

ARTICLE TYPE

# Allies as Armaments: Explaining the Specialization of State Military Capabilities

Anonymized

## Abstract

Scholars and practitioners have long maintained that a full-spectrum military provides the best security in an unpredictable anarchic world. However, not all states seem to make this choice, with some states having imbalanced, specialized militaries. Are specialized militaries that forgo the development of vital defense capabilities and overinvest in seemingly less necessary ones simply making mistakes? I argue that because defense alliances reduce the security risks of specialization, states with militarily-capable alliance partners can reap the gains of economic efficiency that stem from specialization without sacrificing the security benefits of a full-spectrum force. I substantiate these arguments with a new measure of military portfolio specialization using fine-grained data on state military assets from 1970–2014. While existing research has shown that states provide for their defense with allies and armaments, this paper explains how the former can shape the latter not just in amount, but in composition.

**Keywords:** international relations, international security, conflict, alliances

## 1. Introduction

Despite constitutional restrictions on its military, Japan began shifting its military investments in the late 1970's. By 1982, Prime Minister Suzuki had draw up plans to overhaul Japan's military by investing primarily in air defense and light offshore surface ships (Modly 1985). Although the Soviet threat in East Asia ended a decade later, by the turn of the century Japan had doubled its air defense and short-range aerial capabilities and almost completely phased out its amphibious fleet and coastal ships, despite their clear utility for an island-chain state. Japan's military portfolio had changed fairly significantly by specializing in some capabilities and omitting others in a way that did not seem to align with the international security threats they were facing.

This is exemplary of a broader phenomenon of interest to scholars and practitioners. Why do some states possess seemingly vulnerable militaries – under-producing some capabilities or over-producing others – while other states diversify their defenses against unpredictable international threats? How states plan for conflict and the military tools this involves have much to tell us about war's causes and consequences. The combination of capabilities that comprise a military's toolkit determine the operations it plans for and undertakes, the types of threats it can credibly make, and the consequences of resorting to force. Assuming the primary purpose of a state's military is to provide security against perceived threats (Waltz 1979, 102–14), most states should diversify their force structure because doing so compensates for the inherent weaknesses of any one set of capabilities and helps deal with unanticipated or opaque threats (Biddle 2005, 199–200). And yet, there are myriad examples of seemingly risky specialization like the US forgoing minesweepers in the 1980's even though 13 of the 15 US ships sunk since World War II were victims of naval mines (Till 2005), Albania producing dozens of coastal patrol vessels that could be deployed as far as Portugal despite having the 9th *shortest* European coastline (Polak, Hendrickson, and Garrett 2009), or Estonia investing in sophisticated cyber capabilities but having no combat aircraft even in light of warranted concern about Russian aggression (Andžāns and Veebel 2017). Why do some countries have gaps in

their militaries that they could fill, but choose not to, or excesses and redundancies they could avoid, but maintain?

My central argument is variation in the specialization or diversification of a state's defense capabilities can, in part, be explained by the presence of allied states. Alliance relationships allow states to reduce the cost of forgoing some capabilities and overproducing others. States can have their cake and eat it, garner the benefits of having both specialized and diversified military capabilities by individually specializing when the relationship with their allies can produce collective diversification. The result is variation in the composition of military capabilities across states – some being comparatively more specialized or diversified. Examining a state's military specialization and its alliance relationships from 1970 – 2014, I find that states with more militarily-capable alliance partners specialize their militaries more than those with weak or non-existent allies.

This contributes to our understanding of two foundational trade-offs in international politics: guns versus butter (R. Powell 1993; Poast 2019b) and allies versus armaments (Morrow 1993; Yarhi-Milo, Lanoszka, and Cooper 2016). Diversifying one's "guns" may be the right choice for a state's security, but it produces a higher defense burden that necessitates less resources available for "butter" or accepting the risk of not investing in the weapons a state may need. But by influencing the *types* of armaments a state produces, alliances can minimize that guns versus butter trade-off through efficiency improvements (Kinne and Kang 2023). A contribution of this paper is detailing and substantiating an underexamined mechanism by which alliances produce these efficiency improvements: specialization in armament decisions.

In the next section, I describe existing research concerning the factors that determine a state's force structure in general, and more specifically why states sometimes pursue a specialized distribution of military capabilities. Section 3 introduces a model of the trade-offs in choosing a specialized or diversified defense portfolio, theorizing alliances address that trade-off by sufficiently minimizing the risks inherent in specialization. Section 4 empirically tests this theory using a new entropy-based measure of military portfolio specialization adapted from statistical ecology and applying it to existing data on disaggregated national military capabilities. Section 5 concludes by discussing the implications of these findings and motivating future research on how alliances influences armaments.

## 2. Existing Explanations for Variation in the Distribution of Military Capabilities

Much research focuses on variation in the *size* of state militaries (Cappella Zielinski, Fordham, and Schilde 2017) without explain why militaries vary in their *composition*.<sup>1</sup> Although geography (Edström and Westberg 2020) and economics (Brooks 2005) create scope conditions, the decision-making process surrounding the compositions of a states arms is still fundamentally political (Caverley 2007). Early debates about the political determinants of a state's weapons development were framed around internal versus external causes (Evangelista 1988). Theorists forwarding internal explanations argued that because there was no single authority for weapons development decisions (Allison and Morris 1975), the composition of a state's military was determined by domestic factors like bureaucracy (Farrell 1997), constituency interests (Higgs 1988), or scientific R&D culture (Zuckerman 1982). In contrast, external cause advocates argued armament decisions were primarily a strategic response to foreign threats (McNamara 1967).

### 2.1 Internal Sources of Armament Decisions

Theories of internal sources of armament decisions have typically tried to explain weapons acquisition more generally, rather than identifying whether those weapons acquisitions are consistent with a specialized or diversified aggregate military portfolio. These theories identified the role of economic support for influential defense contractors (Kurth 1973), although others believe a strict regulatory

1. On the shortfalls of common aggregate measures like the Composite Index of National Capabilities (CINC), see Kadera and Sorokin (2004) and Carroll and Kenkel (2019).

environment limits this (Mawdsley 2018). Separately, re-election incentives may explain weapon developments that generate jobs or shore up nationalism (R. G. Carter 1989; Whitten and Williams 2011) although there is disagreement about the empirical record (J. M. Lindsay 1991). Similarly, political ideology and regime type may shape preferences for or against a particular military capability, as evidenced by trade protectionist support for battleship fleet development (Kehr 1975; Fordham 2019) and autocratic concerns about regime security (Way and Weeks 2014).

More socially-driven domestic considerations point to the importance of non-state actors and incentives, but are less tied to the assumption of egoistic profit motivations and political self-interest. Instead, the weapons a state develops may be decided by scientists and technologists (Zuckerman 1982), although this perspective has been challenged by further empirical examinations of the same Cold War case studies (MacKenzie and Spinardi 1988). More sociological theories have posited that status concern explains particular weapons acquisitions like high-technology aircraft or naval carriers (Eyre and Suchman 1996; Hintz and Banks 2022) but only in limited empirical cases.

## 2.2 *External Sources of Armament Decisions*

The dominant “external cause” explanation for why a state has the military capabilities it does concerns that state’s international threat environment (Nordhaus, Oneal, and Russett 2012), meaning variation in states’ distributions of military capabilities is explained by the perceived best response to security threats, subject to economic capacity (Resende-Santos 2007). One important implication of this neo-realist assumption concerns states as like-units. States with similar resource endowments should have similar distributions of military capabilities even when they face a common enemy (Resende-Santos 1996; Goldman and Andres 1999). Waltz (1979, 127) argues that even where material capabilities differ, “contending states imitate the military innovations contrived by the country of greatest capability and ingenuity. And so the weapons of major contenders, and even their strategies, begin to look much the same all over the world.” Because states cannot resolve the problem of credibly relying on one another and power is distributed “to protect no group purpose”, the self-help nature of the international system should prevent states from being able to functionally differentiate their military capabilities by relying on each other (Posen 1984, 36–37).

Since the absence of an international sovereign makes cooperation under anarchy difficult, states try to maximize their security through a full-spectrum approach to defense where each state acquires the military capabilities they deem necessary (and feasible) for their national security. Diversifying one’s military resources best aligns to strategy because “each weapon, unit, and technique possesses a unique set of capabilities and vulnerabilities. Taking full advantage of these military assets increases the likelihood that an armed force will fulfill its mission” (Millett, Murray, and Watman 1986, 52).<sup>2</sup> The historical record also finds this logic among practitioners, as “a synergistic mix of platforms and weapons intended to produce a force or more capability than that represented merely by the sum of its parts, has always been justified by the argument that it provides a wide range of responsive options” (Till 1994).

## 2.3 *Unexplained Variation in the Aggregate Composition of Military Capabilities*

While domestic politics certainly influences acquisition decisions, production capacity, and innovation patterns, the predictions they generate for the overall composition of a state’s military are less clear. These theories do not try to explain why, for example, states with an influential military-industrial complex would have highly specialized force structures or why one should expect states with divided governments or protectionist politicians to have a more or less diversified force (Rhodes 1994). Domestic institutions may create biases toward the status quo by imposing constraints on changes

2. Although the claim states desire/need all military capabilities is a simplified theoretical ideal type that is rarely, if ever, realized empirically, the logic that a jack of all trades is safer than being a master of one holds true for state leaders deciding what resource allocation is best for security.

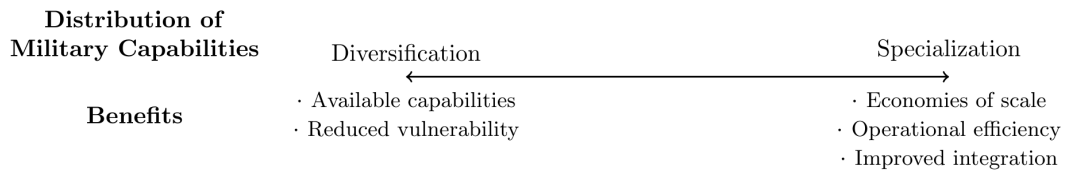
to one's military, but that stickiness explains consistency rather than the changes observed within a country over time (Halperin, Clapp, and Kanter 1974). The same is true of geography. Although it conditions specific armament decisions – aircraft carriers make little sense for landlocked states and rugged terrain may warrant helicopters – it's unclear what geographic factors would explain a highly specialized versus a highly diversified military portfolio. Similarly, while threats certainly condition what capabilities a state chooses to arm itself with, these theories do not explain the empirically observed decision by states to specialize their militaries by omitting or over-producing capabilities given their threat environment. They assume states are like-units that, holding economic capacity and geography constant, should converge in developing similarly diversified full-spectrum militaries. Sameness and diversification are theoretically assumed, but not empirically substantiated.<sup>3</sup>

### 3. A Theory of Specialization Within Alliances

#### 3.1 Costs and Benefits of Specialized Defense

States face a constrained optimization problem where the set of resources available to accomplish a given task are finite. So when allocating resources to defense, decisions about the capabilities a state should possess involve a zero-sum balance between efficacy and efficiency.<sup>4</sup> States can manage this trade-off by allocating resources toward many capabilities (prioritizing efficacy) or toward a few (prioritizing efficiency). States prioritizing efficacy invest in a diversified military portfolio because it reduces their overall vulnerability, but at a relatively higher economic cost. In contrast, a state prioritizing efficiency invests in a specialized military portfolio because it comes with economies of scale and improved integration, but at the risk of not having capabilities it may need.

The costs and benefits of both ends of the dimension of interest – specialization and diversification – are summarized in Figure 1. Although the benefits of military specialization initially seem like economic issues that should take a backseat to security considerations, the two are inevitably intertwined because a state's decisions about how to best provide for its defense occur within a constrained optimization environment. Thus, economically-conscious defense decisions impact how well a state will be able to provide for its security and how well various aspects of their defense portfolio work with one another during conflict. The three primary benefits of specialization stem from economies of scale, operational efficiency, and improved integration.



**Figure 1.** Varieties of a state's distribution of military capabilities.

First, the cost of setting up manufacturing and acquiring the materials for weapons acquisition entail large upfront investment. But the marginal cost of that investment goes down as a state decides to produce more of the same asset (Markowski and Hall 1998). For example, Germany has reduced the need for redundant infrastructure by centralizing car and light truck production all within the Bundeswehr-Fuhrparkservice GmbH which allows them to produce newer but less varied vehicles more quickly (Overhage 2013). Economies of scales are also “active” in that they accrue as a state undertakes defense-related activities, so the more a state operates with a particular asset, the lower

3. An extensive literature has detailed shortcomings of the like-unit assumption. See, for example Onuf (1989) and Sharman (2013).

4. I largely bracket the preferences of domestic actors and instead consider how these aggregate to state-level armament decisions. For contrasting views on this assumption, see Sandler and Hartley (1999) and Fevolden and Tvetbråten (2016).

their marginal costs because of “learning by doing” (Postrel 2002). Even states that are primarily “arms buyers” as opposed to “arms builders” experience reduced maintenance and repair costs from a shorter list of components and end-use products.

Second, specialization allows a military to perform select missions more efficiently by streamlining logistics and reducing the overall cost of learning how to use new equipment. Many assets require capability-specific investments that involve a fixed cost. A state with several dozen different types of aircraft will require more complex pilot training than a state that only has to master the effective use of a few types of aircraft. One source of NATO’s debate over who should send main battle tanks to Ukraine concerns Ukraine’s familiarity with how those more complex systems work; they could immediately operate T-72 tanks sent from Eastern Europe, but training and logistics for the US Abrams tank would take months (Lanoszka and Becker 2023, 6–10).

Third, integration is easier as a country specializes since the complexity of integrating numerous types of platforms with various roles and responsibilities decreases. Even issues as fine-grained as the software used in various pieces of equipment are sufficient impediments to military operations that nations consider this issue carefully. NATO’s Standardization Agreement (STANAG), for example, ensure broad fleet compatibility with the same fuel nozzle. In 2019, Jordan gave up its Chinese-built CH-4 drone fleet because successful integration with other platforms was going to require a costly overhaul of their entire communications system (Penney 2020).

In contrast to specialization, the benefits of diversification concern the security gains of a full-spectrum military that makes combined arms warfare possible (Biddle 2005). States that engage in a full-spectrum approach to warfare instead of specializing benefit from having more of the capabilities needed to defend themselves. No weapons system is perfect, and the nature of warfare means weapons systems that excel at one aspect of international conflict do so precisely because they lack other abilities. Aerial bombers sacrifice maneuverability so that they can carry a high payload. But more maneuverable aircraft like fighters achieve the benefits of speed with lower ordinate payloads. Far from just a tactical consideration, this diversification is a political and strategic concern since higher-order state objectives like credibility, effectiveness, and efficiency are advanced by military platforms in varying and often zero-sum ways. “Military specialization imposes opportunity costs in terms of what a nation does well and where it must compromise its capabilities. Choices about what to buy, and where and how to field the nation’s military might, then pose certain constraints on political strategy” (J. R. Lindsay and Gartzke 2022, 346).

Diversification also reduces vulnerability by making it more difficult for the adversary to develop countermeasures. A state with a limited variety of assets has given their adversary a shorter list of capabilities they must be able to defeat to prevail in combat. Air defense systems, for example, come in three different varieties; surface-to-air missiles (SAM), anti-aircraft artillery (AAA), and aircraft armed with air-to-air missiles (AAM). These systems all differ in the altitudes they can target, stealth, reaction times, mobility, and cost. In a 1940 testimony before the Senate Appropriations Committee, General George Marshall noted the need for both aircraft and anti-aircraft artillery because the former is an area system that excels at searching while the latter is a point system designed to protect key assets. When asked by Congress which was most important he said all of them; “the whole thing is interwoven... all these matters have to be given proper weight to get a well integrated and balanced whole” (Hammel 2010). A state that has chosen to develop only one of these capabilities might have more in quantity (scale economies) and quality (operational efficiency and improved integration), but they are now vulnerable to the development of new missiles and aircraft designed to circumvent the strengths of their adversary’s one air defense system (Gartzke, Kaplow, and Mehta 2014, 484–85).

Former US Chairman of the Joint Chiefs of Staff Colin Powell (2010, 157) described a diverse, full-spectrum force as involving the ability to “prevail, quickly, and cheaply, in any and all forms of conflict”. States that have not embraced this model have consequently suffered. After the Yom

Kippur war, Israel opted to specialize their military by cutting artillery and mechanized infantry in favor of a shift to pure armor-aircraft. This left them vulnerable to an anti-armor and anti-aircraft attack that set them back in the early stages of the 1973 Arab-Israeli War. It was only after they reversed course that they were able to defeat the Egyptian air defense systems (Herzog 2018). After World War II, India's Naval Plan Paper (1947) made the case for a "balanced naval task force" which was later explained by Vice Admiral Parry (1949) as a move to reduce India's vulnerability with a navy "containing all types of ships and aircrafts, on the sea, over the sea, and under the sea".

### 3.2 *Allies Increase Specialization's Payoff*

Even well-resourced states experience difficulty excelling at all forms of conflict simultaneously (D. R. Lake 2012, 91). Making priorities is both a product of luxury and of necessity. An actor can overcome this constrained optimization problem and minimize the trade-off between efficiency and efficacy through security cooperation.<sup>5</sup> Working with partners allows for individual functional specialization under the auspices of a broader defense arrangement. A parsimonious way to think about this in the international context is defense alliances, since they are an indication of the two prerequisites for security cooperation with a committed partner: (1) belief in a partner's willingness to play a role in improving your well-being and (2) their ability to do so (Morrow 1994; Leeds 2003).<sup>6</sup> Specialization is thus not a questionable prioritization of efficiency by states choosing to forgo the security benefits of a diversified military, but instead a way to get the best of both worlds made possible by architectures of international cooperation.

Alliances increase the payoffs of military specialization in a few ways. Having allies who you believe will come to your defense allows a state to allocate resources toward non-security functions since defense resources are aggregated. In spending less on your own military, you can under-invest in certain capabilities that have high marginal production cost at current levels. Practitioners have recognized how the resource re-allocation benefits of alliances translate to focused specialization. US Naval Rear Admiral M. E. Smith (2013) noted that by having a cooperative approach, "each nation can avoid duplication and thereby reduce its proportional share of the expense. This is... about a focused and pragmatic approach to force allocation that acknowledges allies' existing contributions. Countries could immediately apply the freed resources to unique national missions."

Second, the resource gains under cooperation are more than the sum of their parts because of scale economies. Collective defense can be more than the sum of its parts if specialized actor bring a smaller variety of capabilities to the table, but more of them. Discussions in the US about a '1,000 ship Navy' are predicated on precisely this model; "a voluntarily global maritime network that ties together the collective capabilities of free nations to establish and maintain a dramatically increased level of international security in the maritime domain" (Morgan and Martoglio 2005). Similarly, the 2002 Prague Summit outlined 8 areas over which NATO states could try to specialize, which 2011 Chicago Summit advocated as "certain countries should let go of certain capabilities in order to create a more rational defence structure from a Brussels perspective" (Christiansson 2013, 181–86).<sup>7</sup> This resulted in Czechia specializing in CBRN defense, Denmark omitting submarines, the Baltic states emphasizing cyber defense at the expense of fighter aircraft, and a handful of states taking the lead on strategic airlift.

Alliances that vary in their structure and purpose will also vary in the mechanism by which they incentivize specialization (Leeds, Mattes, and Vogel 2009; Mattes 2012). Specialization may be the

5. This theory is derived from business organization research on inter-firm cooperation (Gulati, Nohria, and Zaheer 2000; Meier, Stephenson, and Perkowski 2019).

6. These two conditions exist more generally for theoretical cooperation (Deutsch 1962). I choose the language "well-being" rather than "security" because this also applies to asymmetric alliances where instead of seeking protection, the dominant state may be seeking autonomy to advance pursuit of its preferred foreign policy outcomes (Morrow 1991, 907–9).

7. Auerwald and Saideman (2014, 229–33) also point out specialization can help individual states engage in cost-effective defense investments while maintaining an aggregate full-spectrum allied force, but are skeptical trust issues can be overcome.

product of high interest alignment resolving coordination problems or hierarchy reducing the risk of opportunism coercively or contractually (Gannon 2021a). But theorizing the conditions under which some alliances are more or less likely to induce specialization risks putting the cart before the horse without initial evidence that alliances influence the composition of a state's arms portfolio at all. Linking alliance membership with higher military specialization is a necessary precursor, setting the foundation for differentiating alliances based on the mechanisms by which specialization occurs and which alliance members specialize in what.

In sum, force structures that omit useful defense capabilities and/or overproduce others can occur when a state has opted to specialize its military portfolio. A state is more willing to do so when the security risks of specialization are no longer prohibitive; a condition made possible by alliance relationships that resolve the constrained optimization problem. Shared defense thus garners the security benefits of capability aggregation posited by the neo-realists (Parent and Rosato 2015) as well as the economic benefits put forth by hierarchy theorists (D. A. Lake 2001, 147–51).

## 4. Empirical Analysis

### 4.1 Dependent Variable

The dependent variable is the degree of specialization of a state's distribution of military capabilities in a given year. A state's distribution of military capabilities is defined here as the combination of military equipment that could be used by a state during conflict. This includes platforms like artillery, aircraft, naval vessels, armored vehicles, satellites, and transport ships.<sup>8</sup> I choose these scope conditions because military platforms are equipment that can be deployed, that other nations are likely to observe, that could be used to signal intent and resolve in a crisis without actual use, and that are durable goods.<sup>9</sup> The index is constructed using the rDMC dataset detailing annual counts of 69 different military platforms across all states from 1970–2014 (Gannon 2021b).

To measure military specialization at the country-year level, I create an index quantifying the differences across states' distribution of military capabilities identified as omissions and over-productions relative to the neorealist baseline assumption that states behave as like-units under anarchy and should consequently seek similarly diverse military capabilities subject to resource constraints. Assume that global defense in year  $t$  is composed of  $N$  countries and  $M$  military technologies. I construct an  $n \times m$  interaction matrix for each year  $t$  such that each row  $n$  is a country and each column  $m$  is a technology. Each cell thus represents the observed count of a given technology in that country-year's military. In aggregate, this can be represented as  $d_j = \sum_{i=1}^N (p_{ij} \cdot \frac{p'_{ij}}{q_i})$  where  $N$  is the total number of countries in that year,  $p_{ij}$  is country  $i$ 's possession of technology  $j$  divided by the total amount of technologies  $j$ , and  $q_i$  is the total number of technologies possessed by country  $i$  divided by the total number of technologies in the world.<sup>10</sup>

From this, I calculate the functional entropy of each country's military using a trait-based similarity measure drawn from Rao's (1982) quadratic entropy calculation of the average difference across technology portfolios between each country and all other countries in a given year weighting the technologies by their relative abundance. This calculates the functional entropy of a country's military as:  $R(p_i, D) = \sum_{k=1}^S \sum_{l=1}^S \sqrt{(p_k|i)} \sqrt{(p_l|i)} d_{kl}$  where  $p_i = (p_1|i, \dots, p_k|i, \dots, p_S|i)$  is the vector of relative technology abundance within country  $i$ ;  $S$  is the number of technologies;  $D = (d_k|i)$  is the

8. The data do not include munitions like single-use bombs or ammunition or firearms used by individual military personnel. Existing research has made similar distinctions in what military capabilities are examined cross-nationally (Brooks and Wohlforth 2016).

9. While platforms and capabilities are not synonymous, there are here categorized based on their role/mission which serves as a reasonable proxy for capabilities. For example, fighter aircraft differ from bomber aircraft in what they allow a state to do, and those differ yet still from transport or tanker aircraft.

10. This bipartite network structure is modeled after its use in ecological research (Alarcón, Waser, and Ollerton 2008).

matrix of functional dissimilarity between the technologies, and  $d_{kl}$  is the functional dissimilarity between countries  $k$  and  $l$  (Pavoine 2020).<sup>11</sup>

To provide some intuition, this measure of entropy calculates the degree of surprise or unpredictability produced by the difference between the amount of a military capability we expect a country to possess and what that country actually possess. This prior expectation is based on the distribution of technologies across all other states and within the state in question, thus providing a relative and absolute measure. For example, if most states possess, on average, twice as many transport helicopters as they do transport aircraft, we would expect a state with 10 transport aircraft to have roughly 20 transport helicopters. But if the state in question already possessed many more transport aircraft than everyone else, we would update our expectation since we know a way this quantity differs from other states and other capabilities. Our expectation for transport helicopters can thus be *re-calibrated* based on (1) the number of transport aircraft this states possesses relative to everyone else's transport aircraft, and (2) the number of transport aircraft this state possesses relative its other capabilities. If we now reproduce this method across all other capabilities, we get a revised prior expectation for the capability in question – transport helicopters. The closer the observed quantity is to our final re-calibrated expectation, the less entropy the quantity produces, and thus the lower the level of specialization since producing many more or far fewer transport helicopters than the model expects are both indications that the state has absolute and relative specialization by omitting or over-producing that capability relative to intra-state and interstate expectation.

Figure 2 shows the distribution of this index across all observations.<sup>12</sup> Among the most specialized observations are Japan after 2010 and the least specialized include the Baltic states in the early 1990's. Given the number of destroyers and offshore coastal ships Japan possesses, having almost no amphibious ships is an unexpected form of naval specialization (in the entropic sense). So while Japan may dominate in many military capabilities, that does not mean its relative dominance is equal across the board. Even the United States has specialized, with famous underproductions including the lack of minesweepers during the 1984 Iran-Iraq Tanker War (DeVore 2009), nuclear, chemical, and biological (NBC) reconnaissance vehicles at the start of the 2003 Iraq War (Geis 2013, 241–55), and icebreakers in recent years (Markowitz 2020). Importantly, having a diversified military is not synonymous with having a lot of everything. States can have very little of everything, making them similarly *incapable* across the board.<sup>13</sup>

## 4.2 Independent Variable and Controls

The independent variable measures a state's alliance relationships.<sup>14</sup> A state's allies are those with whom it has a defensive alliance pact whereby the partner state has made a promise to defend the state in question. As most states have at least one formal treaty ally in a given year, existing research using alliances as an independent variable has proxied for the importance of a state's allies to that state's security. I operationalize alliances at the country level two different ways; (1) as the logged sum of military spending of a state's allies (excluding itself) (DiGiuseppe and Poast 2016) and (2) the ratio between a state's CINC score and the sum of their alliance CINC scores (including itself) (Fang, Johnson, and Leeds 2014; Johnson, Leeds, and Wu 2015). For both variables, higher values indicate

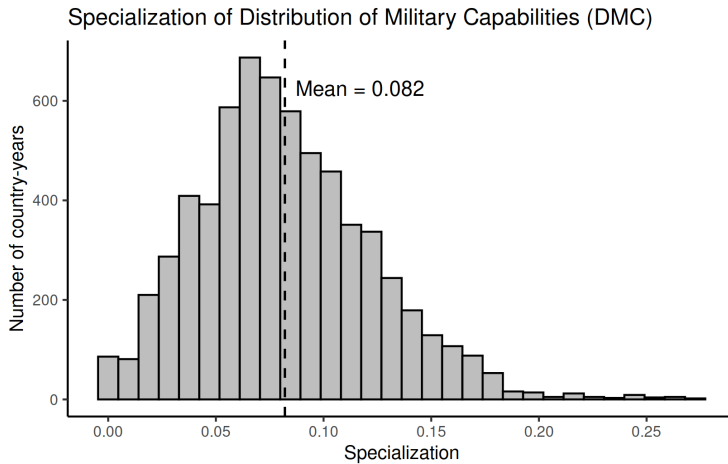
11. As this measure of functional entropy is developed by Pavoine et al. (2017), its formula is provided verbatim. In the original statistical ecology application, this measure uses Hill (1973) numbers to measure the dissimilarity between biological species based on observed traits, accounting for the rarity of those traits.

12. There is a small, statistically significant, positive temporal trend in specialization that is accounted for in the statistical model. Technology evolves dynamically, in this case maybe due to shifts away from high-quantity legacy systems towards high-quality expeditionary warfare systems (Terrieff, Osinga, and Farrell 2010; Schnaubelt 2011).

13. Almost all states possess certain capabilities like light transport aircraft and search and rescue helicopters. This is consistent with accounts of basic infrastructure ensured by "critical assets" (Matl  ry and   sterud 2007) and identifies the importance of accounting for economic capacity to ensure the specialization index is not simply measuring the luxury of economic choice.

14. Data on state participation in defensive alliance pacts is provided by the Alliance Treaty and Provisions (ATOP) dataset, version 5 (Leeds et al. 2002).





**Figure 2.** Distribution of country-year military specialization. The measure is bounded between 0 and 1, with 1 representing the highest theoretically possible level of specialization.

more militarily-capable alliance relationships which serves as an observable indicator of conditions conducive to military specialization. Because a formal defense commitment suggests a mutual belief in a partner's willingness and ability to provide defense, a state with more militarily-capable allies should be more confident that specializing its military will not leave it vulnerable (A. Smith 1995; Benson and Clinton 2016).

I include a set of control variables that existing theories indicate could be causally related to the dependent and/or independent variables of interest. The models control for regime type, coding a country as a democracy if they score higher than 6 on the 21-point Polity V index. Democracies may spend less on defense (Fordham and Walker 2005), build more capital-intensive militaries (Gartzke 2001), and be more (DiGiuseppe and Poast 2016) or less (Gartzke and Gleditsch 2004) reliable partners. There is also a control for whether a country has been involved in an interstate war in the previous half decade, as a salient threat environment (Ghosn, Palmer, and Bremer 2004) or recent conflict experience may change patterns of innovation (Kollars 2015). The models control for GDP, as resource-constrained states may be unable to invest in a diverse array of military capital (Diehl 1994) or may shift defense funds from platforms to personnel due to unemployment (Becker 2021).<sup>15</sup> Finally, I control for CINC scores, as states harboring global ambitions may invest more in power projection capabilities (Markowitz and Fariss 2018).<sup>16</sup>

### 4.3 Model and Results

The dependent variable is military specialization of country  $i$  in year  $j$ , measured with the functional entropy index described above. Higher values indicate more specialization and less diversification. As the dependent variable is continuous, I estimate a series of ordinary least square (OLS) regressions using the two different independent variables – (1) logged sum of allied military spending, (2) ratio of a country's CINC score to that of all its allies and itself. For each independent variable, I estimate a bivariate model country-clustered standard errors to account for the non-independence between

15. "Tech-flation" could explain why higher security costs cause militaries to adopt fewer, but higher performing platforms (Adelman and Augustine 1990), although the empirical record in Europe suggests states diversify their military portfolios despite the financial cost of doing so (Howorth 2007).

16. In addition to having unclear expectations about their relationship to specialization, time-invariant geographic variables are addressed via fixed effects models in the appendix rather than constant model parameters that risk model degeneration (Beck 2011).

observations in panel data (Cameron and Miller 2015) then a model that adds all control variables and year scaled cubic polynomials to account for temporal specialization trends (D. B. Carter and Signorino 2010).

Table 1 shows the results of all four models. Models 1 and 2 demonstrate allied military spending is positively associated with military specialization with statistical significance of at least the 0.05 standardized level. Although allies' CINC ratio is negative associated with military specialization in the bivariate model (Model 3), the inclusion of control variables and temporal dependencies (Model 4) reverses the association, which is consistent with the other models and theoretical expectations. In aggregate, these results provides suggestive evidence that states that have militarily-capable alliance partners have more specialized military portfolios – omitting certain capabilities and over-producing other capabilities – relative to states that are reliant upon self-defense.

I present the OLS results here as they are most easily interpretable and consistent with modeling specifications in existing research with similar data. Nonetheless, these results are robust to a series of alternate model specifications provided in the appendix that relax assumptions about the underlying distribution of the dependent variable and temporal and country-specific trends. Similar results are found using fractional logit and beta regressions, Bayesian zero-inflated and ordered beta regressions, and with alternate fixed effects and standard error clustering specifications.

**Table 1.** Military Specialization and Alliances, Multivariate Analysis

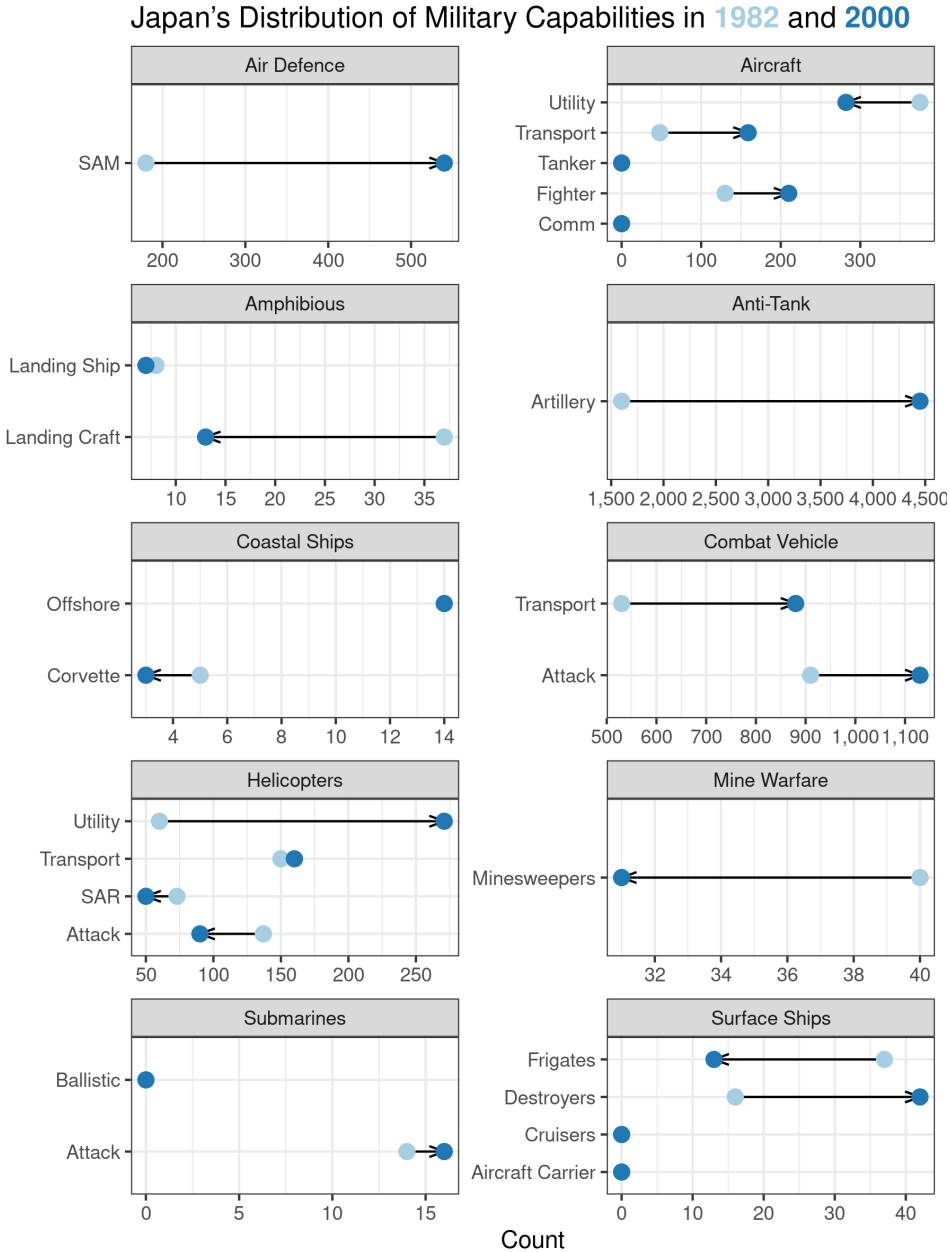
	Model 1	Model 2	Model 3	Model 4
Allies' Mil Spend. (log)	0.004*** ( $<0.001$ )	0.001* (0.035)		
Allies' CINC Ratio			-0.045* (0.022)	0.025* (0.035)
Democracy		-0.002 (0.515)		-0.0002 (0.958)
Interstate War (5yr lag)		0.001 (0.846)		0.002 (0.674)
GDP (log)		0.012*** ( $<0.001$ )		0.013*** ( $<0.001$ )
CINC		0.183 (0.293)		0.203 (0.278)
Year		0.006*** ( $<0.001$ )		0.006*** ( $<0.001$ )
Year <sup>2</sup>		-0.0002*** ( $<0.001$ )		-0.0002*** ( $<0.001$ )
Year <sup>3</sup>		0.000 003*** ( $<0.001$ )		0.000 003*** ( $<0.001$ )
Num.Obs.	4629	3900	4568	3900
AIC	-7400.7	-9085.7	-7079.8	-9067.4
BIC	22 397.6	15 306.0	22 265.1	15 324.2
+ $p < 0.1$ , * $p < 0.05$ , ** $p < 0.01$ , *** $p < 0.001$				
<sup>a</sup> All models include country-clustered standard errors.				

The relationship between alliances and military specialization is also substantively significant. Holding all control variables constant, a one standard deviation increase in allies' CINC ratio (independent variable in Models 3 and 4) is associated with a 1.4% increase in a state's military

specialization; the difference in Japan's military specialization between 1982 and 2000. Despite what is traditionally understood as a lopsided division of security responsibilities, the US and Japan have each specialized their security responsibilities intentionally (Ando 2015). Japan's 1982 capability realignment described in Section 1 signaled the start of a new era of cooperation with the United States, with the joint communique issued by Prime Minister Suzuki and President Reagan (1981, 3) stressing "the desirability of an appropriate division of roles between Japan and the United States". Japan was entrusted with protecting its sea lines of communication (SLOCs) 1,000 nautical miles off its coast and providing logistical support to offensive US operations as needed. Figure 3 illustrates how one result of this strengthened alliance was a more specialized Japanese military. Japan doubled its SAM and far-from-shore naval capabilities like destroyers and utility helicopters and significantly downsized its amphibious and coastal fleets. The alliance relationship with the United States allowed Japan to carry the "defensive shield" by specializing in capabilities for SLOCs and rear-area support while forgoing "offensive spear" attack-capable surface ships and high-tech long-range aircraft (Schoff 2014).<sup>17</sup>

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17. This case illustrates an important avenue for future research – the degree to which specialization at the dyad or alliance-level is complementary. An allies' defense portfolio can compensate for a given state's specialization by possessing the capabilities the given state is missing or by possessing a diversified full-spectrum force. The former suggests the reliance is unidirectional, while the latter suggests a degree of mutual interdependence.



**Figure 3.** Change in Japan's distribution of military capabilities between 1982 and 2000. Capabilities Japan did not possess at any point during this time period (eg ballistic missiles and drones) are omitted.

## 5. Conclusion

Despite recognition that how states spend their defense dollars matters (Kunertova 2017; Becker et al. 2022), research has largely failed to identify ways military portfolios vary, nonetheless explain that variation. This paper focuses on one important dimension on which military portfolios vary - their degree of specialization - and the role that alliances play in explaining that variation. The conventional understanding about a state's choice to provide for their security internally (arms) or

externally (allies) requires understanding that alliance relationships influence not just the amount, but also the *composition* of a state's armaments. This intersects importantly with the guns versus butter trade-off because of the economic implications of the decision to have a military composed of a few specialized assets or a broadly diversified force.

Debates about the value of alliances often turn to the costs of alliance commitments (Alley and Fuhrmann 2021; Cooley et al. 2022) and burden-sharing (Blankenship 2021; Becker et al. 2023). Security cooperation allows states to "take advantage of economies of scale in the provision of defense and to benefit from specialization by coordinating training, equipment, and procedures. By pooling their efforts and/or cooperating with states that have different comparative advantages, leaders hope to create a stronger joint fighting force" (Leeds and Anac 2005, 185). By advancing discussion from burden-sharing *costs* to burden-sharing *configurations*, new perspectives on the value of alliances emerge (Gannon 2022).

Then US ambassador to NATO Ivo Daalder (2013) noted that the problem was not that NATO countries were not spending enough on defense, it was that they were not spending that money wisely. This paper substantiates specialization as a novel mechanism by which alliances can reduce states' military spending by providing "greater security with fewer resources but more coordination" (Rasmussen 2011). As economic pressures maximize the importance of avoiding wasteful defense spending, allies can turn to specialization to ensure that spending is efficient while still being efficacious. As UK Secretary of Defence Hammond (2012) explained, the answer to this economic pressure lies in "prioritizing ruthlessly, specializing aggressively, and collaborating unsentimentally."

But specializing one's military because of reliance on others is not without its risks, as there is always a "fear that the other will not live up to the terms of the agreement" (D. A. Lake 1996, 15). Japan and South Korea's defense strategies have remained neither static nor the same. Contemporary discussions about militarization in response to Chinese, North Korean, and Russian threat have put their respective alliances with the US front and center. To the degree that Japan has specialized their military in forgoing and/or overemphasized certain capabilities because of their relationship with the United States, their ability to defend themselves in the event of attack may be compromised. South Korea may be trending in the opposite direction, signaling their discontent with the alliance by publicly contemplating the need to duplicate uncertain US nuclear protection with an arsenal of their own (Lind and Press 2023). More generally, if states feel confident they can rely on their allies, we should see them continue to specialize their militaries. Conversely, allies beginning to diversifying their military portfolios may be hedging their bets in seeking to defend themselves with a full-spectrum force rather than risk the consequences of abandonment.

Future inquiries should explore several critical avenues. Defense cooperation takes many governance forms that allow states to rely on each other to different degrees and for different reasons (Benson 2012). The analysis here simply looks at defense pacts using existing operationalizations of reliability. But differences across alliances in joint war planning (Poast 2019a, 174–75), the threat environment (Niou and Zeigler 2019), and domination (Lanoszka 2013) may influence who specializes in what and the degree to which specialization by partners produces a coordinated and complementary division of labor. Future work could also look at the size of alliances (Fordham and Poast 2016), specialization across issue areas like diplomacy or economics (Kinne and Bunte 2020), or different security alignments like defense cooperation agreements (DCAs) (Kinne 2020) and ad-hoc coalitions (Kreps 2011; Cappella Zielinski and Poast 2021).

Even if states' fear of exploitation is most salient where survival may be at stake, specialization is evidence states can manage uncertainty about cooperation under anarchy by increasing its expected benefits. This does not necessarily run counter to conventional wisdom about military portfolio diversification, but it does question the common belief that internal balancing and imitation – even in the face of a common enemy – is the best form of defense in the self-help world of anarchy. One of the reasons alliances are created in the first place is to change states' defense spending and their

military portfolio. Rather than think about arms and allies are distinct strategies for security, we should recognize that the arms a state develops are a function of the arms of its allies.

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