

Use Their Force: Interstate Security Alignments and the Distribution of Military Capabilities

Prospectus Draft

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Overview

- **Puzzle** – why do states have heterogeneous distributions of military capabilities?
- **Point** – a state’s relationships with aligned states can encourage a division of labor with shared military capabilities. This happens when their interests are well aligned and/or there is a way to control defection. The result is functional differentiation of specialized and complementary military capabilities.

Research Question

Motivation

States with similar defense budgets manage to spend those budgets in ways that produce dissimilar military capabilities. France and Germany, for example, had nearly identical levels of defense spending in 2014. Yet, the distribution of their military capabilities varied dramatically. Table 1 shows that France possessed substantially more armored infantry vehicles and main battle tanks. For air transport, France relied primarily on transport aircraft while Germany had both aircraft and helicopter transport capabilities. Their navies also differed; with France having a larger navy overall but lacking a submarine presence. These differences persist despite these nations being similar in level of military spending, governance structure, industrialization, and international threat environment.

Domain	Technology	France	Germany
Land	Armored infantry vehicles	5942	2959
	Main battle tanks	2254	662
	Artillery	375	272
Air	Tactical aircraft	255	205
	Transport aircraft	227	74
	Transport helicopters	43	90
Sea	Aircraft carriers	1	0
	Submarines	0	4
	Patrol and coastal combatants	21	8
	Principal surface combatants	24	18
	Amphibious ships	49	2

Table 1: France and Germany, Select Military Technologies (Source: IISS 2014)

This prospectus seeks to explain why countries possess different distributions of military capabilities. In particular, I focus on outliers in military capabilities that seem puzzling – omitted technologies and surplus technologies. Omitted technologies are those that a country

could and should possess in higher quantities than it does.¹ Surplus technologies are those that a country has in excess relative to other states.

Scholars have asked why countries buy the weapons that they do (Kurth 1973). Most explain this phenomenon through strategic choice or bureaucratic and organizational theory. International relations scholars talk about this at the state-level and argue that geopolitical considerations like the make-up of foreign threats explains this but American politics scholars look to bureaucratic explanations like the iron triangle to explain weapons acquisition. These theories often make opposite predictions and more importantly these theories don't tell us why countries possess some weapons systems but not others. Furthermore, theories about differences in inputs and threat environments still assumes that every country would have the same distribution of military capabilities if they had the same inputs and faced the same threats. However, that is not empirically observed. We lack a theory about variation in distributions of military capabilities.

Defining Key Terms

Distribution of military capabilities – the combination of military equipment that could be used by that state during conflict. This includes technologies like artillery, aircraft, naval vessels, armored vehicles, satellites, transport ships, etc but does not include small arms used by individual military personnel nor equipment. This list includes military equipment that can be deployed, that other nations are likely to observe, and that could be used to signal intent and resolve in a crisis without actual use. I focus on distribution because it can account for differences across states of different sizes and across technologies of different overall quantities.

Omitted technologies – technologies that a country possesses in low numbers relative to expectations. This is determined by looking at that nation's share of that capability relative to other nations. If Great Britain's navy is roughly 8% of global naval forces, for example, but it lacks any aircraft carriers, that represents an omitted technology.

Surplus technologies – technologies that a country possesses in high numbers relative to expectations. This is determined by looking at that nation's share of that capability relative to other nations. In 2014, for example, Turkey possessed roughly 40% of the world's air defense systems. There is no other military technology where Turkey owns a share nearly as large.

Aligned state – a country with whom you can coordinate actions because you share certain interests and that thus are more likely to be an ally in international disputes than an adversary (Morrow 1991). As a result, these are states with which one could potentially share production of military capabilities to improve your national defense through measures like joint coalition warfare operations, arms sales, or training exercises. This term is preferred over the more commonly used "ally" because formally structured military alliances are a type of alignment relationship that is distinct from other alignments that do not include things like mutual defense arrangements like informal arms sales relationships.

Alignment tie – Aspects of the *relationship* between two aligned states. This includes

¹'could' simply means the absence of physical production constraints and 'should' means the technology would provide utility in navigating international disputes

things like the degree of formal obligations, the depth of commitment between the signatories, and how much the actors' interests align (Benson and Clinton 2016).

Alignment position – Aspects of the *actor* that is aligned with some other state. In an asymmetrical alignment, one actor has a strong alignment position and the other has a weak alignment position. In symmetrical alignment, there is no difference in alignment position. This includes things like the degree to which a state sets the rules in the alignment relationship and whether that actor's primary benefit from the alliance is security or autonomy.

Significance

Military power is defined as the ability to achieve one's goals, often through the possession of resources (Nye 1990). I am here interested in the technological dimension of military power which is distinct from the number of military personnel or military spending. The technological dimension of military power matters because although we intuitively know that states differ in their ability to translate material strengths into fighting power, this concept is under-evaluated and poorly measured (Brooks 2007).

The puzzle of why countries possess a particular distribution of military capabilities matters because it sheds light on the relationship between capabilities and threats. The common understanding of this relationship is a threat-response model where some threat presents itself to a state and the state develops a response to that threat which may include the development of particular military capabilities. But this story misses a more complex interaction between threats and military capabilities. The capabilities a country possesses determine what actors and events in the international arena are threats to a country. The capabilities that contribute to a state's military power are similar to institutions in that they create path dependence for certain actions and obstruct other actions. As such, the distribution of military capabilities matters because it shapes the environment in which states engage with one another over issues in dispute. Military capabilities influence what is in dispute despite the fact we think of those capabilities as a response to disputes.

Military force matters because it's the means by which countries can impose political solutions during strategic interactions at the international stage at a reasonable cost. What a country is able to accomplish with military force in a specific situation is a function of military technology, organization, and doctrine and the manner in which these things relate with the political and geographic circumstances at hand (Betts 1997). If we think of military power as a tool of politics, then, barring a few exceptions, every nation should have a military and these militaries should primarily differ in size given production constraints. However, the example of France and Germany show we observe militaries differing in terms of what those countries have chosen to invest in.

Most of the research on international conflict has focused on the beginning and end of war – it's causes and consequences. It is odd that despite academic interest in these aspects of war, the study of the middle portion – war's conduct, has been largely relegated to military generals and tacticians. However, the conduct of conflict, whether actual or latent, has much to tell us about the causes and consequences of war. Regarding its causes, if, as Clausewitz noted, war is the continuation of politics with other means, then the tools used for war are the tools used for the continuation of politics with other means. The wide body of

literature studying the causes of war has recognize the importance of *how* nations fight in specific contexts like conflict initiation (Beckley 2017), the balance of power (Horowitz 2010), whether a show of force is a deterrent to conflict or encourages a spiral (Glaser 1992), when and why treaties are chosen instead of war (Allison and Morris 1975), when coups against autocratic leaders are successful (Talmadge 2016), and the type of negotiated settlement a country is able to get given how an opponent feels about the prospect of winning that war. It goes without saying that the consequences of war also depend on its conduct including who wins (Rosen 1994; Lyall and Wilson 2009) and the costs in treasure and in blood (Caverley 2014). Of the many aspects of international war, weapons procurement and acquisition is the most fundamentally political, and thus worth of study within the confines of political science, because its the one aspect of the military that politicians directly control in most countries. Civilian political leaders rarely direct strike plans, fire weapons, or threaten to capture cities. But they do determine the military equipment and weapons that are available to do all of those things.

If military force is itself an important concept in explaining international phenomena, then examining the factors that determine a country's military force is also a worthy endeavor. The innovation, acquisition, and procurement of military weapons is an important determinant of national military force since it comprises the tools available for the resolution of international disputes. The weapons and technology that comprise a nation's force structure determine the military operations it undertakes, the types of military threats it can credibly make, and the consequences of resorting to force (Buzan 1987). International relations is often concerned with the national interest which requires understanding what combination of military forces available to political actors to achieve the objectives set by its leaders. Evaluating answers to that question in light of research about what combination of military forces a country *does* have, *could* have, and *wants* to have tells us about where countries may be headed, what factors foster or hinder their move in that direction, and what objectives a nation will be able to achieve via the use or threat of military force. One cannot understand why Germany was able to control Europe for half of the 1940's in ways it could not during 1914 by examining traditional concepts in international relations like GDP, population, or the size of armed forces. Rather, it was the Wehrmacht's adoption of armored warfare technology and its innovations in battle tank development that were pivotal to Great Britain's success during World War I that allowed Germany to undertake successful military operations (Betts 1997).

Moreover, the importance of understanding why countries have different distributions of military capabilities also informs scholarship on important questions in the study of domestic politics. The importance of lobbying and interest groups (Holland 1993; Gholz 2011; Dombrowski and Gholz 2006), civil-military relations (Brooks 2008; Kadercan 2014), interbranch relations (Jones and Marsh 2011), and public support for the government (Saunders 2015) can all be better understood by seeking explanations for why and how countries determine the military force structure that they possess.

Previous Arguments

On the Distribution of Military Capabilities

Conventional explanations for the distribution of national military capabilities primarily come from research on weapons acquisition and was motivated by attempts to understand the nature of the Cold War arms race between the US and Soviet Union. These theories either focus on international strategic threats or domestic politics. The problem is that these theories still assume every country would have the same force structure if they had the same inputs and threat environment but that is not something we observe. Ukraine has the second largest standing army in Europe. And yet their navy is almost non-existent – comprising of only a single minesweeper despite increasingly threatening Russian actions in the Black Sea as the situation in Syria has escalated. Neighboring Romania, by comparison, has chosen to invest in a strong navy and possesses 3 destroyers, 19 coastal combatants, and 10 minesweepers. This variation would be unexpected if the composition of a state’s military was expected to vary only based on the threat environment and internal factors.

Strategic explanations for weapons acquisition argued that countries will try to acquire weapons with strategic utility given the threats they are facing (McNamara 1967; Rathjens 1969). The United States invested in a particular nuclear triad because it felt this was the best defense against the Soviet threat. More theoretical work ties this to balance of threats to explain differences between states by arguing states facing the gravest threats pay the most because they have the most to lose if the threats they face materialize in a way that negative implicates their security (Waltz 1979).

The primary problem with both of these explanation is that they predict homogeneity. For realists, countries are so vulnerable when it comes to defense that they will never functionally differentiate. This means that differences in the distribution of military capabilities can only be explained by differences in production capacity. When it comes to coalitions of states, the dominant state pays a disproportionate share of the security burden to secure goods because the weaker states will free ride (Olson and Zeckhauser 1966). Even in this case, we may know why countries have larger or smaller pies (militaries), but not why the number and relative size of the *slices* of the pie are different across states (components of those militaries).

There is much heterogeneity among domestic theories of weapons acquisition decisions. The bureaucratic-organizational perspective argue that internal factors matter since no single authority can make all the decisions in weapons-development (Allison and Morris 1975). Thus, the goals and procedures of weapons development matter. Others argue that these decisions are explained by a desire for re-election because the public supports these decisions because they generate jobs or shore up nationalism (Carter 1989; Higgs 1988). Other domestic economic explanations argue that leaders face economic imperatives to continue production to keep major defense contracting firms operational (Kurth 1973).

The problem with these explanations is their inability to explain why one weapon emerged as opposed to another or why weapons are produced in certain quantities that produce a unique combination of national capabilities. Similar to the problem with the strategic realist perspective, they should predict homogeneity across states and don’t theorize the exist of military capabilities as opposed to a particular *distribution* of military capabilities. Theories

of domestic or bureaucratic politics serve only as ex post explanations for what a country *did* buy. It does not help explain why a country didn't buy something else since all military equipment has special interest groups and domestic constituents. As such, it doesn't tell us *what* a country buys for its military, only that domestic factors cause you to buy. This work has also been largely limited to the United States so explaining differences in the distribution of military capabilities across countries has proven challenging.

This research agenda can advance by unpacking the black box of a state's military capabilities. The tendency thus far has been to overbin military capabilities into things like military spending or the overall number of military personnel but that loses important information about how a country chooses to spend on defense and what material capabilities result from those strategic decisions. We are thus far limited in our ability to understand why one state has capabilities that allow them to project power far from their own border while others have militaries geared toward tactical victory on the battlefield. These different distributions of military capabilities result in different outcomes during international interactions and are thus worthy of investigation.

On State Alignments

Initial explanations for why states ally with one another was based on the presence of foreign threats (Olson and Zeckhauser 1966). When countries A and B face a threat from country C, they form an alliance that aggregates their capabilities because that shifts the probability of victory in their favor. In this view, the purpose of the alliance is to serve the common interests of member states. Alliances serve as a substitute for internal balancing. However, the capabilities that are aggregated are considered homogeneous which misses an important story about complementarity. Olson and Zeckhauser (1966) admit that military forces are composed of many types of equipment but their model assumes that the costs to military contributions to an alliance are uniform and constant.

Others have views alliances as more than a sum of their capabilities because specialization and complementarity in the alliance relationship can boost overall defense capacity in ways either state along could not (Morrow 1991). This important innovation notes that it's not that both parties in an alliance receive security benefits, as was originally described. Instead, one actor receives autonomy benefits and the other receives security benefits. Autonomy benefits are defined by the ability to pursue a change in the status quo that is more consistent with your ideal policy preferences. Great powers seek autonomy benefits from alliances and use that alliance to further their pursuit of change by extracting concessions from the weaker party in exchange for the weaker party being protected from external threats. Thus, the weaker nation gains security benefits when they feel the benefits of doing so exceed the costs of sacrificing autonomy to the greater power.

The important innovation established by Morrow (1991) is that actors often seek different benefits from an alliance. This explains the stability of asymmetric alliances where one party seeks autonomy and the other seeks security. Morrow (1991) hints at the effect this should have on the distribution of military capabilities in saying "What should be contentious in asymmetric alliances is the composition of military forces, not the distribution of military expenditure. The dominant nation wants alliance forces configured to advance its autonomy interests rather than the security of the alliance. When autonomy and security interests

demand different force structures, we should expect to see conflict in asymmetric alliances over the appropriate force structure." While he notes the importance of different distributions of military capabilities for the goals of security and autonomy, the interest is in theorizing how symmetry affects alliances rather than theorizing how alliances affect the composition of each alliance member's military capabilities. It should be the case that as alliances change, a nation's distribution of military capabilities will change because the alliance dictates what military capabilities an actor should have given their concern for autonomy, defense, and the degree to which it impacts the actions of your allies.

One of the other trade-offs in alliances is between abandonment and entrapment (Bennett, Lempgold and Unger 1994/ed). Strong commitments to your ally reduce the risk of abandonment but increase the risk of entrapment. While theoretically sound, this view has suffered from limited empirical tests that simply look at whether strong states threaten weaker allies over contributions to conflict. It does not examine how this alliance security dilemma influences what a country possesses. This matters because what military capabilities country A has influences the conflicts they'll get involved in, and thus influences the risk that country B gets entrapped. It also matters because what military capabilities country B has should enter country A's calculation about whether their ally, country B, will come to their aid in a way that will help them win a dispute.

Theory

A Shared Production Model of Military Capabilities

My central puzzle is trying to explain why countries have different distributions of military capabilities. States want to optimize their military capabilities in a way that helps them shape a foreign policy environment most conducive to that state's ideal point. However, countries face a problem of constrained optimization. They have to allocate their military capabilities in ways that are constrained by a variety of factors that could be financial, political, or logistical in nature. The question then becomes about how states try to save resources given these constraints.

I argue that a state's distribution of military capabilities will have more technological outliers (omissions and surpluses) when their relationship with aligned states encourages a shared production model of military capabilities. Under these conditions, alignment ties represent a means to deal with the constrained optimization problem by taking advantage of capability specialization and complementarity made possible by shared production. One of the general benefits of forming relationships with other actors that applies to cases of security cooperation is the ability to enjoy a division of labor and economies of scale. Furthermore, the omission and surpluses in that state's distribution of military capabilities can be explained by the capabilities of the aligned states with which they engage in this shared production model. This theory should be able to explain both changes within a country over time (as a state's international alignments change, their prioritization of different military capabilities will also change) as well as changes across countries at the same point in time (two countries with different international alignments should prioritize different military capabilities).

The security payoffs of an alignment relationship depend, in part, on the shared pro-

duction benefits of the military capabilities of both parties. The key question is the degree to which the alignment relationship gives a state confidence that they can safely omit the development of certain military capabilities because they can rely on the capabilities of the aligned state and also their willingness to contribute to that state's security when the threat environment calls for it.

Two aspects of an alignment relationship determine the degree to which it will encouraged shared production. The first is the *alignment tie*. The alignment tie refers to the relationship itself. Formal mutual defense pacts are a different type of alignment than coincidentally voting together at the UN General Assembly. Three measurable characteristics of the strength of an alignment tie are the degree of formal obligation, the depth of the commitment between the signatories, and the degree to which the actors' interests align (Benson and Clinton 2016). While sharing production costs reduces the cost of security, it is not costless when it comes to autonomy. Depending on another state who may renege when asked to contribute to your defense could seriously jeopardize a state's security. Alliance ties that reduce the risk of renegeing are thus more conducive to specialization and complementary production. While alignments themselves may not necessarily change a lot over time, the salience of the threats that a particular alignment can reliably help counter does change. The United States is a reliable ally to Israel in the threat environment with Syria and Iran; Israel can confidently rely on United States military assets in the event that a conflict here broke out. However, Israel may feel the United States is a less reliable ally were there to be conflict with Saudi Arabia. As a result, the strength of an alignment tie can change as a result of changes in a state's threat environment that make some threats more salient than others. If the security threats that are important to a state are ones where an aligned state is less reliable, then that alignment is less likely to give a state confidence that it can share the production of military capabilities with that partner.

The second characteristic is a state's *alignment position*. This refers to the state's position within the alignment that is characterized by the degree of asymmetry in the alignment (Morrow 1991). For a relationship with an aligned state to encouraged a shared production model of military capabilities, it must deal with the problem of defection such that countries are willing to risk becoming dependent on one another. Strong countries in hierarchical alignment relationships hope that the alignment can prevent opportunism on the part of the weaker county. Sharing production of heterogeneous distributions of military capabilities can serve this role because having a credible and costly threat of defection can give a state influence over what their partner does. A strong state can also ensure that they control capabilities that the weaker state is limited by not possessing. Without aerial refueling capabilities, for example, weaker US allies are limited in their ability to project power without a green light from the US. The dynamic where this is most easily seen is in extended deterrence. The US offers a nuclear umbrella to allies like South Korea and Japan with the hopes that such an umbrella will reduce the incentive those weaker allies have to produce nuclear weapons on their own. When there is a reduced ability to defect, state's are more likely to specialize because the benefits of becoming dependent on one another exceed the costs of possible defection. By creating a military relationship that encourages specialization on the part of both the stronger and weaker partners, the stronger partner can ensure that the military capabilities available to the weaker partner do not risk moral hazard and instead create a system of security dependency that allows the stronger partner to influence national

decisions that implicate their foreign policy.

The alignment tie and alignment position also interact in an important way. They both operate through a similar mechanism that argues that countries will specialize and share complementary capabilities when they feel their partner will not defect. The probability of defection is influenced by the alignment of interests and asymmetric control. An interaction exists where the more interests are aligned, the less asymmetric control is needed because aligned interests make defection more costly. Similarly, when the relationship is asymmetric, interests do not need to be as closely aligned because the powerful state would lose reputation and credibility from defecting and the weaker state would lose access to vital resources if they defected.

In sum, interstate alignments have a contingent effect on specialization and complementarity of a state's distribution of military capabilities. In alignment partnerships with strong ties and hierarchical positions, states are more willing to divide their labor such that each has a controlling share of a different set of military technologies. Alignments can allow for the creation of complementary distributions of military capabilities that have appropriate security and financial benefits for both states but that also give the stronger state foreign policy autonomy by providing a means to limit how aligned states pursue security and wealth. The result is variation in their distribution of military capabilities as measured by technological omissions and/or surpluses. These specializations encourage complementarity with the omissions and/or surplus of the aligned state.

Hypotheses

My first dependent variable is *specialization* in a state's distribution of military capabilities. The distribution of military capabilities is the combination of major physical assets a state possesses in a given year. I operationalize this for each military technology as a state's ownership of the global share of each type of military capability. For example, if the US has 10 of the world's 15 aircraft carriers in 2017 its aircraft carrier distribution would be 0.66. A state's distribution of military capabilities is more specialized when there is more variation in the global share it possesses in its capabilities. This occurs when there is a higher prevalence of surplus technologies (where the distribution ratio is very high) and the prevalence of omitted technologies (where the distribution ratio is very low).

My two explanatory variables concern the state's *alignment ties* and *alignment positions* with other states. The alignment tie with another state is high when it discourages renegeing on alignment promises. This can be operationalized as the degree of formal obligation, the depth of the commitment between signatories, and the degree to which the actor's interests align. These three factors are observable indicators of the degree to which an aligned state is a reliable security partner. The alignment position refers to the degree to which one of the actor's sets the terms of the alignment. Since the theory predicts there will be high specialization of military capabilities when the alignment relationship is hierarchical, regardless of direction, this variable should be measured as the absolute value of the relative power of both states. If state A is much more powerful than state B or if state B is much more powerful than state A, the alignment position value should be high. If both states are equally powerful, the alignment position score should be low.

Hypothesis 1 *Monadic specialization and alignment ties:* *The specialization of a state's distribution of military capabilities should increase when their alignment ties are stronger.*

Hypothesis 2 *Monadic specialization and alignment positions:* *The specialization of a state's distribution of military capabilities should increase when their alignment positions are more hierarchical.*

My second dependent variable is *complementarity* in states' distribution of military capabilities. While specialization is a measure of a state's military capabilities relative to itself, complementarity is a measure of a state's military capabilities relative to the aligned state in question. I operationalize this for each pair of state as the rate of redundancies in their military capabilities. I expect fewer redundancies when alignment ties are low and alignment positions are hierarchical because the benefits to alleviating the constrained optimization problem with a shared production model of military capabilities exceed the costs. The explanatory variables here are similarly the dyadic alignment tie and alignment position.

Hypothesis 3 *Dyadic complementarity and alignment ties:* *The complementarity of a dyad's distribution of military capabilities should increase when their alliance tie is stronger.*

Hypothesis 4 *Dyadic complementarity and alignment positions:* *The complementarity of a dyad's distribution of military capabilities should increase their their alliance position is more hierarchical.*

Methodology

Measurement Strategy

Distribution of Military Capabilities

A military technology portfolio can be measured as a nation's distribution of capabilities in a given year. This represents a simple count of the number of vehicles, aircraft, etc that a nation had a given year. There are various units of analysis that can be used to enumerate a country's military capabilities. Figure 1 gives a example of the different units of analysis that exist. There are broad equipment categories like artillery, engineering and maintenance vehicles, helicopters, aircraft, etc that are uniform across all countries. Within each of those equipment categories are subcategories. Helicopters, for example, can be divided into attack helicopters, intelligence and reconnaissance, multi-role helicopters, search and rescue, transport, etc. Lastly are the units where each unique type of transport helicopter is listed.

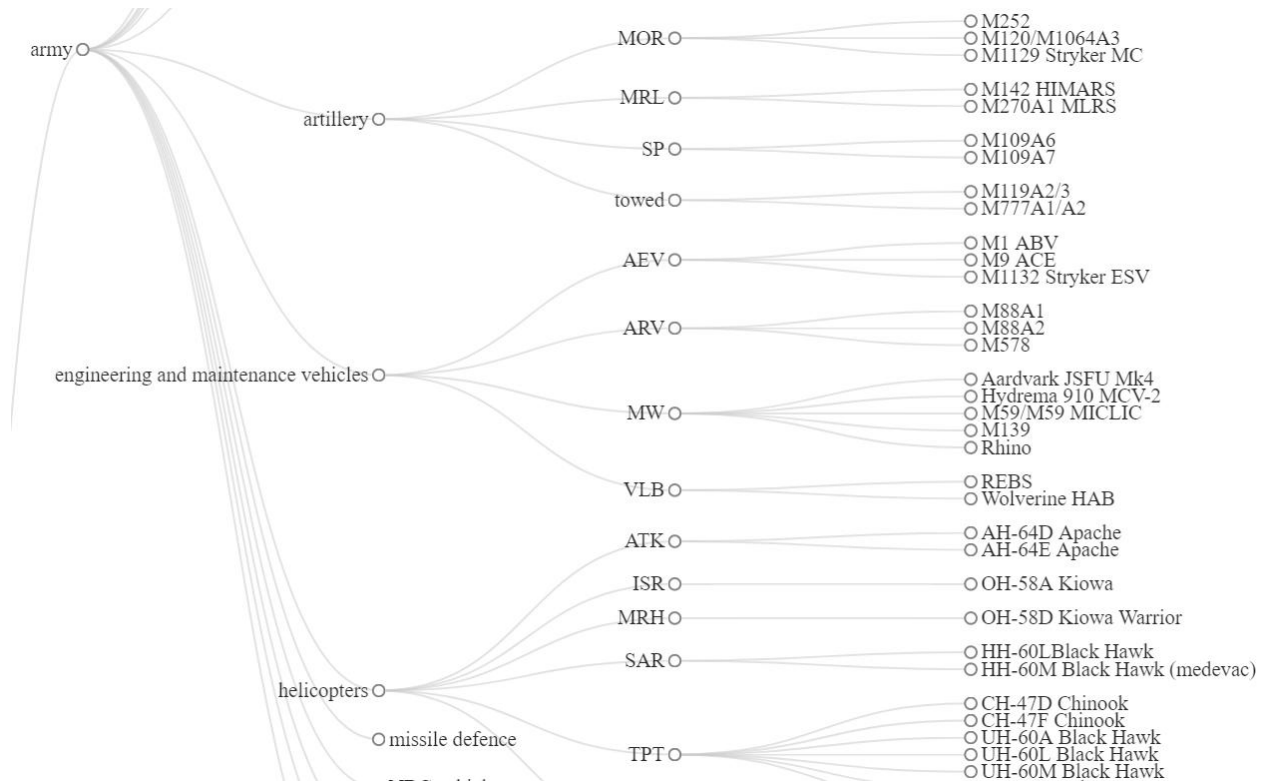


Figure 1: Sample of nested technology structure categories (Source: IISS 2014)

The data allows us to quantify a country's assets at the unit level, meaning we can identify, for example, the number of CH-47D Chinook helicopters each country had in a given year. This level of disaggregation is unnecessary for the theory presented here. We have no theoretical priors about how a relationship with an aligned state would influence why a country would invest in the CH-47F Chinook transport helicopter as opposed to the UH-60A Black Hawk transport helicopter. However, the theory predicts that the alignment relationship should influence your overall number of transport helicopters since if your ally possesses those capabilities and can be relied on to not defect in providing them when the threat environment calls for it.

Since these equipments all exist in widely varying quantities, they cannot be directly compared with one another just by looking at how many a nation possesses. The United States has 11 aircraft carriers and 2,380 main battle tanks. Yet, conventional wisdom rightfully holds that the US possesses a comparative advantage in aircraft carriers that it does not in main battle tanks. A metric for making this comparison is looking at the US share of these capabilities relative to the rest of the world. The US possesses 55% of the world's aircraft carriers (11 out of 20) yet it possesses 0.02% of the world's main battle tanks. This ratio of global capabilities provides a way to compare a country's relative specialization across technologies. Figure 3a shows the breakdown for the United States. The baseline measure, represented by the dotted line, is the US percent of world military spending (roughly 34% in 2014). If the US did not specialize we would expect the US to have roughly 34% of the world's military capabilities in every category. Yet that is clearly not the case. The US possesses a disproportionately high share of the world's UAV's and command ships. It possesses

a disproportionately low share of the world’s patrol and coastal combatants, mine warfare ships, and artillery.

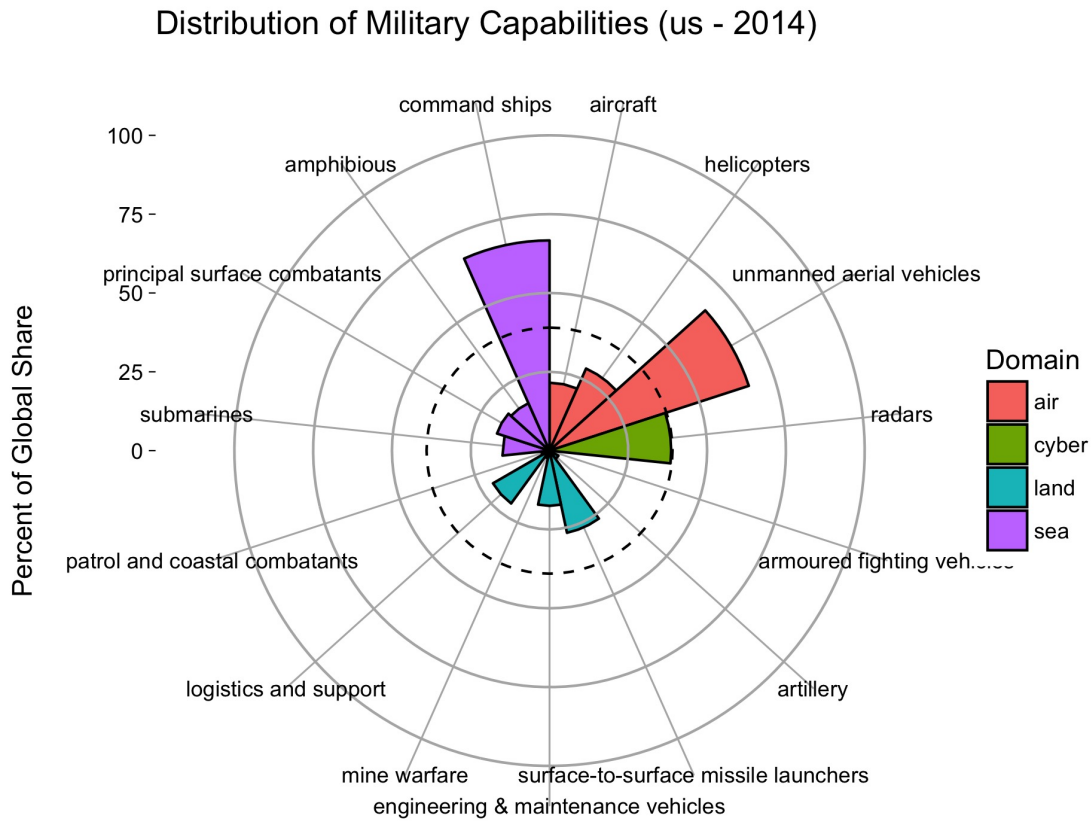


Figure 2: US share of global military capabilities (Source: IISS 2014)

(a) The dotted line represents US military spending as a percent of global military spending

This disaggregation of military capabilities represents a significant empirical contribution to the study of military power. For the first time, we have a measure of a state’s distribution of military capabilities which can provide illuminating insights into how countries fight, why they win the wars that they do, and a host of other questions in international relations.

My dependent variables are a measure of a state’s distribution of military capabilities. A state’s distribution of military capabilities is specialized if they possess a high quantity of omitted and surplus technologies. Omitted technologies are those a country possesses in a lower quantity than we would expect and surplus technologies are those possesses in a higher quantity that we would expect. The expectation for any capability is in line with that countries military spending ratio. Thus, a country whose military spending is 10% of the world’s military spending can be expected to possess 10% of the world’s share of any given military capability. Deviations from that 10% represent the variation of interest. My first dependent variable, specialization, can thus be quantified as the standard deviation of a country’s capabilities ratios using their military spending ratio as a baseline. Countries

that are more specialized will have higher standard deviations on their capabilities ratios.

My second dependent variable, complementarity, is the degree to which one states omitted technologies are compensated by their aligned state possessing those capabilities. In the Ukraine example, although they lack any significant naval assets, their alignment ties with NATO have increased in a way that compensates for that omitted capabilities. NATO has begun doing more training exercises with Ukraine and has maritime deployments in the region, including the recent "Sea Breeze" multilateral training exercise designed to train against Russian submarine warfare. Measuring the complementarity between the naval assets of these NATO countries and Ukraine would show that the capabilities Ukraine lacks in the naval domain are those that these NATO allies can provide. This can be operationalized as the cosine similarity of each state's distribution of military capabilities. Two states that have similar military portfolios irrespective of size will have high cosine similarity. Their plots are roughly the same shape, even if one nation's is bigger overall. States with low cosine similarity have low redundancy in capabilities which means they have complementary capabilities.

Alliances

Alliances differ in the scope of formal obligations (breadth of circumstances under which the terms of the agreement obligate alliance members to commit to military action), depth of the commitment between signatories (degree to which the alliance commitment imposes peacetime and related costs on the signatories), and potential military capacity of the alliance (total adjusted potential military power of the alliance measures) (Benson and Clinton 2016). These things are measurable and have been done for alliances from 1816-2000.

My explanatory variable is a composite variable that captures the political alignment with a country. This can include a range of operationalizations used in international relations literature like UN votes, the size of the consulate and embassy, military basing personnel, and military training exercises. A composite measure of these observables operationalizes alignment ties between two states in line with theoretical expectations. The stronger the alliance tie and the more aligned your interests, the less likely you are to defect and thus the more likely those two countries are to share production of military capabilities.

Expected Data Collection

Data on military technology portfolios is produced by the International Institute for Strategic Studies (IISS) in the annual Military Balance reports. Aspects of this data have been frequently used in academic publications. Most of this work has used IISS data on military spending (Hallerberg and Marier 2004; Goldstein 1998; Wohlforth 1999; Greenhill and Major 2007) or personnel (Walter 2006; Sundstrom 2005; Gaibulloev et al. 2015; Stanton 2013; Lieber and Alexander 2005). The little work that has looked at IISS data on the distribution of military capabilities has focused on a narrow list of platforms like mechanized vehicles (Lyall and Wilson 2009; Sechser and Saunders 2010), strategic lift aircraft, (Kupchan 1988) and fighter jets (Saunders and Souva 2018) or a short list of countries like great powers (Brooks and Wohlforth 2016) or China and its rivals (Beckley 2017). The primary reason

for this relatively limited use of fine-grained high-quality data is difficulty in converting the data to an easily-usable format and standardizing it across years and countries.

The data covers 1961-2017 with a total of 7,568 country-years and roughly 10,454 technology-years. The exact number of unique technologies has not yet been calculated. However, the data from 1961-1975 does not include as many states in the international system and has a bias towards NATO and Warsaw Pact states with much more information provided about the former than the latter. Figure 4 shows the distribution in the data for each country-year. Each country represent a unique row on the y-axis and the x-axis represents the years for which military technology portfolio data is available for that country. Country names are omitted for readability, but the plot demonstrates that few countries are missing from the data, especially after 1975. Those states that do disappear from the dataset are typically countries that ceased existing and years where a large number of countries enter the dataset (like 1991) correspond to years where many countries entered the international system. The data has already been collected for every state for the year 2014.

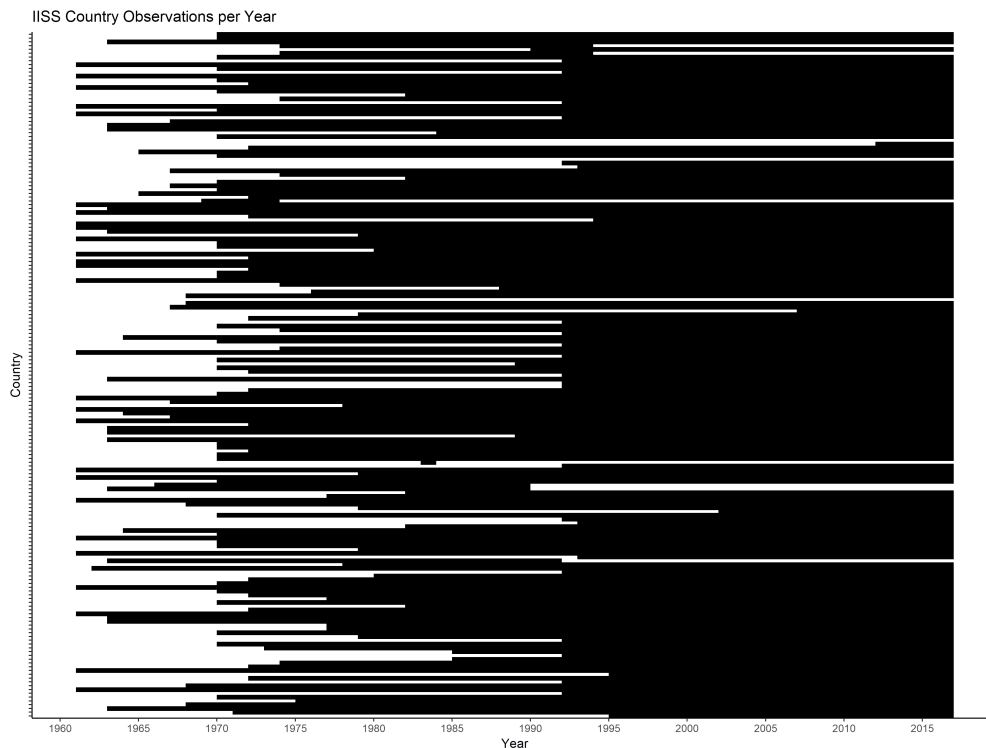


Figure 4: Missingness Plot: Each row is a country. Black indicates a country-year with data, white space indicates missing data for that country-year

Proof of Concept

Cross-Country Comparisons

Returning to the example of France and Germany, the differences in their military capabilities is readily apparent. Figures 5 and 6 show that while both countries have a disproportionately

high share of the space-based systems in the world, they differ on many other metrics. Germany possesses many more radar systems and mine warfare capabilities while France has more logistics and support vessels and armored fighting vehicles.

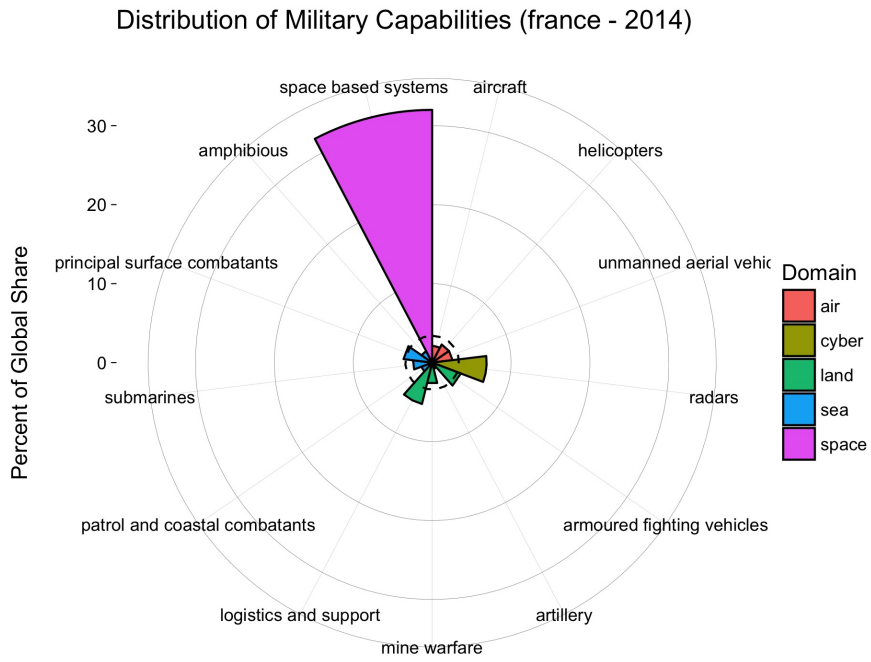


Figure 5: France's Distribution of Military Capabilities (2014)

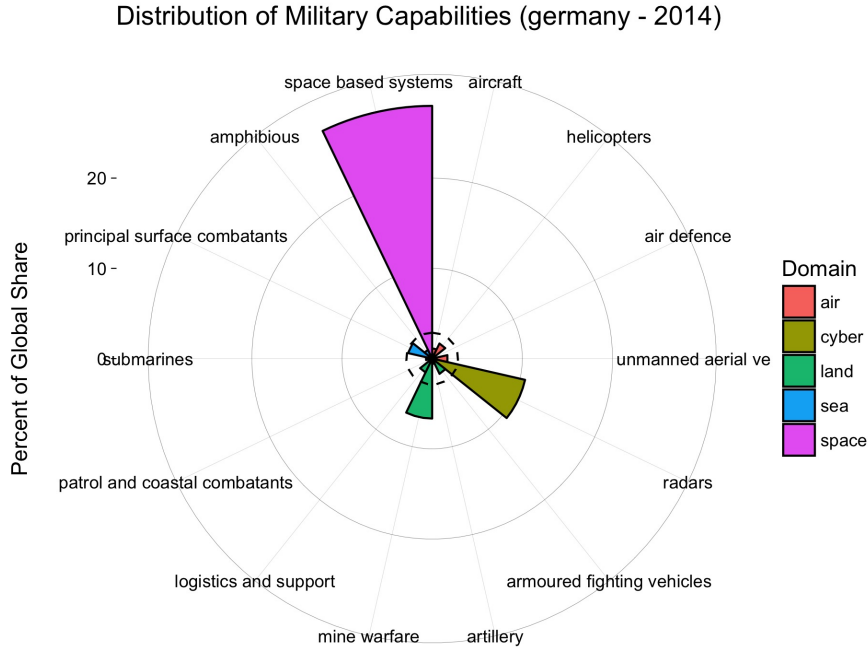


Figure 6: Germany's Distribution of Military Capabilities (2014)

Time Series Comparisons

We can also analyze changes in a single state's distribution of military capabilities over time. Here, the share of global capability is less relevant since that value can change even if a state makes no change to its own distribution. Rather, the raw count of capabilities is of interest.

Coding for a select number of military platforms for 6 countries from 2011-2017 demonstrates further variation. These countries were selected because they were the ones analyzed in Brooks (2007) and the platforms were chosen because they were highlighted by IISS as important platforms. This helps identify salient examples along the continuum of what constitutes the variation.

The validity exercise include a sample of the distribution of select technological capabilities for China, France, India, Russia, the UK, and the US. A sample of technologies were coded and divided into the categories of strategic nuclear technologies, maneuver technologies, and projection technologies. These categories were provided by IISS and represent only one way of categorizing technologies. Categorizing by military domain/branch (air, land, sea) could also prove informative. The technologies listed under each of these categories is far from exhaustive, but provides a useful starting point for thinking about variation in military technology portfolios and can identify observations that seem puzzling.

Figure 7 shows temporal changes in military platforms used for power projection. This includes naval and aerial technologies that can be forward deployed or that assist in the forward deployment of other military technologies. The results here are not surprising. The US has far more transport and re-fueling aircraft than the other countries surveyed and there is not much unusual change within any one country's distribution.

Projection Technology Platform Distribution (2011-2017)

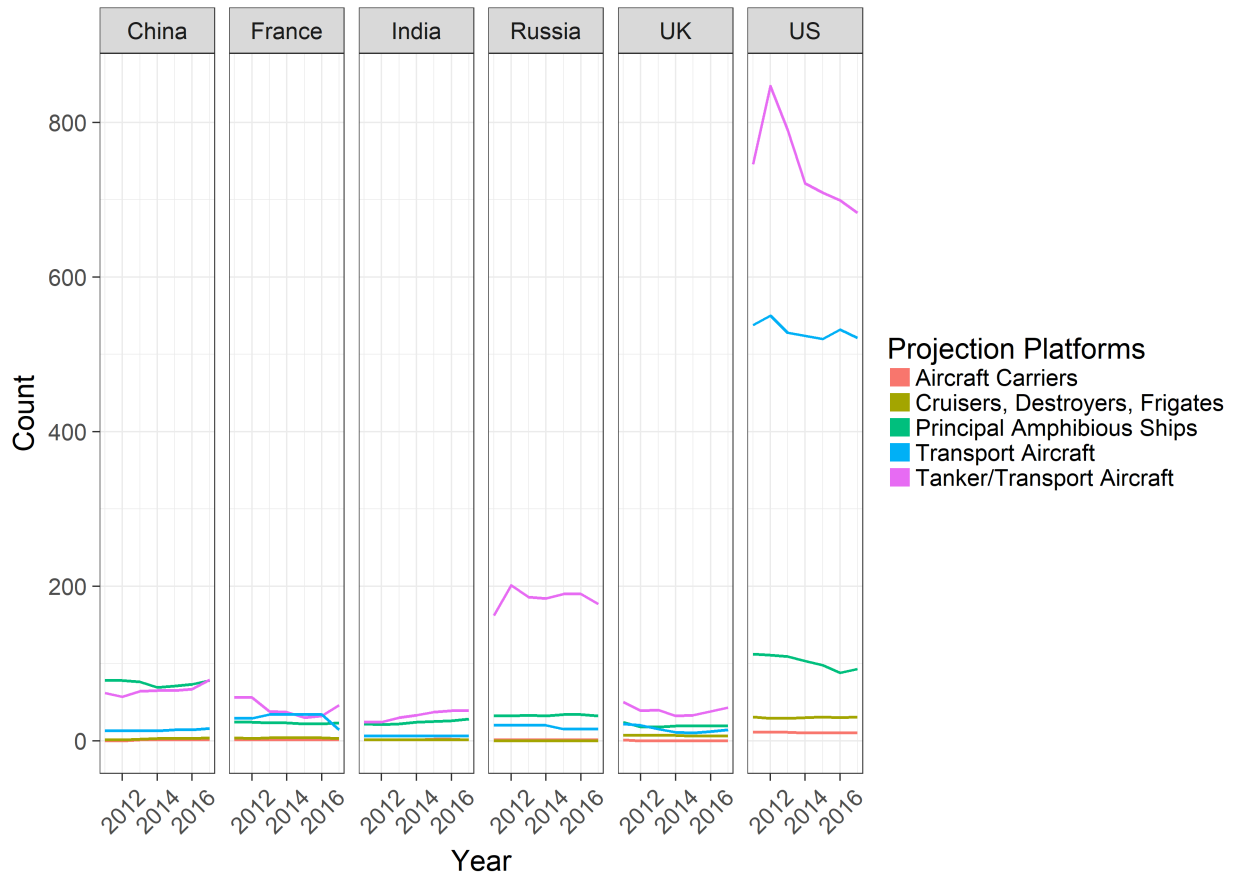


Figure 7: Change in Projection Platforms

Figure 8 shows temporal changes in military platforms used for maneuvering which can be thought of as technologies that engage in direct kinetic combat. These platforms can directly attack the target and have little use for non-battlefield activities like signaling or general deterrence. Some interesting variation here is of note. China, India, and Russia all experience a dramatic increase in tactical aircraft (fighter jets) between 2013 and 2014. In China and India's case, their number of fighter jets more than doubled during that year. France and the UK had no change in tactical aircraft during this entire time period while the US cut its number of tactical aircraft in half. More broadly, the US appears to have dramatically reduced the number of maneuver vehicles in its arsenal after 2011 without offsetting that with an immediately obvious increase in some other platform.

Maneuver Technology Platform Distribution (2011-2017)

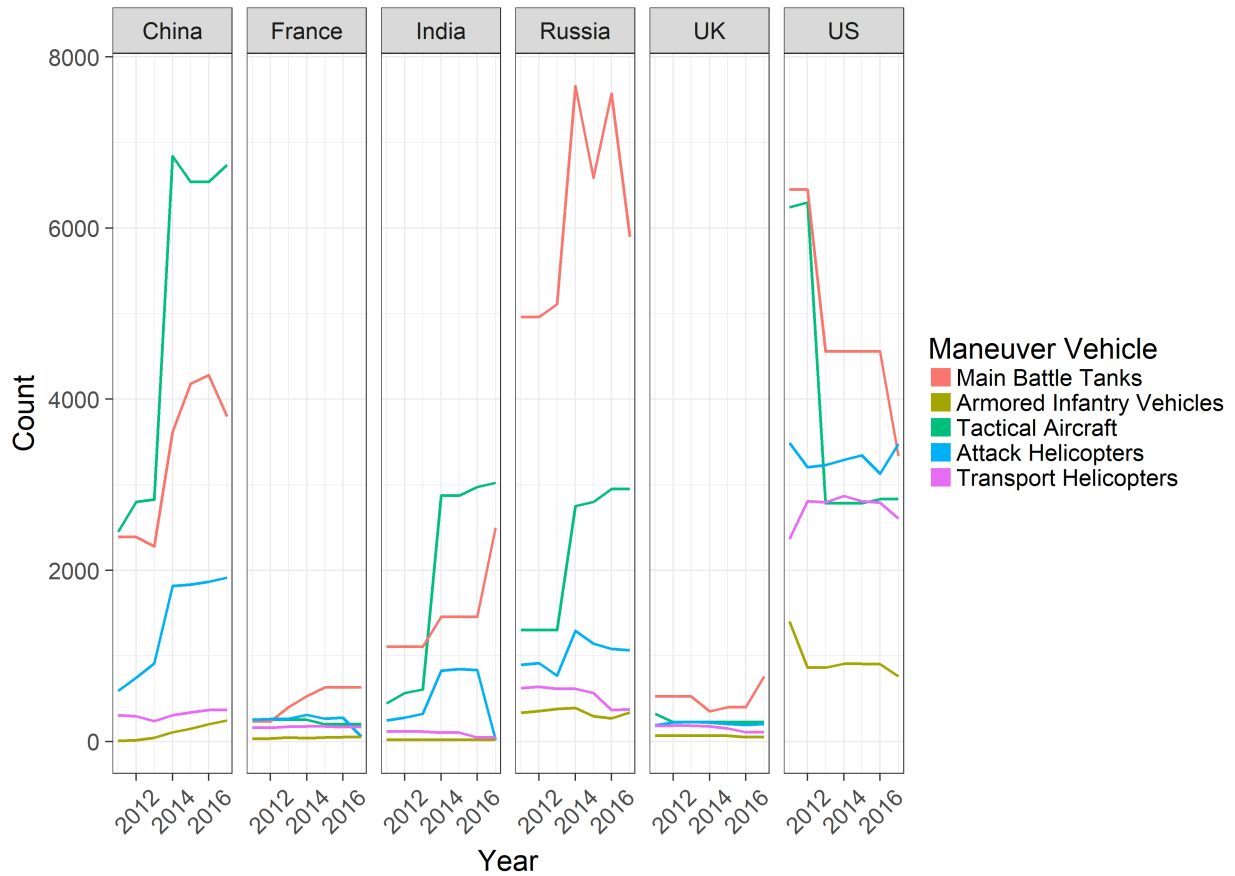


Figure 8: Change in Maneuver Platforms

Vertical proliferation of nuclear capabilities has received little attention since the end of the Cold War outside of select contexts. However, renewed attention to the *type* of nuclear weapons that interest current and soon-to-be nuclear powers can tell us about the threats and targets a nuclear-armed country anticipates. Much of the discussion surrounding North Korea’s recent missile tests, for example, surrounds whether those missiles allow for a nuclear warhead to reach the continental United States. While this subsample of data does not include North Korea, it does show that between 2011-2017, Russia and China shifted their nuclear platform distribution in a way that suggests a shift in purpose. China’s reduction in nuclear bombers between 2011-2014 ran parallel with an increase in ICBM launchers. From 2014-2017 that pattern reversed and ICBM launchers were reduced while they increased their number of bombers. In Russia, 2012 was the beginning of an increase in ICBM launch platforms accompanied by an almost identically-sized reduction in nuclear bombers.

Strategic Nuclear Platform Distribution (2011-2017)

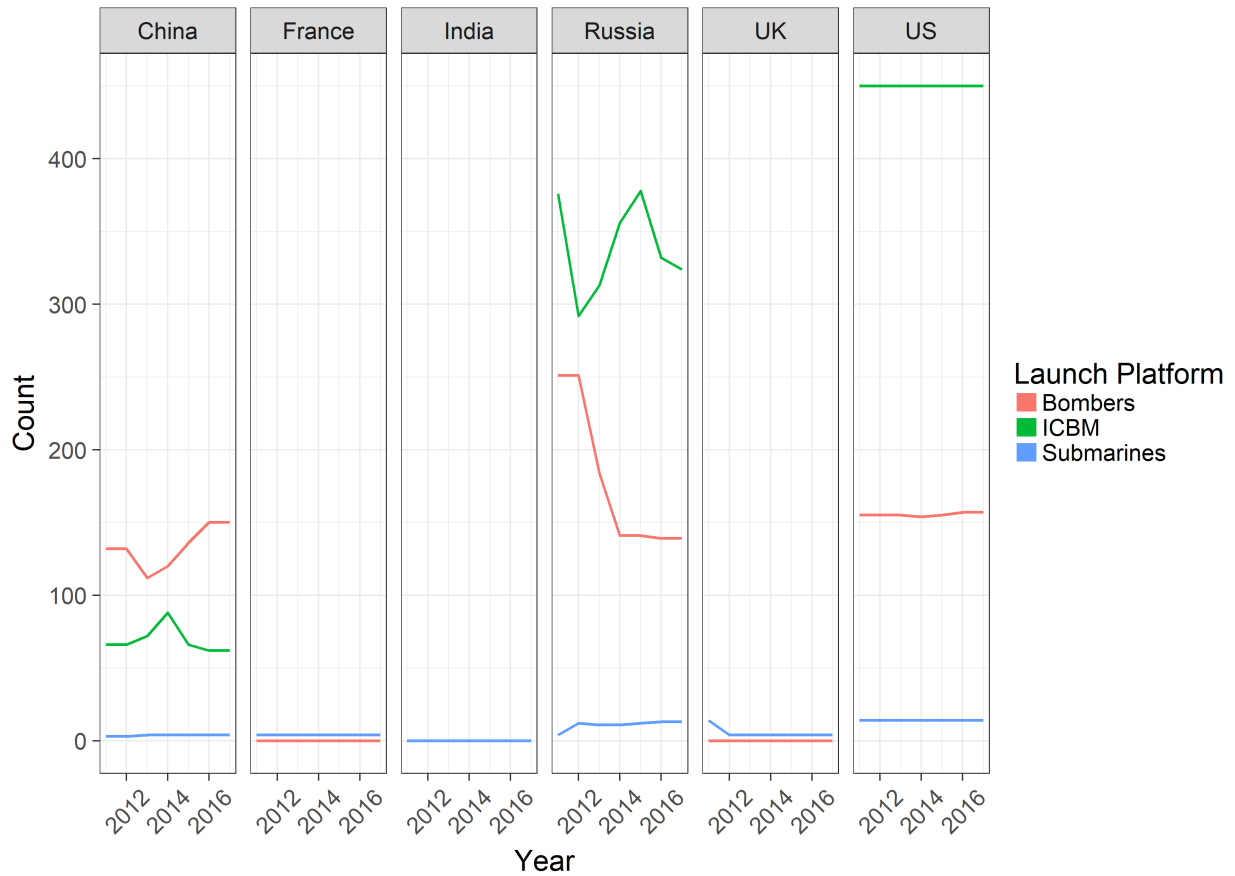


Figure 9: Change in Nuclear Delivery Platforms

Proposed Dissertation Outline

Below I outline the proposed structure of the dissertation, including, where appropriate and necessary, a short summary of the content of that chapter.

Introduction

The introduction will focus on the importance of having a theory of the distribution of military capabilities. I will motivate the project by explaining why there is utility in unpacking the black box that is the composition of a state's military power.

Identifying Variation in the Distribution of Military Capabilities

An entire chapter should be devoted to a univariate analysis and explanation about how military capabilities vary across states and over time. While much of this is understood anecdotally and in small sub-samples (eg. the US has many aircraft carriers) the large-n analysis of this fine-grained data is new and innovative. This chapter should explain what

this variation looks like across time and space and devote significant time to explaining how we can measure differences over time and space. This includes data univariate data about what states are most specialized, interesting outliers we note in omitted or surplus technologies, and what countries have the most similar distributions of military capabilities.

Literature Review

Given that this question has not been tackled in precisely this manner before, the literature review chapter will focus on three things. First is theories about how states respond to threats. This dissertation is part of a larger research agenda about the relationship between capabilities and threats and argues that we need to understand more about what determines military capabilities to understand the endogenous relationship between capabilities and threats in a way that differs from the traditional threat-response model. Second is literature relating to the dependent variable about weapons acquisition and force structure that explains the drivers of these decisions. Third is literature about the explanatory variable that looks at variation in state alignments, why they happen, and how they are operationalized.

Theory

An important framing for my research agenda is that while I am interested in the broader question of military capabilities, why they matter, and where they come from, that question is too large for a single dissertation. Thus, the first section of my theory will try to fit the dissertation into this research agenda by explaining how military capabilities are determined by domestic politics, the threat environment, and interest alignment. This dissertation focuses on interest alignment because it is measurable, tractable, has a developed literature base, and allows me to lay out a theory about why countries buy, borrow, and build the capabilities that they do which is a necessary precondition for the investigation of the broader question of interest.

Large-n Quantitative Analysis

The primary test of my theory will be analysis of the distribution of military capabilities across all states over the past half century. Further data exploration will investigate the exact year range based on data quality and availability. The data on the dependent variable will primarily come from the IISS Military Balance reports but can be supplemented by other data collection efforts that focus on particular military capabilities. For example, other research groups focus on data collection of specific military capabilities like artillery that can be used to fill in gaps where IISS data is missing and also verify the accuracy of the IISS data.

Case Study

The primary goal of the case study chapter is to answer questions that cannot be answered through the large-n analysis. In this case, that involves questions about the time lag of

weapons acquisition decisions, the complexity of the threat environment (local vs global), and tracing the process of changes in the nature of an alignment between states over time.

A potential case that fits these criteria is NATO and eastern European states during the collapse of the Soviet Union. Significant amounts of work have explored whether the end of the Cold War signaled the collapse of NATO but instead, the nature of the alliances changed in unpredicted ways. The theoretical underpinnings of this dissertation can be explained by that event by looking at how the alliance, although no longer needed to combat the Soviet threat, was useful for doing things like bombing Libya because the NATO countries already had an established shared production model of military capabilities. Even still, as interests between Western European countries and the US diverged after the end of the Cold War, the European countries realized that as a result of that change in alignment they could no longer rely on the US to provide aerial refueling capabilities that they had depended on during the Cold War. As a result, they began developing their own capabilities and now have redundancy as opposed to complementarity in that aspect of military capabilities. A case study analysis of force structure changes in European countries at the end of the Cold War could shed light on what military capabilities each country felt they had to develop domestically and what capabilities they felt could fall under a shared production model with newly aligned states as those relationships changed in dramatic ways.

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