators that the CCP is expecting armed conflict, the likelihood and potential paths to war must be explored. China has a very long dynastic history. At points in its history, China was atop the social order amongst its neighbors and was able to indirectly control its neighbors under a tributary system.[28] Until European powers effectively invaded and subjugated the region carving China into spheres of influence and drawing the wealth of the nation back to Europe. This influence slowly waned and was replaced for a short time by the Japanese during World War II. The Chinese refer to these periods of subjugation as the Century of Humiliation or Shame.[29] The Chinese resisted during this period through multiple conflicts, but the colonial powers were vastly superior to the Qing forces allowing the Europeans to dictate terms.[30] These events have made the PRC wary of

western culture and have made it follow a pragmatic mindset when making national and international decisions.

The PRC has not used direct invasion in the past few decades, but it has used other methods to expand its influence. The PRC is following the Sun Tzu maxim of "The skillful leader subdues the enemy's troops without any fighting."[31] A recent example is the PRC building up of shoals and reefs into military outposts in the South China Sea. This is a gain that normally requires conflict to achieve, but it did not reach the threshold of active war with its neighbors. Thus, the PRC has seemingly won a battle without fighting a war.

The CCP foreign policies could cause it to enter a war with one of its neighbors or the United States. Predicting the exact reason and characteristics of a future conflict is not possible, but the PRC could find itself in a war because of one of these reasons:

- A Thucydides trap where the rising power (PRC) and the current power (US) enter a security dilemma.[32]
- A claims dispute with Japan over islands that border the East China Sea leads to a military clash.[33]
- A claims dispute with Philippines and/or Vietnam in the South China Sea leads to a military clash.
- The PRC military expansion in the India Ocean along India's periphery places India into a security dilemma leading to a military clash.[34]
- The PRC annexing parts of Russia where there are large populations of Chinese workers (e.g. the Jewish Autonomous Oblast). This would be a similar scenario as Russia's actions in Crimea.[35&36]

The PRC has resource vulnerabilities that an adversary would and most likely will exploit.[37] The PRC relies heavily on imports of petroleum and other goods that it receives from other countries via sea shipping lines.[38] Any competitor nation will likely seek to threaten the PRC sea lines of communication if they find themselves involved in an armed conflict with the PRC.

Oil, Coal and Energy

Energy production is directly linked to the successful growth and maintenance of any modern economy. In a modern economy, energy is used to heat and cool homes and businesses, transport goods and people, operate farm equipment, power communication networks, and pump water and sewage. Petroleum and coal are the primary non-renewable power sources in the PRC.[39] As of 2017, the PRC imports 9 million barrels of petroleum a day with an approximately linear increase in consumption of about 0.5 million barrels a day every year based on the past decade.[40] In 2015, the PRC imported 63% of the petroleum it consumes making the PRC economy vulnerable to oil price and oil supply fluctuations.[41] To put this in perspective, the 1973 oil shock caused by OPEC quadrupling the price of its oil exports caused a momentary fluctuation in the world economy. This was a price shock and not a supply shock that causes prices to increase. The crude oil production in 1972 and 1976 were 53.5 and 60.4 million barrels a day respectively.[42] The production is linear for the 1970's with the exception of this oil shock with the actual dip in production occurring in 1975 by about four million barrels lower than the rest of the straight line data predicts.[43] The delay in the production decrease is the system reacting to the reduced demand caused by the price hike in 1973. This dip of four million barrels of crude oil in the world stimulated a 7 percent drop in production of crude oil in the world. Percentage wise the PRC imports nine times this amount of petroleum. The 1973 oil crisis caused a short recession in the United States until the economy recovered about two years later.[44]

Specifically, GDP growth in the US was 5.6% in 1973, and shifted to a negative GDP growth of 0.5% for 1974 and 0.2% GDP for 1975 before returning to 5.3% GDP growth in 1976.[45] Additionally, unemployment in the United States rose from 4.9% to 8.1% between 1973 to 1975.[46] These figures from the 1973 oil crisis in the United States could be influenced by other factors outside of the cost and supply of petroleum and the world economy has changed since the 1970's, but it can be used to estimate effects to the PRC economy assuming no mitigating actions are taken.

Any interruption in PRC petroleum imports or price spikes would cause a need for fuel rationing and would contract the PRC economy. Using the 1973 oil crisis as a template, applying a 7 percent drop in oil would cause the PRC GDP growth to drop by about 6 percent and increase unemployment by 3 percent or roughly three million migrant workers. Without protective measures to mitigate the economic damage, for every percent of oil removed from the PRC economy results in six seventh of a percent negative in GDP growth and half a percent increase in unemployment. A full severance of petroleum import would cause a 54 percent drop in GDP growth and a 27 percent increase in unemployment. The real concern for the PRC would be the large number of unemployed migrant workers that operate in the mostly free market sectors of the PRC economy that would need to be shielded from an oil shock.

If the petroleum supply lines to the PRC were interrupted, then the CCP would have an instant oil deficit and will have to tap its strategic reserve of 457 million barrels, which is about 50 days of its 2017 petroleum imports.[47] The PRC would be able to leverage its SOE petroleum sector to surge its domestic petroleum extraction from its proven reserves and institute fuel rationing to make its strategic reserve last longer. There are many ways that the PRC could have a supply interruption. There could be a global oil crisis, but the most likely that would only affect

the PRC are embargoes or sanctions from petroleum exporters or blockades from a nation that could interrupt shipping going to and from Chinese ports. Un mitigated petroleum shortages would stall or retract the PRC economy, cause unemployment and lead to a huge number of dissatisfied citizens especially amongst the migrant workers. Economic elites with larger disposable incomes would be the only ones with access to energy and would expose the growing wealth distribution problems that exist in the PRC.[48] The disenfranchised would see a drop in their standard of living as energy costs rise above their budget. This lack of energy would cause significant problems that could shutdown whole sections of cities.

This oil dependency will cause a need for changes in the PRC economy and energy sources. The most obtainable solution based on technologies available throughout the world is to electrify the transportation systems, but the PRC electric grid is heavily dependent on coal.[49] In 2017, the PRC received 60.4% of its energy from coal with 18.8% from petroleum, 7.0% from natural gas, and 13.8 from other sources.[50] The PRC has been shifting away from coal, but in a crisis the coal dependency would increase because of the ease of access to coal within the PRC. Coal as an energy source has a cost to society based on its air pollution especially if simply burned without filtering the exhaust gases. The PRC does not seem to meet the same air quality standards for its coal fired power plants and is most likely to release its exhaust gases without any kind of purification processes.[51]

The PRC used coal to produce 65% of its energy needs in 2015.[52] The PRC has continued to consume coal at a steadily increasing rate.[53] The PRC has large coal deposits, and only imports a few hundred million tons of coal a year compared to the six billion tons it consumes a year.[54] The main problem with coal is the air pollution.[55] Air pollution also gets proportionally worse with population density.[56] The primary weakness with coal is the air

pollution it produces and the lowered living conditions that the nascent population must endure. This burden takes the form of respiratory health. The World Health Organization (WHO) sets annual mean limits on certain types of air pollutants. (see table 1)[57] Some of the pollutants are easier to track than others. Coarse particulate matter (PM_{10}) is defined as air borne material that is less than 10 microns in size. PM_{10} has a significant amount of ground sampling stations that can be monitored in near real time.[58] Studies indicate that the PRC citizens breathe between double and five times the annual limit set by the WHO.[59] Placing an economic impact takes into account more factors than focusing on one respiratory issue like lung cancer. In 2017, the PRC lost 106.5 billion dollars from its GDP from air pollution related issues while in comparison the United States lost 9.5 billion dollars.[60]

The PRC is exploring clean coal solutions and placing regulations on coal to reduce air pollution.[61] The ease of access to coal compared to other energy sources makes coal the preferred source of energy for the PRC, because the PRC has all that it needs within its borders. Thus, coal provides energy security while being fairly immune to world events.

The PRC does not have a significant amount of any other energy. Other energy sources available would be solar, wind, natural gas, and plant-based fuels. Solar and wind are not reliable enough to maintain a constant supply, so there is a need for energy storage that is expensive at the scale of the power grid. These energy sources can be used as distributed power generation, but the most viable energy storage is at the residential level scale.[62] This divorcing from the power grid will be difficult for the PRC because of how dense its population is along the eastern half of the country. Additionally, the CCP controls the energy sector and will probably resist changes that cause shifts of citizen employment. Natural gas is a cleaner source of energy when compared to coal, but it is also an imported product for the PRC, so just as

vulnerable to the world market as petroleum. Finally plant based fuels (e.g. ethanol) are not viable for the PRC because its arable land is primarily being employed to produce food for its population.[63] This would cause the need to import more food if crops were grown specifically as a substitute fuel source. In 2016, surplus corn was used to produce substitute fuel, but it seems that it is a miscalculation of demand which can be explained by animal protein imports being larger than expected.[64] Energy is critical to the PRCs water distribution, since a one day electricity disruption would cause 57 billion m^3 of water to not be moved by the water pumps in the SNWTP .[65]

The PRC has resource vulnerabilities that an adversary would and most likely will exploit.[66] The PRC is making moves to lower its petroleum import vulnerability by growing its fleet of purely electric vehicles where they would ultimately be powered by coal and renewable energy. A growing economy requires a stable financial sector where entrepreneurs can access capital to exploit inefficiencies in the market to add value and expand markets. Any competitor nation will likely attack the PRC financial sector the same way if they find themselves involved in an armed conflict with the PRC.

Capital

Traditional banks use the money that people deposit to provide loans and make a profit on the loan's interest. There are risks to providing loans. Depositors may want to withdraw more of their capital than the bank has available. Bank runs have become uncommon in the US since the creation of FDIC in 1933.[67] There are also federal regulations that dictate the percentage of currency a bank must have available to cover withdrawals. A loan could go into default resulting in the bank losing the rest of the revenue from the loan. Collateral is used to protect the investment by guaranteeing repayment from the selling of the collateral. The

currency reserve is one of the reasons banks have a desire to sell loans which makes a debt market for buying and selling of debt.

The PRC has similar institutions and policies in place to maintain a functional economy. Its cash reserve ratio for large banks was raised to 21.5% in 2011, but has been incrementally dropped to 13.5% in 2019.[68] The 21.5% reserve ratio was an attempt to gain control of some off balance sheet lending.[69] The off balance sheet, known as shadow banking or other financial institution (OFI) lending, was caused by the strict regulations on large banks.[70] These OFIs were small enough to have less strict reserve requirements and avoided other regulations on borrower risk. These OFIs effectively served as intermediaries between the bank and the lender for risky borrowers.

In 2014, the PRC passed the United States in total corporate sector debt.[71] In 2017, the PRC had a total domestic credit of 27.3 trillion USD and a GDP of 12 trillion USD, while the United States has a total domestic credit of 21.6 trillion USD and a GDP of 19.5 trillion USD.[72i] This debt sector is being affected by the OFI lending. Because these OFIs do not operate on the balance sheet it is difficult to determine the amount of the corporate debt sector that is caused by OFIs, but S&P estimates that OFIs represent up to one-third of the corporate sector's debt.[73] The problem with OFIs is that they short circuit the PRC regulations on lending, and that they indirectly place risky loans on the SOE banks' balance sheets.

There is one large problem with using the PRC GDP. It is set by the PRC and not market forces.[74] This makes the data provided by the PRC questionable. Using the CIA factbook value of purchasing power parity (PPP) instead of official exchange rate places the PRC GDP at 23.2

[i] The sources switched from debt to credit. In this case they are describing the same thing from different points of view. In the case of a loan, the bank is a creditor and the customer is a debtor. These figures are either adding all of the debts or credits, either way, if the data is collected accurately total debt will equal total credit.

trillion USD thus making the ratio of debt to income to be less severe unless the domestic credit value also inflates with GDP.[75] The entire PRC monetary system is based on fiat and not market forces. To avoid the 2008 financial crisis, the CCP issued about 5.4 trillion USD of stimulus to prevent the economic down turn, but the net result was a tremendous amount of loans creating real estate and credit bubbles.[76]

The CCP expects the local governments to provide the majority of social services but limits their tax revenue.[77] The CCP was not interested in the burdens of the local governments, but the CCP did want to generate employment and did so by doling out loans.[78] The local governments are not always able to get a loan directly from one of the SOE banks, but they can always resort to the OFIs. One of the ways local governments can secure a loan is to force their communities to urbanize and then use the now empty land as collateral.[79] This has the benefit of increasing their community's urbanization ratio and creating some jobs, which are two of the ways these officials are graded as a leader by the CCP.[80] The easy access to loans caused local governments to borrow beyond their cash flows to build infrastructure that the community did not necessarily need.[81] These "ghost cities" were partially funded by OFI, which is why the CCP increased the cash reserve ratio to 21.5% in 2011.[82] This risky debt is heavily focused in sectors that received the most of the spending stimulus: mining, coal, steel and transportation.[83] These sectors are dominated by State Owned Enterprises (SOE), so CCP is heavily exposed to this OFI debt.[84] The bulk of the OFI debt being on the SOE balance sheet shows that the large financial inject and the existence of loans is a hidden form of deficit spending.

The PRC has allowed a few firms to fail which has helped to reduce some of the risky off-balance sheet investing. This has forced some firms to tighten their belts and not rely on the CCP to prop them up when their debt burden grows unwieldy. The PRC monetary system and

financial markets are controlled by the SOE banks, and from them all loans originate. The system of OFI seems to be a way to fill voids left by the government's control of the economy. The CCP tolerates the OFI and tries to regulate instead of destroying them because they are vital to sectors of the economy that cannot receive loans and are responsible for maintaining the PRC GDP growth.

The CCP cares about maintaining stability and control of its population, not the size of its actual GDP. The real number that the CCP cares about is unemployment rate. There is an example from 2009 where the PLA absorbed 130,000 unemployed college graduates which was sixty times more than the 2008 figure.[85] This follows the idiom "the devil finds work for idle hand" where unemployed labor will be more likely to be criminals.[86] The PRC economy is based on the debt issued by the SOE banks and not the net value of its trade of goods and services within its borders, so the PRC financial system is a planned and closed system where GDP is set by the planned system. This makes it inefficient where the OFIs make up some of the inefficiencies. The only real natural vulnerability is the bad OFI loans that end up defaulting. The CCP maintains about six trillion USD in savings that it can use to absorb the losses from defaulted loans.[87] The financial system is increasingly reliant on electronic commerce and payments. This digitalizing of currency makes the PRC financial system vulnerable to digital attack. In 2012, the PRC had the most vulnerability computers in the world with 54.1% of all computers containing malware with some of the malware being pre-installed on new computers.[88] The PRC has been systematically improving cyber security to include developing a computer operating system to replace windows on computers and android on phones.[89]

The PRC has resource vulnerabilities that an adversary would and most likely will exploit.[90] The CCP owns the majority of the PRC "private" debt, so it is fairly well insulated from market

instability. Perhaps the amount of food and water to sustain its large population is a vulnerability that an enemy could exploit, and the PRC would take extra measures to protect in a war time environment.

Food and Water

The PRC has a large population that it must feed. While it is able to grow enough food to support its population using grain and other food staples, the average Chinese is demanding a more protein rich diet as shown by the 19,000% increase in beef imports over the past decade.[91] Raising livestock to support these diets with additional animal protein will require more land than a more vegetarian focused diet. This land is not necessarily land that can be used for growing crops. Based on data from the United States, it takes 0.13 hectare (ha) per person per year of cultivated crop land to sustain a purely vegetarian diet were a hectare is 10,000 square meters.[92] A healthy western diet requires 0.15 ha per person per year of cultivated crop land, 0.17 ha per person per year of perennial cropland and 0.71 ha per person per year of grazing land.[93] While the total cultivated crop land barely increases with the diet change the added need for perennial cropland and grazing land is not supported by the PRC. The 2002 Grassland law was revised to allow local government to regulate grassland usage in the PRC pastoral lands to allow for the expansion of animal husbandry, but not at the expense of land exhaustion and desertification.[94] The existence of this law indicates that there is no room for expansion of animal husbandry with in the PRC, and that land exhaustion from overgrazing is already occurring.[95]

On the surface, it appears that the CCP is pouring large amounts of capital into the One Belt One Road (OBOR) program to lower the prices of food in Chinese supermarkets, but in reality a large portion of the food produced under this program stays in the local markets.[96]

Perhaps this is to build up those areas to increase the world's ability to produce food, since the PRC will continue to need to import food to maintain the diverse diets that its citizens want to eat while these developing nations are also increasing their food demands. The amount of land that each worker in the PRC works when compared to other countries shows a large disparity.[97] The average PRC farm laborer maintains half a hectare of land while the United States and Australia maintains 73 and 156 hectares respectively. This data indicates that the PRC has not industrialized the agriculture sector. This suggests that the PRC agriculture policies and farming practices are a job program to keep people on the farm instead of becoming a migrant worker. Industrializing the PRC agricultural sector would increase the amount of energy consumed by the PRC and would cause more people to depart the rural areas. A modernized agriculture sector will be able to produce more food to lessen dependence on foreign food.[98]

The PRC uses water conservation programs to help address shortages in its water supply.[99] There is a vast network of water redistribution of 700,000 kilometers of water pipeline to distribute water around the country.[100] This is enough pipeline to stretch around the planet seventeen times. The PRC has one of the largest hydroelectric plants ever built called the Three Gorges dam. This dam was meant to solve a two-fold problem. The first was to maintain a steady flow of water throughout the year and the second was to provide electrical power. The dam has stumbled a few times in recent years to control water flow. A low amount of rain fall caused downstream low levels that caused ships to run aground.[101] This is not a fair assessment of the dams though, because if the dam ran out of water the river would have ran low a lot earlier. However, when there is a lot of rainfall the dam's basin fills and changes the normal landscape by making hills into islands while the extra weight causes earthquakes.[102]

The UN defines three levels of water scarcity. Water stress equates to less than 1,700 m3 per person per year, water scarcity is less than 1,000 m3, and absolute scarcity is less than 500m3 per person per year.[103] Ten northern provinces suffer from absolute water scarcity and four suffer from water scarcity.[104] Overall, in the PRC there are around half a billion people living with some level of water scarcity.[105] The problem has reached the point where Beijing enacted a law to limit its population to 23 million people and Shanghai's law placed the limit at 25 million people.[106]

The PRC has around 80% of its water supply in the south half and 64% of the arable land in the north half.[107] To be able to grow food and support the northern populations the PRC built a large canal to transport water to the northern parts of the country. This canal is part of the South-North Water Transfer Project (SNWTP). The rest of the project is best represented by the CIA factbook reporting of 710,000 KM water pipelines.[108]

Water is vital to the PRC economy. Nationally it uses 62% in its agriculture sector and 22% in its power/industry sectors.[109] When this consumption is divided up into provinces, 38% of agriculture, 50% of power generation and 46% of industrial water consumption is from these water scarce provinces.[110] The CCP indicates that 50% of water used in agriculture is wasted.[111] This is because poor irrigation techniques and the lack of modernizing the agricultural sector.[112] 21% of the PRCs water consumption comes from ground water.[113] This supplement to its water supply is unsustainable. Two indicators of lowering ground water levels is land subsidence of greater than 200mm over a year and the rate of desertification.[114] 46% of the North China Plain has fallen over 200mm since 1959, and the amount of desertification is trending up with almost 2500 km^2 of land turning into desert in 2015.[115] The land subsidence indicates the collapse of

the sub terrain aquafer which prevents its refilling and removes some of the natural filtration processes.

Decades of industrial modernization has caused a lot of pollution in the PRC. The PRC's water supply is contaminated to varying levels. The State Environment Protection Agency in 2014 that determined that 40% of all the water in the PRC river basins is not fit for human consumption.[116] The National Development and Reform Commission (NDRC) determined that just over 8% of all water in the PRC is contaminated and not be fit for humans.[117] The problem is these two percentages do not agree, since most water in the PRC comes from its rivers and ground water therefore 8% of all and 40% of river water does not match since other reports indicate that the groundwater is not fit for human consumption. Perhaps a better metric is the sale of bottled water. Sales in the PRC bottled water market was 47 billon USD in 2018 compared to the US at 28 billion USD.[118] Additionally, there is other data that indicates that those that don't drink bottled water boil their tap water before consumption after cooling or as hot tea.[119]

The PRC has large areas that are experiencing water scarcity. Exacerbating the problem is high levels of pollution in the ground and river waters. The SNWTP eases the hardship of citizens of the northern provinces, but also makes it vulnerable target in an armed conflict. A determined, and perhaps amoral, foe would target the pumping stations and stop the flow of water to reduce food production in the country and would cause an immediate humanitarian crisis for the PRC to manage. Another target would be the Three Gorges Dam, which would damage the PRCs electrical distribution system and would cause flooding followed by possible water shortages depending on the rainfall that year.

The PRC has resource vulnerabilities that an adversary would and most likely will exploit.[120] The PRC has wide spread water scarcity and pollution issues that are holding back its economic growth. Any competitor nation will likely take advantage of these resource vulnerabilities especially if they find themselves involved in an armed conflict with the PRC. The PRC has several areas where it can continue to grow, but it knows its growth will cause a shift in the current world order where it can take market share from the United States.

China Pragmatism – Increasing competitiveness and maintaining stability

The PRC strategy is to accomplish its objective short of war. Nonetheless the CCP leaderships expects that eventually the US to react to exert pressure on PRC economic activities. As a results the PRC will take actions to minimize the effects of a US reaction The PRC is highly dependent on its petroleum imports. The shifting from fossil fuel to electric vehicles is a solution to this dependence, but it is a long-term solution that will cause additional stress to the PRC electrical grid. In the short term, the PRC needs additional sources of petroleum as its demand continues to rise. The PRC will need to increase through put of its ports and its commercial shipping fleet. Additionally, a few pipelines from Russian oilfields will also help to meet its increased petroleum demands. The PRC has proven reserves, but it is either unable or unwilling to expand production. Another way to improve its petroleum supply would be to prospect within the PRC for areas that may have undiscovered or currently unusable petroleum deposits. For example, the South China Sea has an estimated 11 billion barrels and 190 trillion cubic feet of proven reserves, and experts estimate that there is almost the same amount of these resources that are undiscovered.[121] Newly found reserves may require innovative extraction technologies like hydraulic fracturing in the United States.

The PRC is not very diverse in its electrical production, but they are diversifying mainly along the lines of renewable energy sources. There are areas in the PRC that have the weather to support wind and solar farm, but these renewable technologies do not produce nearly as much energy as a conventional power plant, so they are mostly practical for residential uses. . The investment in developing these technologies will have the greatest benefit in the regions west of the "Heihe-Tongchang" line where the population is less dense and does not need a large power plant for their village and will remove the need for power distribution investments to get electricity to some of these remote areas.

The expansion of cleaner coal products and the shifting from coal energy in general will improve the quality of life for the citizens of the PRC who have significant air and water pollution in their lives. The PRC is expanding its reliance on nuclear power plants, but at a rate slower than planned.[122] The lack of natural gas deposits places that energy source in the same category as petroleum where a pipeline or the discovery of new deposits is required to make it a viable and sustainable energy source for the PRC.

The PRC needs to diversify its trade routes, since most of its imports come by sea through one of the choke points on the border of the South China Sea (SCS). All of these choke points are controlled by other nations. Bad relations or Bad weather could cause PRC shipping to have to add days to their trip to enter the SCS. PRC will continue to invest in its current sea-based trade routes by building additional shipping capacity in its ports and merchant marines. The CCP will continue to improve its own road and railroad systems to increase the through but for the flow of goods between eastern and western PRC. The PRC has pledged to spend one trillion USD on the famed "One Belt One Road" program to increase influence on the PRC

periphery, so it can eventually have access to land trade routes that avoid the use of the SCS or avoid its choke points.[123]

The CCP has added dozens of destroyers that are nearly as capable as the Type III Arleigh Burke class destroyers used by the United states.[124] The CCP also has increased its diesel-powered submarines fleet. These submarines are great for protecting the inner island chains but are vulnerable outside of those areas because of the need for fuel. The PLA(N) also has a few nuclear-powered submarines, but not enough to turn the tide in a blue water conflict if one uses Germany during World War I and World War II as a predictive model. Overall the PLA(N), can defend inside the first island chain with A2/AD system supplementing its surface and subsurface combatants.[ii] The PRC can threaten the second island chain with these forces, but they would be much more vulnerable to destruction, so it is not likely that the PRC can or even wants go outside the SCS. All of the preparations seem to suggest more of building a fortress to defend instead of developing expeditionary capabilities to conduct offensive operations. Indicating that the PLA and PLA(N) plans to stay in the range of their missile defensive belts and defend their homeland while making it expensive for an enemy to attack.

The CCP has tight control over its financial system using its central banks. This makes the PRC economy a debt-based economy with most loans originating at the central banks. There is a cascading loan system that gives access to capital for risky investments through second and third order loans though a group that is best described as other financial institutions (OFI). The equity based financial systems in the PRC economy are small compared to their economy and tend to have problems with insider trading and other corruption.[125] Both systems need further

[ii] The first Island chain refers to the islands that border the South China Sea and East China Sea, and the second island chain includes the Philippine and Celebs seas

regulation to remove the potential for corruption. The bad loans, insider trading, building unused infrastructure and other forces will erode the credibility of the PRC financial system if regulation and reform is not put in place. An adversary could use this bad debt as a weapon by causing the default on large number of OFI loans, and preventing the free flow of revenue by using counterfeit currency and manipulating the accounting data at these state owned enterprise banks.

While the PRC economy has "opened up" it is not a free market as shown by how the PRC sets it monetary values and GDP. The PRC also does not allow market forces to dictate its economy especially when it is protecting a SOE. This model has allowed the PRC to expand its economy, but at the cost of a massive national debt. Eventually, the debt will become too large for the government to continue to make the economy expand.

The PRC can grow enough food to support its population on staples like wheat and rice, but the growth of the PRC economy has raised the demand for animal proteins which require more land to raise than the PRC has available. The PRC has developed much of its arable land. There are also detractors to agricultural expansion in the form of pollution, out dated farming practices and poor irrigation. The PRC agriculture sector seems to be a source of employment for its citizens instead of a way to feed its people. There have been reforms in this sector that allow commercial forces to increase production, but not a move to modernize.

Water is scarce in northern PRC, so the short-term solution is to move water from the south. This is a band aid for a gunshot wound and is causing problems within the PRC economy. It takes energy to move the water. Part of the trip is uphill, and it needs to be filtered to remove sediment and pollutants. The PRC has resettled millions for this North South Water Transport Project (NSWTP). Cities have enacted laws to create and enforce a population limit on their cities. The PRC will need to take more extreme measures to take control of their water

problems. This could be why the CCP sends ethnic Hans to places within and outside of the PRC. It is easier to physically support them somewhere that is not Northern China.

Desalination technology is a solution for the CCP, but there will have to be some major innovations to be able to implement it at the scale needed for the PRC. Perhaps if it is only used for drinking water and no other use it will help some of these PRC megacities, since part of the water problem is water pollution. The problem is that the coastal sea water is heavily contaminated, and the ground water along the coastal regions has sea water intrusion.[126]

With the amount of pollution in the PRC it may be monumental task to clean up its pollution, but the PRC can adopt the US Environmental Protection Agency (EPA) model and its Superfund sites.[127] The "EPA's Superfund program is responsible for cleaning up some of the nation's most contaminated land…ensuring that people can live and work in healthy, vibrant places"[128] The Superfund program does not work if environmental pollution laws are not enacted and enforced. An EPA could stop companies from polluting, and the Superfund program would allow the PRC to clean up its waste water problems by isolating the worst offenders and stopping the problem from spreading while toxins are removed from the site. As April 2019, the US EPA superfund program manages 1810 sites using its National Priority List (NPL).[129] Using the NPL, there are 413 sites that have been cleaned up since 1982, and all of the active sites have been quarantined to minimize human exposure to harmful substances.[130] It would help to better the quality of life for their citizens, and prevent rivers from catching on fire.[131]

The PRC has resource vulnerabilities that an adversary would and most likely will exploit.[132] The PRC relies heavily on imports of petroleum and other goods that it receives from other countries via sea shipping lines.[133] Any competitor nation will likely deal with the PRC the same

way if they find themselves involved in an armed conflict with the PRC. The PRC will likely take more overt actions to shield its vulnerabilities if it is expecting to enter an armed conflict with one of its neighbors.

Indications that the PRC is preparing for conflict or expanded competition

The CCP knows that it has resource vulnerabilities. Prior to provoking an incident or taking a preemptive attack against an adversary it will want to shore up its own economic position.

One of the first steps to prepare for conflict would be to expand strategic petroleum reserves. A 30, 60 or 90 day supply is not sufficient to wage a war. Prior to World War II, Japan stockpiled a two year supply of petroleum and had to make decisions late in the war based on their fuel shortages.[134] Like Japan, the PRC does not have a large natural petroleum reserve to draw upon, so a two year supply may not be enough if petroleum imports are completely severed. Unlike the 1940's Japan, the PRC does have proven reserves it could access.[135] Rapid expansion of PRC strategic petroleum reserves coupled with expanded production capacity could be a prologue to PRC armed conflict. The claims in the South China Sea could see the CCP sending out Mobile Drilling Units into the region to search for and extract petroleum. International law does not recognize these claims, so this action would have to be on a small scale to stay below the threshold of war.

The petroleum dependence is unlikely to cause the PRC to enter a war except in the near term, since it is focusing electrifying its transportation system. This would shift from a petroleum consumption to electrical energy consumption. It has enough coal infrastructure and a large enough strategic supply of petroleum that it should be able to last for a few months before needing more petroleum. There are side effects to coals use, but the coal reserves in the PRC are

enough to make it energy independent especially when the PRC can reduce its petroleum dependence through electrifying its entire transportation system.

Most trade arrives in the PRC via commercial shipping. There are several different specialized ships that are used to transport crude oil, liquefied natural gas, etc. They all share one common feature in that they are large and can only enter the South China Sea by a few routes. Any military with the ability to interdict vessels heading towards these choke points will do so in a war against the PRC.[136] Small scale interdiction would cause effects to their population. The PRC A2/AD covers the SCS, which would move the interdiction of commercial shipping outside of the SCS unless the enemy is able to defeat the A2/AD system. This enemy would either destroy or divert the ships to other ports. This interdiction does not need to be military. It could be a pact between energy exporters to not sell to the CCP. This maritime vulnerability will cause the PLA(N) to escort these easily targeted commercial ships. PLA(N) escorts would have the effect of spreading the PLA(N) forces out and away from the missile umbrella of the South China Sea.

To prepare for conflict the PLA(N) would train on how to escort vessels in a contested sea. They would invest in the development of technology to detect and destroy submarines. The biggest indicator would be the expansion of production capability for vessels that would be used as escorts to replace their expected losses. This would not necessarily be the vessels, but the facilities to produce the vessels the PRC has been doing several of these actions which puts it in a security dilemma with the United States.

The PRC has enough food production capacity to feed its population, but their diets would lose a lot of animal protein. While this would cause some grievances within the population it would not be catastrophic to internal stability. To account for the expected

devastation to food production, the PRC would improve their food storage lengths by drying and canning food. In 1944, the devastation in Europe lead to the United States providing nearly all of the food for the continent, but there was still a shortage causing starvation. This indicates that a country that is nearing its agriculture capacity will be vulnerable to even a small disruption in their food production capability.

The already scarce water in northern PRC could be an issue even if the PRC's enemy does not directly target the NSWTP canals and pumping stations. Water scarcity is a difficult problem in a peace time environment, but in a war it could become severe. The PRC could resettle large portions of the northern population. It could divert more water by expanding the NSWTP, construct sports stadium sized water tanks or retention ponds, repurpose some commercial vessels to desalinize sea water in international water, or some combination of these.

The CCP tends to make decision based on improving internal stability, and as long as the PRC is stable it will continue to pursue regional hegemony. The goal of hegemony does not necessarily require conflict. The most likely resources that will drive the CCP strategic decisions and policy will be water and energy related.

Conclusion

The PRC has slowly shifted from a fully planned economy to an economy that has some aspects dictated by market forces. These market forces allowed the expansion of the PRC economy through the establishment of free markets and globalization. Market forces in the labor market allowed the expansion of the urban work force away from the rural areas, because of the *hukou* system and other factors keeping the workers families away from the cities.

The globalization of the PRC economy into the world economy has expanded some of its resource vulnerabilities. The two most vulnerable areas are petroleum and water. The PRC

imports 9 million barrels a day of petroleum to supplement its 13 million barrels a day of consumption. The PRC has stopgaps in place to try to reduce this vulnerability, but eventually they would erode. The PRC is developing land-based trade routes using pipelines to Russian oil fields, and they have more than 450 million barrels of petroleum in reserve. Regardless, the PRC requires petroleum to come through the straits of Malacca and other choke points into the SCS. In a conflict the PLA(N) will want to control these choke points and protect its trade from attack.

Water is scarce in the northern half of the PRC. There are indications that it is going to get worse before it gets better. There will need to be reforms to improve the agriculture sector to not waste water, and the use of the SNWTP to provide the CCP with more time to prevent a water crisis in northern PRC. The SNWTP is a huge vulnerability that a committed enemy would exploit in a protracted war to cause a humanitarian crisis for the PRCs areas that already have water scarcity issues. The problem with the PRC water distribution is that the majority of the arable land is located in water scarce areas and reducing the amount of water being sent via the SNWTP would affect the PRCs food and water supplies.

The PRC is in a strategic competition with the US with the goal of gaining hegemony over its near abroad. To do this the PRC has expanded its PLA(N), built shoals and reefs into military outposts and built an A2/AD system that cover the SCS. It has built up a reserve of petroleum to be able to survive a short time oil shortage. The PRC continues to grow staples to feed its population even though its population is eating increasing amounts of animal proteins.

The most likely indicator that the PRC is expecting a conflict is the expansion of its strategic petroleum reserve and establishing a strategic water reserve that would most likely need to be filled with imported water. The PRC would most likely do both very slowly but would have to build the infrastructure to store both liquid resources. Monitoring for a sudden increase

of petroleum imports and using tankers to bring water into its northern ports could indicate that the PRC is preparing for armed conflict.

Table 1: Summary of Safe Air Quality Limits

Air Pollutant	WHO annual mean limit[1]	WHO short term mean limit[1]
Fine Particulate Matter ($PM_{2.5}$)	10	25 (24-hour)
Course Particulate Matter (PM_{10})	20	50 (24-hour)
Nitrogen Dioxide	40	200 (8-hour)
Sulfur Dioxide	20	500 (10-minute)
Ozone (Smog)	N/A	100 (8-hour)

1. Units in μg/m3 annual mean

Source: "Ambient (outdoor) air quality and health," *World Health* Organization, May 2, 2018, https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health

Footnotes

[1] John King Fairbank, and Merle Goldman. *China : A New History*. 2nd enl. ed. (Cambridge, Mass: Belknap Press of Harvard University Press, 2006) 406-407.
[2] Loren Brandt and Thomas G. Rawski, *China's Great Economic Transformation*. (Leiden: Cambridge University Press, 2008), 6.
[3] Brant and Rawski, *China's Great Economic Transformation*, 5.
[4] Brant and Rawski, *China's Great Economic Transformation*, 9.
[5] Brant and Rawski, *China's Great Economic Transformation*, 9.
[6] Brant and Rawski, *China's Great Economic Transformation*, 10.
[7] Brant and Rawski, *China's Great Economic Transformation*, 10-11.
[8] Brant and Rawski, *China's Great Economic Transformation*, 11.
[9] Brant and Rawski, *China's Great Economic Transformation*, 11.
[10] Brant and Rawski, *China's Great Economic Transformation*, 12.
[11] Fairbank and Goldman. *China : A New History*. 402.
[12] Brant and Rawski, *China's Great Economic Transformation*, 12-13.
[13] Brant and Rawski, *China's Great Economic Transformation*, 13.
[14] Brant and Rawski, *China's Great Economic Transformation*, 13.
[15] https://www.investopedia.com/articles/markets/091515/5-biggest-chinese-oil-companies.asp
[16] Peter Wood," Population Density in China", Commentary on East Asian Security Issues & Foreign Policy, last updated May 16, 2017, https://www.p-wood.co/2017/05/16/population-density-in-china/.
[17] Peter Wood," Population Density in China", Commentary on East Asian Security Issues & Foreign Policy, last updated May 16, 2017, https://www.p-wood.co/2017/05/16/population-density-in-china/.
[18] "Special Topic Paper: China's Household Registration System: Sustained Reform Needed to Protect China's Rural Migrants," Congressional-Executive Commission on China, accessed Feb 12, 2019, https://www.cecc.gov/publications/issue-papers/cecc-special-topic-paper-chinas-household-registration-system-sustained.
[19] Brant and Rawski, *China's Great Economic Transformation*, 11.

[20] "Special Topic Paper: China's Household Registration System: Sustained Reform Needed to Protect China's Rural Migrants," Congressional-Executive Commission on China, accessed Feb 12, 2019, https://www.cecc.gov/publications/issue-papers/cecc-special-topic-paper-chinas-household-registration-system-sustained.
[21] Favin Xu, "The Structuration of Chinese Migrant Workers: Institutional Transitions, Life Experiences and Subjective Experiences" (Order No. 3707989, University of Kentucky, 2015), 56.
[22] "Migrant workers and their children," China Labour Bulletin, last modified May 2018, https://clb.org.hk/content/migrant-workers-and-their-children.
[23] "Last Train Home," Public Broadcasting Service, accessed Apr 2019, http://www.pbs.org/pov/lasttrainhome/
[24] "China's Military Strategy," the State Council, People Republic of China, Updated May 27, 2015, http://english.gov.cn/archive/white_paper/2015/05/27/content_281475115610833.htm.
[25] International Monetary Fund. Asia and Pacific Department. *The People's Republic of China, IMF Country Report no. 18/240* https://www.imf.org/~/media/Files/Publications/CR/2018/cr18240.ashx,, 6-12.
[26] *The World bank*, s.v. "china" accessed April 10, 2019, https://data.worldbank.org/country/china.
[27] International Monetary Fund. Asia and Pacific Department. *The People's Republic of China, IMF Country Report no. 18/240* https://www.imf.org/~/media/Files/Publications/CR/2018/cr18240.ashx, 33.
[28] Seunghyun Han, "China's Hegemony: Four Hundred Years of East Asian Domination by Ji-Young Lee (review)." *Sungkyun Journal of East Asian Studies*, Volume 17, Number 2 (October 2017): 264.
[29] Howard W. French, "China's Quest to End Its Century of Shame," New York Times, last modified June 13, 2017, https://www.nytimes.com/2017/07/13/opinion/chinas-quest-to-end-its-century-of-shame.html.
[30] *Encyclopedia Britannica Online*, s.v. "Opium-Wars," accessed April 10, 2019, https://www.britannica.com/topic/Opium-Wars.
[31] Sun Tzu, O*n the Art of War: The Oldest Military Treatise in the World.* Translated by Lionel Giles, M.A. (Allandale Online Publishing, Leicester: England 2000), https://sites.ualberta.ca/~enoch/Readings/The_Art_Of_War.pdf, 9.
[32] Farah Mohammed, "Can the U.S. and China Avoid the Thucydides Trap?," JSTOR, last modified November 5, 2018, https://daily.jstor.org/can-the-u-s-and-china-avoid-the-thucydides-trap/.
[33] "How uninhabited islands soured China-Japan ties," British Broadcasting Corporation, last modified November 10, 2014, https://www.bbc.com/news/world-asia-pacific-11341139.
[34] Maninder Dabas, "Here Is All You Should Know About 'String Of Pearls', China's Policy To Encircle India", India Times, https://www.indiatimes.com/news/india/here-is-all-you-should-know-about-string-of-pearls-china-s-policy-to-encircle-india-324315.html.
[35] Paul J. Bolt, "Sino-Russian Relations in a Changing World Order." *Strategic Studies Quarterly* 8 (4) (Winter 2014): 54
[36] McDougal, Trevor. "A New Imperialism? Evaluating Russia's Acquisition of Crimea in the Context of National and International Law." *Brigham Young University Law Review*, (2015): 1847-1850.

[37] Michael D. Swaine and Ashley J. Tellis, *Interpreting China's Grand Strategy: Past, Present, and Future* (Santa Monica, CA: RAND Corporation, 2000), x-xiii.
[38] Micheal Meidan, "China's Burgeoning Demand and its Quest for Resources," in *New Realities: Energy Security in the 2010s and Implications for the U.S. Military*, edited by John Deni (Carlisle, Pennslyvania: U.S. Army War College, Strategic Studies Institute, 2014) 185-204.
[39] *China Dash Board*. IHS Markit: Jane's Online, https://janes-ihs-com.lomc.idm.oclc.org/dashboard/country/China.
[40] BP Statistical Review of World Energy, (67th edition), June 2018, https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html.
[41] Qingsong Wang, et al., "An Early Warning System for Oil Security in China" *MDPI Sustainability*, 10, 283 (2018): 5-6.
[42] "Energy and the environment," *British Petroleum*, accessed April 30, 2019, https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy/primary-energy/energy-and-the-environment.html.
[43] "Energy and the environment," *British Petroleum*, accessed April 30, 2019, https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy/primary-energy/energy-and-the-environment.html.
[44] Chang-Ruey Ay, "Labor market institutions and productivity growth: A six-country comparison." (Doctorate thesis, University of Illinois, 1994) 129.
[45] *The World bank*, s.v. "United States" & "GDP growth" accessed April 10, 2019, https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?end=1977&locations=US&start=1972&view=chart
[46] *The World bank*, s.v. ""United States" & "Unemployment, total (% of total labor force) (national estimate)" accessed April 10, 2019, https://data.worldbank.org/indicator/SL.UEM.TOTL.NE.ZS?end=1982&locations=US&start=1970.
[47] "Strategic Stockpiling to Support China's Crude Imports" OilVoice, last modified September, 10, 2018, https://oilvoice.com/Opinion/22018/Strategic-Stockpiling-to-Support-Chinas-Crude-Imports.
[48] Yeoh, Emile Kok-Kheng and Wang Fan. "Housing in China: State Governance, Market and Public Perception." *Contemporary Chinese Political Economy and Strategic Relations*, 3 (2017): 447.
[49] Wenji Zhou et al., "Energy Consumption Patterns in the Process of China's Urbanization." *Population and Environment* 33 (2012): 203-204.
[50] "9-2 Total Consumption of Energy and Its Composition," *China Statistical Yearbook*, Accessed May 8, 2019, http://www.stats.gov.cn/tjsj/ndsj/2018/indexeh.htm
[51] Haiyang Xing, "The Source of China's Coal Dependency," *The New York Times*, last modified January 12, 2016, https://www.nytimes.com/2016/01/13/opinion/the-source-of-chinas-coal-dependency.html
[52] Zhihua Ding et al., "Coal Price Fluctuation Mechanism in China Based on System Dynamics Model."*Natural Hazards* 85 (2017): 1152.
[53] Yuhuan Sun et al., "Dynamic Factor Analysis of Trends in Temporal-Spatial Patterns of China's Coal Consumption." *Sustainability* 7 (2015.): 15120.
[54] Ding, "Coal Price Fluctuation," 1160.

[55] Berkley Earth, last accessed April 10, 2019, http://berkeleyearth.lbl.gov/air-quality/map.php
[56] Yi Zhou, Lianshui Li, and Lei Hu. "Correlation Analysis of PM10 and the Incidence of Lung Cancer in Nanchang, China." *International Journal of Environmental Research and Public Health* 14, 1253 (2017): 2
[57] "Ambient (outdoor) air quality and health," World Health Organization, accessed April 10, 2019, https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health
[58] Berkley Earth, last accessed April 10, 2019, http://berkeleyearth.lbl.gov/air-quality/map.php

[59] Zhou, Li, and Hu. "Correlation Analysis of PM10." 2.
[60] Zhou, Li, and Hu. "Correlation Analysis of PM10." 2.
[61] Zhu Tong, "Seven Decades of China's Energy Industry Development: Retrospect and Outlook." *China Economist* 14 (2019): 38.
[62] "Powerwall," Tesla, accessed April 10, 2019, https://www.tesla.com/powerwall
[63] Kakali Mukhopadhyay, Paul Thomassin, and Jingyuan Zhang. "Food Security in China at 2050: A Global CGE Exercise."*Journal of Economic Structures*, no. 1 (Dec, 2018): 2.
[64] Bloomberg News, "Farming the World: China's Epic Race to Avoid a Food Crisis," Bloomberg, last modified May 22, 2017, https://www.bloomberg.com/graphics/2017-feeding-china/
[65] Charles Parton, "China's Acute Water Shortage Imperils Economic Future" *FT.Com,* Feb 27, 2018, 10.
[66] Michael D. Swaine and Ashley J. Tellis, *Interpreting China's Grand Strategy: Past, Present, and Future* (Santa Monica, CA: RAND Corporation, 2000), x-xiii.
[67] Julia Kagan, "Bank Run," Investopedia, last modified April 8, 2019, https://www.investopedia.com/terms/b/bankrun.asp
[68] "China Cash Reserve Ratio Big Banks," Trading Economics, accessed April 10, 2019, https://tradingeconomics.com/china/cash-reserve-ratio
[69] Shalendra D. Sharma, "China's Debt Woes: Not Yet a "Lehman Moment"." *Journal of East Asian Economic Integration* 19 (2015): 105.
[70] Tommaso Gabrieli, Keith Pilbeam, and Bingxi Shi, "The Impact of Shadow Banking on the Implementation of Chinese Monetary Policy." *International Economics and Economic Policy* 15 (2018): 433
[71] Sharma, "China's Debt Woes," 99
[72] Central Intelligence Agency. *World Fact Book*. s.v. "China" and "United States," https://www.cia.gov/library/publications/resources/the-world-factbook/geos/ch.html.

[73] Sharma, "China's Debt Woes," 99
[74] Central Intelligence Agency. *World Fact Book*. s.v. "China"
[75] Central Intelligence Agency. *World Fact Book*. s.v. "China"
[76] Sharma, "China's Debt Woes," 102
[77] Sharma, "China's Debt Woes," 103
[78] Sharma, "China's Debt Woes," 104
[79] "Emerging from the shadows," *The Economist,* last modified April 19, 2014 https://www.economist.com/special-report/2014/04/19/emerging-from-the-shadows
[80] "Emerging from the shadows," *The Economist,* last modified April 19, 2014 https://www.economist.com/special-report/2014/04/19/emerging-from-the-shadows

[81] Sharma, “China's Debt Woes,” 104
[82] Sharma, “China's Debt Woes,” 107
[83] Sharma, “China's Debt Woes,” 108
[84] Sharma, “China's Debt Woes,” 109
[85] Yao Liu. "Governing the Restless and Young in Contemporary China: In Search for the Chinese Communist Party's Ruling Logic.", (Master’s Thesis, University of Toronto, 2010) 28-29.
[86] *Cambridge Dictionary* s.v. “the devil finds work for idle hands” https://dictionary.cambridge.org/us/dictionary/english/devil-finds-work-for-idle-hands
[87] Sharma, “China's Debt Woes,” 108
[88] Nir Kshetri, "Cybercrime and Cyber-Security Issues Associated with China: Some Economic and Institutional Considerations." *Electronic Commerce Research* 13 (2013): 45.
[89] “China plans new PC operating system in October” *British Broadcast Corporation,* last modified August 25, 2014, https://www.bbc.com/news/technology-28928369
[90] Michael D. Swaine and Ashley J. Tellis, *Interpreting China's Grand Strategy: Past, Present, and Future* (Santa Monica, CA: RAND Corporation, 2000), x-xiii.
[91] Bloomberg News, “Farming the World: China’s Epic Race to Avoid a Food Crisis,” Bloomberg, last modified May 22, 2017, https://www.bloomberg.com/graphics/2017-feeding-china/
[92] Christian J. Peters et al., “Carrying capacity of U.S. agricultural land: Ten diet scenarios” *Elementa: Science of the Anthropocene* • 4, 000116: 9
[93] Peters et al. “Carrying capacity, 9
[94] Xiao Jun Wang, "Legal Framework of Ecosystem Approach in China." *Applied Mechanics and Materials* 295-298 (2013): 2156.
[95] Miao Liu et al., "Vegetation Traits and Soil Properties in Response to Utilization Patterns of Grassland in Hulun Buir City, Inner Mongolia, China." *Chinese Geographical Science* 24 (2014): 472.
[96] Bloomberg News, “Farming the World: China’s Epic Race to Avoid a Food Crisis,” Bloomberg, last modified May 22, 2017, https://www.bloomberg.com/graphics/2017-feeding-china/
[97] Bloomberg News, “Farming the World: China’s Epic Race to Avoid a Food Crisis,” Bloomberg, last modified May 22, 2017, https://www.bloomberg.com/graphics/2017-feeding-china/
[98] Bloomberg News, “Farming the World: China’s Epic Race to Avoid a Food Crisis,” Bloomberg, last modified May 22, 2017, https://www.bloomberg.com/graphics/2017-feeding-china/.
[99] Raymond Yu Wang et al., “Unpacking water conflicts: a reinterpretation of coordination problems in China’s water-governance system.” *International Journal of Water Resources Development*, 33:4, (2017): 565.
[100] Central Intelligence Agency. *World Fact Book*. s.v. “China”
[101] Mara Hvistendahl, “China's Three Gorges Dam: An Environmental Catastrophe?,” *Scientific* American, last modified March 25, 2008, https://www.scientificamerican.com/article/chinas-three-gorges-dam-disaster/
[102] Mara Hvistendahl, “China's Three Gorges Dam: An Environmental Catastrophe?,” *Scientific* American, last modified March 25, 2008, https://www.scientificamerican.com/article/chinas-three-gorges-dam-disaster/

[103] "Water Scarcity," *UN Water,* http://www.unwater.org/water-facts/scarcity/
[104] Parton, "China's Acute Water," 7
[105] Parton, "China's Acute Water," 8
[106] Helen Roxburgh, "China's radical plan to limit the populations of Beijing and Shanghai" *The Guardian,* last modified March 19, 2018, https://www.theguardian.com/cities/2018/mar/19/plan-big-city-disease-populations-fall-beijing-shanghai
[107] Parton, "China's Acute Water," 7
[108] Central Intelligence Agency. *World Fact Book*. s.v. "China"
[109] Parton, "China's Acute Water," 8
[110] Parton, "China's Acute Water," 8
[111] Parton, "China's Acute Water,: 10
[112] Parton, "China's Acute Water," 10
[113] Dou, Xiangsheng. "A Critical Review of Groundwater Utilization and Management in China's Inland Water Shortage Areas." *Water Policy* 18 (2016): 1373.
[114] Dou, "Groundwater Utilization and Management in China's," 1371.
[115] Dou, "Groundwater Utilization and Management in China's," 1371.
[116] Parton, "China's Acute Water," 34
[117] Parton, "China's Acute Water," 9
[118] *Statista,* s.v. "Bottled water" accessed February 12, 2019, https://www.statista.com/outlook/20010000/117/
[119] Liu Hongqiao, "China's bottled water industry poses new threat to precious resources," *Chinadialogue*, https://www.chinadialogue.net/article/show/single/en/8550-China-s-bottled-water-industry-poses-new-threat-to-precious-resources?gclid=EAIaIQobChMI6_n9odOU4QIVjRyGCh0g-AhjEAAYASAAEgLUqfD_BwE
[120] Michael D. Swaine and Ashley J. Tellis, *Interpreting China's Grand Strategy: Past, Present, and Future* (Santa Monica, CA: RAND Corporation, 2000), x-xiii.
[121] South China Sea Expert Working Group, "A Blueprint For Cooperation On Oil And Gas Production In The South China Sea," *Asia Maritime Transparency Initiative*, https://amti.csis.org/a-blueprint-for-cooperation-on-oil-and-gas-production-in-the-south-china-sea/.
[122] Irina Slav, "Can China Meet Its Nuclear Power Goals?," *Oilprice.*com, https://oilprice.com/Energy/Energy-General/Can-China-Meet-Its-Nuclear-Power-Goals.html
[123] "How will the Belt and Road Initiative advance China's interests?," *China* Power, accessed May 7, 2019, https://chinapower.csis.org/china-belt-and-road-initiative/.
[124] Kyle Mizokami, "This Is What a Real Naval Buildup Looks Like," *Popular* Mechanics, last modified June 5, 2018, https://www.popularmechanics.com/military/weapons/a21086031/china-naval-build-up/
[125] Lixin Sun and Yuqin Huang. "Measuring the Instability of China's Financial System: Indices Construction and an Early Warning System." *Economics* 10, no. 19 (Jul 12, 2016): 1-42.
[126] "Statistical Bulletin of China's Land and Sea Resources," *Ministry of Land Resources of the People's Republic of China* (MLRPRC), 2017
[127] "Superfund," *United States Environmental Protection Agency*, https://www.epa.gov/superfund
[128] "Superfund," *United States Environmental Protection Agency*, https://www.epa.gov/superfund

[129] "Superfund Human Exposure Dashboard," *United States Environmental Protection Agency*, https://www.epa.gov/superfund/superfund-human-exposure-dashboard
[130] "Deleted National Priorities List (NPL) Sites - by Deletion Date," *United States Environmental Protection Agency*, https://www.epa.gov/superfund/deleted-national-priorities-list-npl-sites-deletion-date
[131] Sara Malm, "River of fire: Chinese waterway becomes so polluted it bursts into flame after lit cigarette is thrown into it," *DailyMail.com*, last modified March 6, 2014, https://www.dailymail.co.uk/news/article-2574714/River-fire-Chinese-waterway-polluted-bursts-flame-lit-cigarette-thrown-it.html
[132] Michael D. Swaine and Ashley J. Tellis, *Interpreting China's Grand Strategy: Past, Present, and Future* (Santa Monica, CA: RAND Corporation, 2000), x-xiii.
[133] Michael Meidan, "China's Burgeoning Demand and its Quest for Resources," in *New Realities: Energy Security in the 2010s and Implications for the U.S. Military*, edited by John Deni (Carlisle, Pennsylvania: U.S. Army War College, Strategic Studies Institute, 2014) 185-204.
[134] Robert Goralski and Russel W. Freeburg. *Oil and War: How the Deadly Struggle for Fuel in WWII Meant Victory or Defeat.* New York: William Morrow and Company, Inc., 1987, 95-96.
[135] BP Statistical Review of World Energy, (67th edition), June 2018, 3-5.
[136] Meidan, "China's Burgeoning Demand and its Quest for Resources," 186.

Bibliography

Ay, Chang-Ruey. “Labor market institutions and productivity growth: A six-country comparison,” Doctorate thesis, University of Illinois, 1994.

Bolt, Paul J. "Sino-Russian Relations in a Changing World Order." *Strategic Studies Quarterly* 8, (Winter 2014): 47-69.

Brandt, Loren, and Thomas G. Rawski. *China's Great Economic Transformation*. Leiden: Cambridge University Press, 2008.

Central Intelligence Agency. *World Fact Book*. https://www.cia.gov/library/publications/resources/the-world-factbook/geos/ch.html.

“China Dash Board.” IHS Markit: *Jane's Online*, https://janes-ihs-com.lomc.idm.oclc.org/dashboard/country/China.

Dai, Xin. “Regulating Reputation in China: Privacy, Falsehoods, And Social Credit.” Doctorate thesis, University of Chicago, 2018.

Ding, Zhihua, Caicai Feng, Zhenhua Liu, Guangqiang Wang, Lingyun He, and Manzhi Liu. "Coal Price Fluctuation Mechanism in China Based on System Dynamics Model. *“Natural Hazards* 85 (2017): 1151-1167.

Dou, Xiangsheng. "A Critical Review of Groundwater Utilization and Management in China's Inland Water Shortage Areas." *Water Policy* 18 (2016): 1367-1383.

Fairbank, John King and Merle Goldman. *China: A New History*. 2nd enl. ed. Cambridge, Mass: Belknap Press of Harvard University Press, 2006.

Gabrieli, Tommaso, Keith Pilbeam, and Bingxi Shi. 2018. "The Impact of Shadow Banking on the Implementation of Chinese Monetary Policy." *International Economics and Economic Policy* 15 (2018): 429-447.

Goralski, Robert and Russel W. Freeburg. *Oil and War: How the Deadly Struggle for Fuel in WWII Meant Victory or Defeat.* New York: William Morrow and Company, Inc., 1987.

Han, Seunghyun. “China's Hegemony: Four Hundred Years of East Asian Domination by Ji-Young Lee (review).” *Sungkyun Journal of East Asian Studies*, Volume 17, Number 2, (October 2017): 264-267 https://muse.jhu.edu/article/678113/pdf.

International Monetary Fund, Asia and Pacific Department. *The People's Republic of China, IMF Country Report no. 18/240* https://www.imf.org/~/media/Files/Publications/CR/2018/cr18240.ashx.

Kshetri, Nir. "Cybercrime and Cyber-Security Issues Associated with China: Some Economic and Institutional Considerations." *Electronic Commerce Research* 13 (2013): 41-69.

Lin, Li-Wen. 2017. "Reforming China's State-Owned Enterprises: From Structure to People." *The China Quarterly* 229: 107-129.

Liu, Miao, Guohua Liu, Xing Wu, Hao Wang, and Li Chen. "Vegetation Traits and Soil Properties in Response to Utilization Patterns of Grassland in Hulun Buir City, Inner Mongolia, China." *Chinese Geographical Science* 24 (2014): 471-478.

Liu, Yao. "Governing the Restless and Young in Contemporary China: In Search for the Chinese Communist Party's Ruling Logic.", Master’s Thesis, University of Toronto, 2010.

McDougal, Trevor. "A New Imperialism? Evaluating Russia's Acquisition of Crimea in the Context of National and International Law." *Brigham Young University Law Review*, (2015): 1847-1887.

Meidan, Michael. “China’s Burgeoning Demand and its Quest for Resources.” In *New Realities: Energy Security in the 2010s and Implications for the U.S. Military*, edited by John Deni,

185-204. Carlisle, Pennsylvania: U.S. Army War College, Strategic Studies Institute, 2014.
Mukhopadhyay, Kakali, Paul Thomassin, and Jingyuan Zhang. "Food Security in China at 2050: A Global CGE Exercise. “Journal of Economic Structures, no. 1 (Dec, 2018): 1-29 http://www.econis.eu/PPNSET?PPN=1019686820.
Parton, Charles. "China’s Acute Water Shortage Imperils Economic Future." *FT.Com,* Feb 27, 2018.
Peters, Christian J., Jamie Picardy, Amelia F. Darrouzet-Nardi, Jennifer L. Wilkins, Timothy S. Griffin, Gary W. Fick, “Carrying capacity of U.S. agricultural land: Ten diet scenarios” *Elementa: Science of the Anthropocene* • 4, 000116: 1-15, https://newfoodeconomy.org/does-veganism-save-more-land/
Sharma, Shalendra D. "China's Debt Woes: Not Yet a "Lehman Moment"." *Journal of East Asian Economic Integration* 19 (2015): 99-114
Su, Kun and Rui Wan. "State Control, Marketization, and Firm Value: Evidence from China." *Journal of Applied Business Research* 30 (2014): 1577-1586.
Sun, Lixin and Yuqin Huang. "Measuring the Instability of China's Financial System: Indices Construction and an Early Warning System." *Economics* 10, no. 19 (Jul 12, 2016): 1-42.
Sun Tzu. O*n the Art of War: The Oldest Military Treatise in the World.* Transated by Lionel Giles, M.A. Leicester, England. Allandale Online Publishing, 2000, https://sites.ualberta.ca/~enoch/Readings/The_Art_Of_War.pdf.
Sun, Yuhuan, Qian Li, Ting Chen, and Xiaoai Jia. "Dynamic Factor Analysis of Trends in Temporal-Spatial Patterns of China's Coal Consumption." *Sustainability* 7 (2015.): 15119-15135.
Swaine, Michael D and Ashley J. Tellis. *Interpreting China's Grand Strategy: Past, Present, and Future*. Santa Monica, CA: RAND Corporation, 2000. https://www.rand.org/pubs/monograph_reports/MR1121.html.
Tong, Zhu. "Seven Decades of China's Energy Industry Development: Retrospect and Outlook." *China Economist* 14 (2019): 34-65.
Wang, Qingsong, Hongrui Tang, Xueliang Yuan, Mansen Wang, Hongkun Xiao and Zhi Ma. “An Early Warning System for Oil Security in China” *MDPI Sustainability*, 10, 283 (2018): 1-19.
Wang, Raymond Yu, Cho Nam Ng, James Hans Lenzer Jr., Heping Dang, Tao Liu & Shenjun Yao “Unpacking water conflicts: a reinterpretation of coordination problems in China’s water-governance system.” *International Journal of Water Resources Development*, 33:4, (2017): 553-569.
Wang, Xiao Jun. "Legal Framework of Ecosystem Approach in China." *Applied Mechanics and Materials* 295-298 (2013): 2155-2158.
Xu, Fayin. "The Structuration of Chinese Migrant Workers: Institutional Transitions, Life Experiences and Subjective Experiences." Order No. 3707989, University of Kentucky, 2015.
Yeoh, Emile Kok-Kheng and Wang Fan. "Housing in China: State Governance, Market and Public Perception." *Contemporary Chinese Political Economy and Strategic Relations,* 3 (2017): 433-503.
Zhou, Wenji, Bing Zhu, Dingjiang Chen, Charla Griffy-brown, Yaoyao Ma, and Weiyang Fei. "Energy Consumption Patterns in the Process of China's Urbanization." *Population and Environment* 33 (2012): 202-220.

Zhou, Yi, Lianshui Li, and Lei Hu. "Correlation Analysis of PM10 and the Incidence of Lung Cancer in Nanchang, China." *International Journal of Environmental Research and Public Health* 14, 1253 (2017): 1-19.
Zhu, Xiaodong. "Understanding China's Growth: Past, Present, and Future. "*The Journal of Economic Perspectives"* 26 (2012): 103-124.