

Military Arsenal: A Consequence of Alliances

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1 Introduction

Military alliances are strategic partnerships that ensure mutual protection and support in a time of conflict. The countries within a given alliance are not random or arbitrary, but are deliberate in order to provide the greatest benefit for the cause. This means that each country must contribute a military arsenal that would serve as an advantage over the opposing alliance, thus dictating the distribution of military capabilities. One country can build up certain equipment in order to make up for another countries lack-there-of. Or, a country can build up certain equipment just to support the efforts of the alliance, despite their personal armed force needs. The needs of the alliance can overshadow individual needs. The alliance thus dictates the distribution of military capabilities within each country. As a result, multinational alliances have an impact on the structure of each countries military arsenal. So, the purpose of my model is to demonstrate how a country organizes its armed forces, which can then explain how alliances influence the military equipment of a given country.

In order to do this, I am going to focus on the alliance that formed during the Afghanistan War. The war started in 2001 following terrorist attacks by al-Qaeda. In response, a major military coalition formed in order to lead an effort to "oust the Taliban and ... dismantle al-Qaeda". [6] This operation consisted of countries that made up the NATO-led International Security Assistance Force (ISAF). The ISAF coalition served as the alliance that engaged in the 2001-2014 war with the Taliban insurgency. Troops were mobilized because the interest of the alliance was put over individual military goals. [4]

I am going to build my model by creating an alliance network that reveals the relationships between countries within the alliance and then by comparing individual global shares of equipment with the alliance's global share. These results will reveal behavior that correlates to how an alliance's obligations impact the military arsenal of the involved countries.

This model will then be able to indicate which countries will contribute, what equipment they contribute, and how much of that equipment that they contribute to future conflicts given the military needs.

2 Data

My model depends heavily on data in relation to multi-national alliances and the military arsenal of different countries.

The military equipment data I used was gathered from the International Institute for Strategic Studies' (IISS) annual "Military Balance" reports (International Institute for Strategic Studies N.d.) which includes detailed information on every country's current military portfolio and overseas commitments. I then found the ISAF alliance data from The Correlates of War Project. This dataframe includes the formal alliance ties between different countries.

Every row for the IISS data includes the year, country, equipment type, and its unit count. There are a few other variables as well, but they are not necessary for my model. In the alliance data set, a row consists of the year, the two countries, and four different binary components that determine the strength of the relationship between the two countries. The four components are defence, neutrality, nonaggression, and entente. Combined, this score assigns a rating to the given alliance. Through R, I was able to read in the files, clean and format all of the data, and merge the data sets. From this, I had all the information necessary to build my model.

These sources are very reliable as they come from think tanks that specialize in research related to international relations. IISS is a research institute that provides objective information on military developments that could lead to conflict. The Correlates of War project was an academic study about the history of war. Both used extensive research methods to collect and verify their data.

3 Model & Analysis

An alliance, if it is truly the most influential factor, should have a relatively complete military force structure. Equipment types can be dispersed across the alliance, but when considered as a single unit, the arsenal should essentially be complete. As a result, my model will demonstrate the impact an alliance has on a country's military technology.

Lanchester has already proven that there is a correlation between the escalation of war and military technological development. Although the Lanchester equations look at how a conflict can incite two opposing forces to build arms against one another [2], they ignore how a collective force can develop a more diverse arsenal. An alliance allows for greater distribution of equipment types across various countries.

In order to keep my model simple, I focused on just the major contributors in the ISAF alliance at work in the Afghanistan war and did not consider alliances that

no longer exist in society today. I also restricted my time frame to just 2001-2014, as it covered the duration of the entire war. In this time, the countries that were members in the alliance did not change. These omissions did not impede the analysis of my model, but integrating them will be important for its generalization.

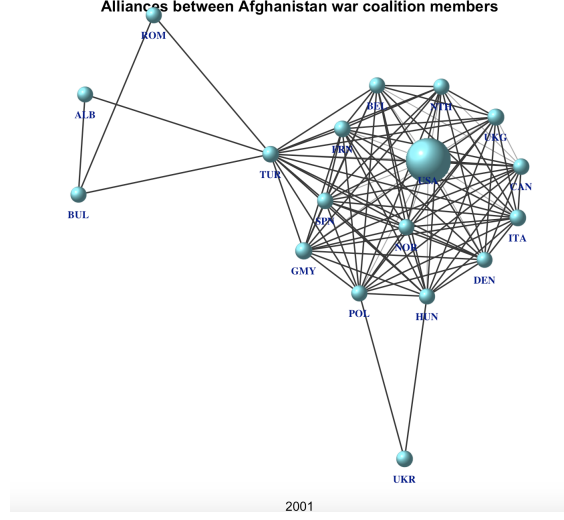


Figure 1: ISAF Military Alliance Network

My model first considers the ISAF alliance network, as seen in Figure 1. I selected a list of important countries from the ISAF alliance to focus on, as there were many countries that made contributions to the Afghanistan War, some of which were not as significant as others. The countries that will be considered for my model are Albania, Belgium, Bulgaria, Canada, Denmark, France, Germany, Hungary, Italy, Netherlands, Norway, Poland, Romania, Spain, Turkey, Ukraine, the United Kingdom, and the United States.

These countries were selected because they were either major participants in the efforts or contributed a significant portion of military equipment relative to their capabilities. With these main 18 countries, I built the alliance network, in order to better understand each country's relationships and how those could possibly impact their military arsenal.

In the Figure 1 network plot, each sphere represents a country, which is labeled by its 3-letter abbreviation. The size of the sphere is proportional to its Composite Index of National Capability (cinc) score. A cinc score is a statistical measure of national power, so the larger the sphere, the stronger the country. Most countries are about the same size, but the United States is significantly larger due to its extensive military and economy. The lines that connect the spheres represent direct alliances between those two countries. Yet, alliances

ties can have different strengths. So, the width and color of the line reflects how closely aligned they are. The score is determined by the equation:

$$allianceStrength = defense + neutrality + nonaggression + entente$$

Each of the four components is a binary value representing the type of alliance the two countries share. For instance, the United States and Hungary are directly connected. They have a defensive, non-aggressive, and entente agreement; not a neutrality one. As a result, their alliance receives a score of 3. The higher the score, the stronger the alliance. So, the dark/thick lines represent a stronger connection and the light/thin lines represent a weaker one.

This network can show how the different relationships within the alliance can possibly influence the military arsenal of a given country.

My model then looks at an individual country's world ratio possession of different equipment types as well as the cumulative ratio of the ISAF alliances' possessions. These ratios serve as indicators of influence from the alliance rather than personal military needs.

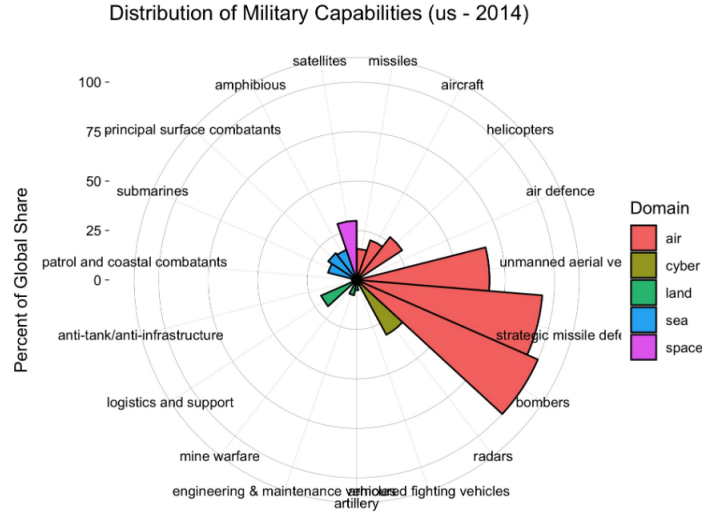


Figure 2: United States Global Shares of Military Equipment

I used the IISS data to calculate each of the countries global share of a given military equipment in 2014. I used the global percent as a way to normalize the equipment unit counts. Normalizing was important as there could be thousands of helicopters and only hundreds of principal surface combatants, yet the actual quantity of each equipment is on different scales and is thus not reflective of the same relation between a country and its arsenal. So, turning the values into

global percents makes it easier to compare different equipment types with each other and across countries. In order to best understand the data, I plotted my results as a spider plot, as seen in Figure 2.

Every country in the ISAF alliance has its own ratio spiderplot. In each plot, there are 19 different equipment types that are all categorized into its spacial domain. Each bar represents that country's global percent possession of the given equipment. For example, the United States has roughly 67 percent of the worlds unmanned aerial vehicles. The United States also has an arsenal that is largely focused on air-domain equipment, most likely due to their geographical location in relation to conflicts. Although it looks substantial, “bombers” and “strategic missile defence” take up such high percentages because there are very few of that equipment in the world in the first place.

All of these factors can have an impact on how an alliance influences other countries to develop their military force structure. These spiderplots tell us different ways in which countries build certain equipment in order to fill a portion of the collective arsenal. When put all together, the spiderplots can show patterns and behavior that would indicate a correlation between alliance membership and possession of a given military equipment.

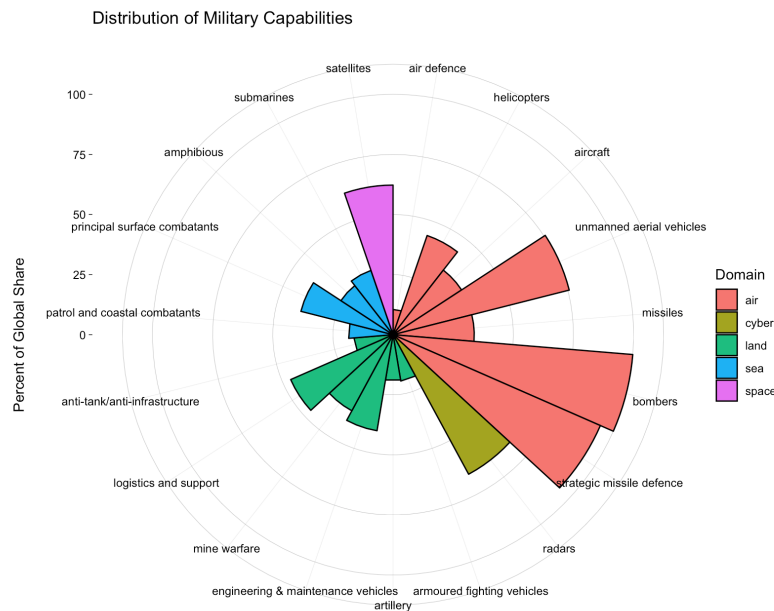


Figure 3: Cumulative ISAF Shares of Military Equipment

The cumulative ratio spiderplot, Figure 3, reveals that the ISAF alliance has a relatively full military arsenal, spread across all 18 countries. There isn't a spacial domain in which the alliance lacks equipment. The alliance possesses

at least 10 percent of the global share of every equipment type. As not every country within the alliance can contribute to all equipment types, most countries just contribute to a few of the categories that the alliance needs. This helps to form a complete weapons portfolio and shows how the alliance influences the military force structures of members.

Air defence seems to be a weak point of the arsenal. Yet, air defence mainly pertains to home-territory protection and, as a result, is an equipment that just about every country has. The largest percentages are held by Egypt and Syria. Both each have about 9 nine percent of the global shares of air defence equipment, most likely because they are dealing with different, personal military crises. The rest of the air defence equipment is dispersed among many countries around the world.

An alliance shapes the military arsenal of each country and can, thus, expect support from different countries depending on their specific military needs. As certain countries possess more of a particular equipment for the sake of the alliance, it can be expected that those countries will be the ones to contribute to the efforts. The ratio spiderplots demonstrate how the alliance determines how the equipment will be dispersed across multiple countries. The cumulative arsenal histogram, Figure 4, reveals which countries will contribute, what they contribute, and how much they contribute to future conflicts.

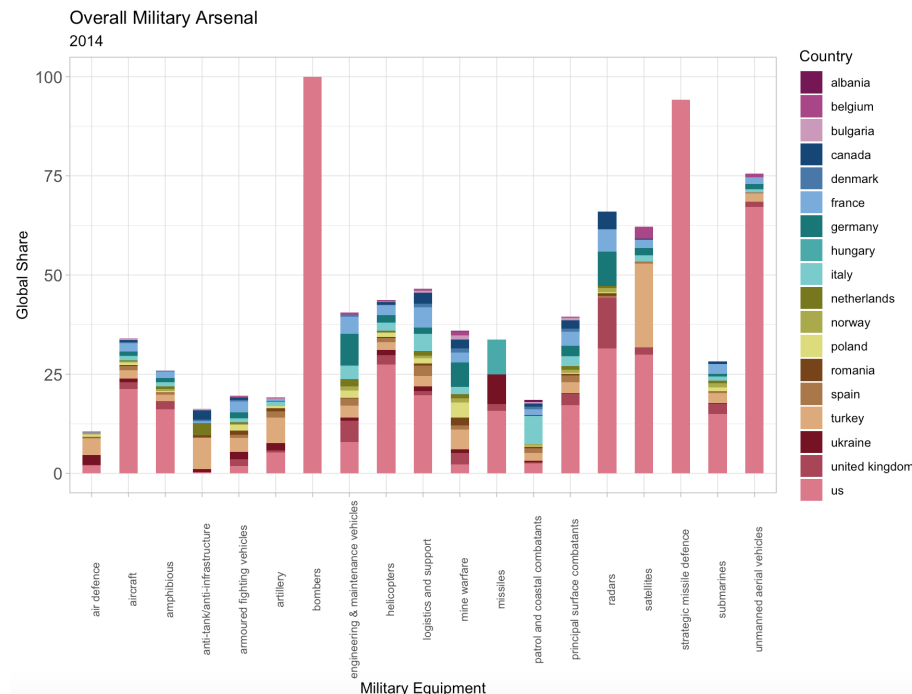


Figure 4: ISAF Shares of Military Equipment by Country

Each bar still represents the alliance’s overall global percentage of a given equipment. But, the different colors that make up the bar reflect the different countries that have the given equipment individually. Then, the height of each colored portion is the percent at which that country possesses it. It is more clear how the military equipment is distributed.

Although the United States contributes a substantial quantity of equipment, they still need help and support from the alliance. The U.S. has some quantity of just about every equipment. Yet, the alliance, on average, doubles the percentage of what the U.S. has in order to help fill out the military portfolio. In the places where the U.S. lacks, their allies compensate. For instance, the U.S. has little to no anti-tank/anti-infrastructure equipment. But, the total alliance makes up roughly 15 percent of the global share.

Collectively, the network alliance plot, the individual ratio plots, the cumulative ratio plot, and the histogram make up my model. These components help to answer the questions as to how an alliance influences a military force structure and, more specifically, who will contribute what equipment to future conflicts given the military needs.

4 Results & Further Analysis

An alliance is a mutually beneficial agreement based on an common interests and goals. A military alliance brings different countries together that share the same mission of international security. Together, the countries can combine their arsenals to form a comprehensive and capable military portfolio. Individually, countries benefit from the assistance of others. Collectively, the alliance serves as a stronger deterring force.

Countries, generally, will not engage in a conflict alone; they need an alliance to support them and provide military aid. The primary benefit a state gets from an alliance are its security benefits since states are able to aggregate capabilities in a way that increases their protection against foreign threats [5]. Some states contribute forces to coalition wars because they care about the material outcome of the conflict and hope to influence that outcome in some significant way. Others contribute forces because alliance obligations or expectations create a cost to free riding. Nonetheless, there are plenty of advantages to being a contributing member in the alliance.

Yet, in order to gain the advantages of alliance membership, a country must prove itself to be useful for different military operations. So, being in an alliance requires a country to provide military equipment that serves to be beneficial to the collective cause. Each country needs to serve a purpose in the coalition. So, it is fair to say that multinational alliances have an impact on the structure of each countries military arsenal. As a result, the alliance has an influence on the distribution of equipment across countries.

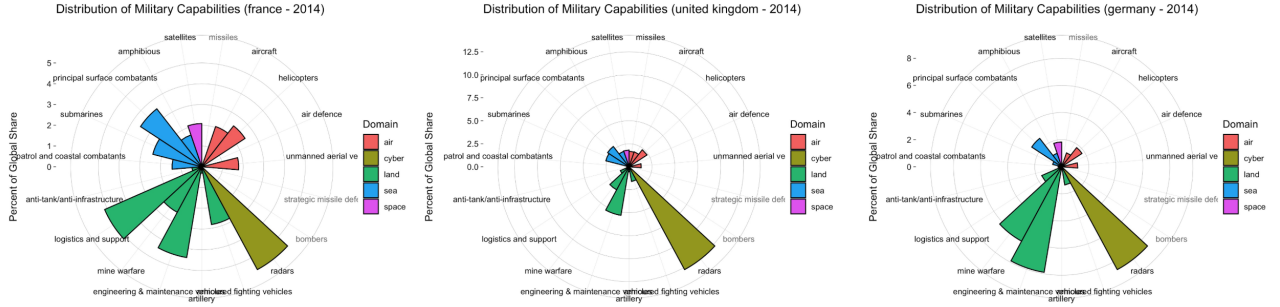


Figure 5: Major US Allies Share of Military Equipment

Research has found that states that are more centrally located within the international network as measured by policy preferences will contribute the most to that peacekeeping mission because they gain private benefits from fighting alongside like-minded states [3]. We expect states that are closely aligned with the initiating state to contribute more than those weakly aligned. This is most likely because closely aligned countries have more to gain from the outcome of the conflict where weakly aligned countries have more to gain from being in the alliance. But, they both need to supply weapons that would help in forming a diverse military portfolio.

France, Germany, and the United Kingdom are all close allies with the United States. So, they would be expected to contribute more to the ISAF coalition compared to countries like Romania or Albania. Yet, it would not be the most beneficial to provide just the same military equipment as the United States. In order to diversify the arsenal that would be utilized for the conflict, close allies should possess a military portfolio that varies from one another, especially from the U.S. For this group of countries, this happens to be the case, as seen in Figure 5, thus reflecting how an alliance can shape a military force structure. While the United States is largely focused on the air-domain equipment, these three countries are more focused on land, sea, and cyber. They provide different equipment and thus expand the type of available equipment. This serves as a result of trying to fill out the collective military arsenal of the alliance.

From Figure 6, we can see some interesting cases of how individual countries have focused on one specific military equipment. These ratio plots help to demonstrate how countries will build up equipment in order to help fill the military portfolio of an alliance. Each of these countries has amassed a singular equipment rather than a diverse arsenal. This reflects their potential purpose within an alliance and, more significantly, how their equipment could be a result of an alliance's influence. Alliances have regulations in place that prevent free-riding. So, that would indicate that these countries were able to contribute something useful to the alliance as active members solely through one major

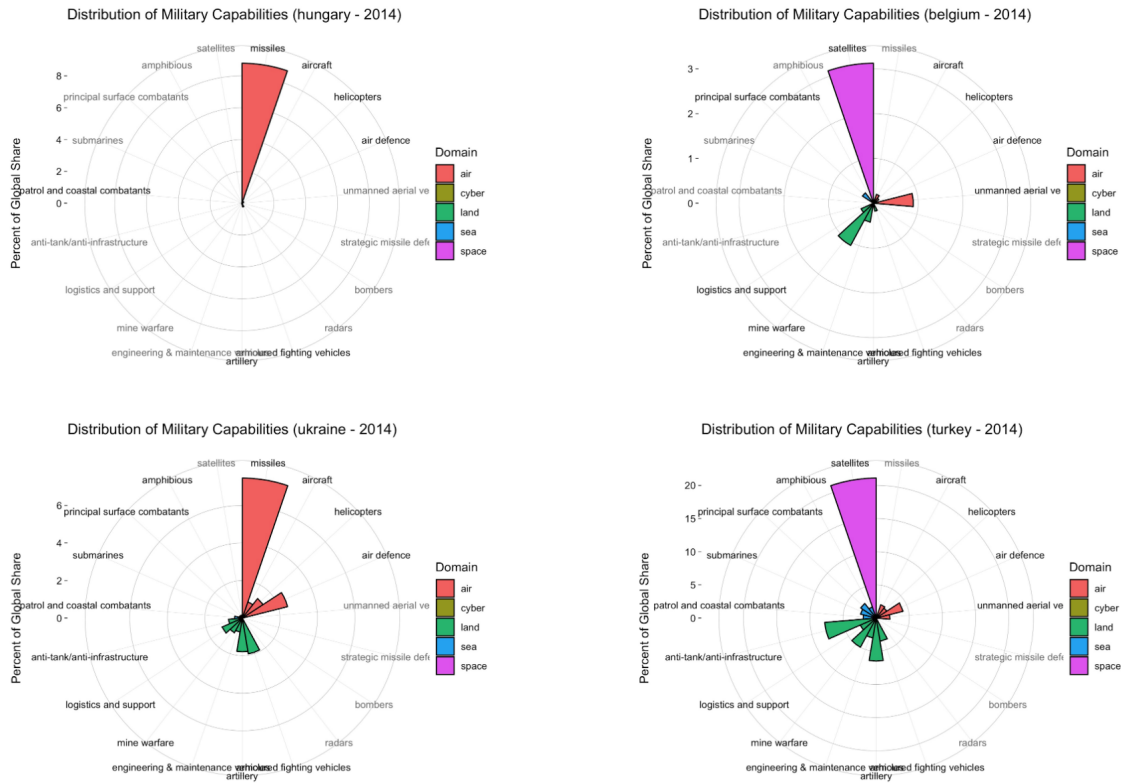


Figure 6: Interesting Shares of Military Equipment

equipment. It is fair to assume that these countries understood that in order to gain the benefits of being in an alliance, they needed to contribute a specific equipment that was deemed as important to the alliance. As a result, they developed an arsenal that would grant them entry into the alliance, thus putting the alliance's needs above their own. Thus, the alliance influenced the military force structure of these countries.

This is best demonstrated by the interesting case of Hungary. For instance, Hungary has roughly 8 percent of the world's share of missiles and has little to nothing else in terms of armaments. As Hungary's only military capability is just missiles, the alliance must have needed those weapons from Hungary in order to complete its own military arsenal. This becomes emblematic of a supply and demand exchange. The ISAF needs missiles, so Hungary provides them and gains the benefits of being an alliance member. The same argument stands for the other three cases, although they are slightly less extreme. Consequently, Hungary and the Ukraine together make up 16 percent of the global share of missiles. Belgium and Turkey make up 25 percent of the global share of satellites.

That is good portion of equipment that is held by just two small countries each. A reasonable justification for this is that the needs of the alliance influenced these countries to develop their arsenal in this way.

While this analysis is limited to an examination of the war in Afghanistan, there is suggestive evidence that the model holds for other coalition conflicts.

5 Conclusion

My model demonstrates that an alliances does in fact influence the military force structure of its members. This is proven as the diverse military equipment is distributed among all of the allies.

The alliance network plot reveals how the different relationships among countries could possibly have an impact on how they structure their personal arsenals. The individual ratio spiderplots and the cumulative spiderplot show how the global shares of equipment are dispersed across the alliance yet still make up a complete military portfolio as a result of the alliance's influence. The histogram would then answer what countries could contribute how much of a given equipment for future conflicts given the military needs.

Although my model is focused on answering how an alliance influences the military force structure of its members, there could be plenty of other interpretations to be drawn. As this model pertains to international relations and global conflicts, it would be very useful for making military strategy decisions. The information can help to determine whether or not to engage in a conflict with another country given each side's capabilities. Or, it could help to answer questions about forming new alliances with countries depending on what they can offer. This model could assist in forming military policy.

My model could definitely be improved through generalization. With more time, I would extend my model by completing it for the duration of the Afghanistan War as it could show how the equipment changed over time. These changes throughout a large-scale military operation could reveal different behavioral patterns and ways in which the alliance's needs impacted the force capabilities of individual countries. Furthermore, I would extend my model to consider other, even older alliances, such as the Axis and Allies in World War II. The code for my model is already generalized, the only thing that would need to change is the input data. My model could also be improved by considering troop contributions. While troops and military equipment are related, there is a different cost to contributing troops to a cause. Sending troops could show different possible behaviors that reflect the relationships within an alliance.

6 Acknowledgments

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