

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

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Why do states under-produce some military capabilities and over-produce others in ways that seem to leave them vulnerable? This article argues alliances help explain states' decisions to specialize defense. By reducing the risks of under-producing some capabilities and creating an incentive to over-produce others, alliances enable states to achieve the benefits of specialization and diversification simultaneously. Using granular military capability data, this paper develops the first systematic measurement of military specialization and finds states with militarily-capable alliance partners are more likely to specialize their own militaries. This finding suggests a new interplay between seemingly opposing strategies for defense that challenges existing perspectives on internal versus external balancing. In identifying how alliances shape the composition of arms, these findings have important implications for current debates about burden-sharing and motivate future research explaining armament decisions and the consequences of alliances.

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1 Introduction

Despite constitutional restrictions on its military, Japan began shifting its defense investments in the late 1970's. By 1982, Prime Minister Suzuki had drawn up plans to overhaul Japan's military by investing primarily in air defense and light offshore surface ships designed to counter the concerning increase in Soviet naval forces.¹ Although the end of the Cold War marked the end of the Soviet threat in the Western Pacific, it was soon replaced with Japanese concerns about Chinese expansion and the island-chain state's vulnerability to a blockade.² But over the following decade, Japan's defense capabilities continued shifting, and by the turn of the century Japan had doubled its air defense and short-range aerial capabilities but almost completely phased out its amphibious fleet and coastal ships, despite their clear utility in countering a potential blockade.³ In specializing in air defense while neglecting amphibious and coastal capabilities, Japan's military portfolio appears to have left it unnecessarily vulnerable.

This is exemplary of a common phenomenon in international politics. Conventional wisdom holds that because the primary purpose of a state's military is to provide security against perceived foreign dangers,⁴ most states should invest in a diversified full-spectrum force, hedging their bets in an unpredictable international environment by compensating for the inherent weaknesses of any one set of capabilities, or prioritize strengthening defenses against the most salient threats.⁵ However, there are myriad examples like Japan's of a capable state possessing a seemingly vulnerable military that specializes by under-producing some capabilities

¹Thomas B. Modly, "The Rhetoric and Realities of Japan's 1,000-Mile Sea-Lane Defense Policy," *Naval War College Review* 38, no. 1 (1985): 25–36, <https://www.jstor.org/stable/44636429>.

²Shogo Suzuki and Corey Wallace, "Explaining Japan's Response to Geopolitical Vulnerability," *International Affairs* 94, no. 4 (July 2018): 711–34, <https://doi.org/10.1093/ia/iyy033>.

³Jennifer M. Lind, "Pacifism or Passing the Buck? Testing Theories of Japanese Security Policy," *International Security* 29, no. 1 (2004): 107–10, <https://www.jstor.org/stable/4137548>.

⁴Kenneth Waltz, *Theory of International Politics* (Reading, MA: Waveland Press, 1979), 102–14.

⁵Stephen Biddle, *Military Power: Explaining Victory and Defeat in Modern Battle* (Manas Publications, 2005), 199–200.

and over-producing others. The US omitted minesweepers during President Reagan's 600-ship rebuilding plan despite their low cost and the fact that 13 of the 15 US ships sunk since World War II were victims of naval mines – a decision that caused serious problems in the late 1980's during the Iran-Iraq Tanker War.⁶ Given its 225 mile coastline, Albania's decision in the early 2000's to purchase dozens of open-water patrol vessels that could reach Portugal's coast 1,750 miles away seems a poor fit for their self-defense needs, especially considering the disintegration of the military and looting of defense installations just a few years prior left them without any functioning battle tanks.⁷ Estonia's sophisticated cyber capabilities have been frequently lauded, but those sizable investments have occurred alongside divestment of their entire combat aircraft fleet, even in the presence of increasingly warranted concern about Russian aggression and possible invasion.⁸ 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 that the extent to which a state specializes its defense capabilities can, in part, be explained by alliance participation. Alliances reduce the costs of forgoing some defense assets and also increase the benefits of over-producing others. By gaining protection from your allies' armaments, alliances allow states to simultaneously garner the benefits of a collectively diversified set of arms while lowering the risk of – and creating an additional incentive for – individually specialized militaries. The result is variation in the composition of military capabilities across states - some being comparatively more specialized. Empirically, this paper examines state-level military specialization and alliance relationships from 1970 to 2014 and finds that states with more militarily-capable alliance partners specialize their

⁶Geoffrey Till, "Holding the Bridge in Troubled Times: The Cold War and the Navies of Europe," *Journal of Strategic Studies* 28, no. 2 (April 2005): 309–37, <https://doi.org/10.1080/01402390500088379>.

⁷Ryan C. Hendrickson, Jonathan Campbell, and Nicholas Mullikin, "Albania and NATO's 'Open Door' Policy: Alliance Enlargement and Military Transformation," *The Journal of Slavic Military Studies* 19, no. 2 (July 2006): 253–54, <https://doi.org/10.1080/13518040600697779>.

⁸Māris Andžāns and Viljar Veebel, "Deterrence Dilemma in Latvia and Estonia: Finding the Balance Between External Military Solidarity and Territorial Defence," *Journal on Baltic Security* 3, no. 2 (2017): 29–41.

militaries more than those with weak or non-existent allies. When it comes to zero-sum resource allocation to defense, alliances allow states to have their cake and eat it, too, garnering the benefits of diversification and specialization simultaneously.

This article makes a number of contributions to the study of international politics. For one, it develops the first rigorous and systematic measurement of an important, yet under-studied dimension of armament decisions: military specialization. Despite a general acceptance that militaries differ, scholars have been unable to identify those differences in degree or kind. In doing so, this paper also introduces a novel theory of specialization within alliances that has significant implications for our understanding of two foundational trade-offs in international politics: guns versus butter and external versus internal balancing.⁹ Diversifying one’s “guns” may maximize security under anarchy, but it produces a higher defense burden that necessitates less resources available for “butter”. But by influencing the *types* of armaments states produce, alliances can minimize that guns versus butter trade-off through specialization-induced efficiency improvements.¹⁰ Regarding the second trade-off, although states can provide for their defense by arming (internal balancing) or forming alliances (external balancing), a common and influential view holds there are inherent inefficiencies and risks associated with the latter.¹¹ Because self-interested states only abide by international agreements that involve decisions they would have made otherwise, attempts to jointly produce public goods like security through alliances that are little more than “temporary marriages of convenience”¹² are inevitably haunted by incentives to exploit, renege, and free ride.¹³ But alliances do

⁹Michael Altfeld, “The Decision To Ally: A Theory and Test,” *Western Political Quarterly* 37, no. 4 (December 1984): 523–44, <https://doi.org/10.1177/106591298403700402>; James D. Morrow, “Arms Versus Allies: Trade-Offs in the Search for Security,” *International Organization* 47, no. 2 (1993): 207–33, <https://doi.org/10.1017/S0020818300027922>.

¹⁰Brandon J. Kinne and Stephanie N. Kang, “Free Riding, Network Effects, and Burden Sharing in Defense Cooperation Networks,” *International Organization* 77, no. 2 (January 2023): 405–39, <https://doi.org/10.1017/S0020818322000315>.

¹¹Stephen M. Walt, “Alliance Formation and the Balance of World Power,” *International Security* 9, no. 4 (1985): 3–43, <https://doi.org/10.2307/2538540>.

¹²John J. Mearsheimer, “The False Promise of International Institutions,” *International Security* 19, no. 3 (1994): 11, <https://doi.org/10.2307/2539078>.

¹³Glenn H. Snyder, “The Security Dilemma in Alliance Politics,” *World Politics* 36, no. 4 (July 1984): 461–95,

not jointly produce security simply by aggregating defense;¹⁴ alliances *reconstitute* each participant's defense capabilities via this under-appreciated mechanism of specialization. Allies and armaments are not two different ways a state can provide for its security,¹⁵ they are fundamentally intertwined in a more complex manner which requires rethinking our current understanding of their substitutable or complementary nature as well as how states try to strike the optimal balance between them.

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 efficiently 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 annual data on disaggregated national military capabilities since 1970. Section 5 concludes by discussing the implications of these findings and motivating future research on how alliances, and other factors, explain why states have the weapons that they do.

2 Existing explanations for the distribution of military capabilities

State militaries differ in more than size. Although commonly accepted, this observation is seldom theorized and even more rarely measured. Instead, material military power is homogenized and aggregated using broad indices like the Composite Index of National Capabilities

<https://doi.org/10.2307/2010183>.

¹⁴James D. Morrow, "Alliances and Asymmetry: An Alternative to the Capability Aggregation Model of Alliances," *American Journal of Political Science* 35, no. 4 (1991): 904–33, <https://doi.org/10.2307/2111499>.

¹⁵Paul F. Diehl, "Substitutes or Complements?: The Effects of Alliances on Military Spending in Major Power Rivalries," *International Interactions* 19, no. 3 (February 1994): 159–76, <https://doi.org/10.1080/03050629408434825>.

(CINC) or military expenditures¹⁶ where scholars explain variation in the *size* of state militaries with less attention paid to variation in *composition*.¹⁷ Yet much of international politics and interstate conflict requires understanding variation in how states arm and why. The combination of capabilities that comprise a military’s toolkit determine the operations it plans for and undertakes,¹⁸ the types of threats it can credibly make,¹⁹ and the consequences of resorting to force.²⁰

Similarly, state militaries differ due to more than necessity. Certainly, constraints placed by

¹⁶David Singer, Stuart Bremer, and John Stuckey, “Capability Distribution, Uncertainty, and Major Power War, 1820-1965,” in *Peace, War, and Numbers* (Beverly Hills, CA: Sage Publications, 1972), 19–48; Wuyi Omitoogun and Elisabeth Skons, “Military Expenditure Data: A 40-Year Overview,” in *SIPRI Yearbook 2006: Armaments, Disarmament and International Security* (Stockholm International Peace Research Institute, 2006), 269–94.

¹⁷On the shortcomings of measuring material military power using commonly-used aggregate measures like CINC, SIPRI, and national military spending, see Michael Brzoska, “The Reporting of Military Expenditures,” *Journal of Peace Research* 18, no. 3 (1981): 261–75, James H. Lebovic, “Using Military Spending Data: The Complexity of Simple Inference,” *Journal of Peace Research* 36, no. 6 (November 1999): 681–97, <https://doi.org/10.1177/0022343399036006005>, Kelly Kadera and Gerald Sorokin, “Measuring National Power,” *International Interactions* 30, no. 3 (January 2004): 211–30, <https://doi.org/10.1080/03050620490492097>, Hyung Min Kim, “Comparing Measures of National Power,” *International Political Science Review* 31, no. 4 (August 2010): 405–27, <https://doi.org/10.1177/0192512110371239>, Jocelyn Mawdsley, “Comparing Militaries: The Challenges of Datasets and Process-Tracing,” in *The Routledge Companion to Military Research Methods*, ed. Alison J. Williams et al., 2016, 115–25, Brian Crisher, “Power and National Capability,” in *Oxford Research Encyclopedia of Politics* (Oxford University Press, 2017), <https://doi.org/10.1093/acrefore/9780190228637.013.468>, Ron P. Smith, “Military Expenditure Data: Theoretical and Empirical Considerations,” *Defence and Peace Economics* 28, no. 4 (July 2017): 422–28, <https://doi.org/10.1080/10242694.2016.1245823>, Sam Perlo-Freeman, “SIPRI’s New Long Data-set on Military Expenditure: The Successes and Methodological Pitfalls,” *Defence and Peace Economics* 28, no. 4 (July 2017): 404–21, <https://doi.org/10.1080/10242694.2017.1279782>, Michael Beckley, “The Power of Nations: Measuring What Matters,” *International Security* 43, no. 2 (November 2018): 7–44, https://doi.org/10.1162/isec_a_00328, Robert J. Carroll and Brenton Kenkel, “Prediction, Proxies, and Power,” *American Journal of Political Science* 63, no. 3 (2019): 577–93, <https://doi.org/10.1111/ajps.12442>, Mark Souva, “Material Military Power: A Country-Year Measure of Military Power, 1865–2019,” *Journal of Peace Research*, December 2022, <https://doi.org/10.1177/00223433221112970>, J Andrés Gannon, “Planes, Trains, and Armored Mobiles: Introducing a Dataset of the Global Distribution of Military Capabilities,” *International Studies Quarterly* 67, no. 4 (2023): 1–12, <https://doi.org/10.1093/isq/sqad081>, and Jordan Becker et al., “Disaggregated Defense Spending: Introduction to Data,” *Journal of Peace Research*, March 2024, 1–17, <https://doi.org/10.1177/00223433231215785>.

¹⁸J Andrés Gannon, “One If by Land, and Two If by Sea: Cross-Domain Contests and the Escalation of International Crises,” *International Studies Quarterly* 66, no. 4 (December 2022): sqac065, <https://doi.org/10.1093/isq/sqac065>.

¹⁹Jon R. Lindsay and Erik A. Gartzke, eds., *Cross-Domain Deterrence: Strategy in an Era of Complexity*, 1st edition (New York: Oxford University Press, 2019).

²⁰Benjamin O. Fordham, “A Very Sharp Sword: The Influence of Military Capabilities on American Decisions to Use Force,” *Journal of Conflict Resolution* 48, no. 5 (October 2004): 632–56, <https://doi.org/10.1177/0022002704267935>.

geography and economic capacity explain why few landlocked states harbor sizable navies and why primarily industrially advanced states can threaten ballistic missiles across continents.²¹ But unlike militaries, geography is fairly constant over decades, if not centuries, and it is unclear what geographic factors would explain a highly specialized versus a highly diversified military portfolio. Economic capacity is also indeterminate in making comparisons across both states and time as a wealthy state insensitive to costs could afford to build more of everything or could conversely develop only a high-technology advanced force. These environmental factors serve as important scope conditions, but the decision-making process surrounding the compositions of a state's arms is fundamentally political since some set of actors deliberately chooses the distribution of military capabilities available to a state.²² Early debates about the political determinants of a state's weapons development were framed around internal versus external causes.^{23,24} Theorists forwarding internal explanations argued that because there was no single authority for weapons development decisions,²⁵ the composition of a state's military was determined by domestic factors like bureaucracy,²⁶ constituency interests,²⁷ or scientific R&D culture.²⁸ In contrast, external cause advocates argued armament decisions were primarily a strategic response to foreign threats.²⁹

²¹Stephen G. Brooks, *Producing Security: Multinational Corporations, Globalization, and the Changing Calculus of Conflict* (Princeton University Press, 2005), <https://www.jstor.org/stable/j.ctt7sjz7>; Michael C. Horowitz, *The Diffusion of Military Power: Causes and Consequences for International Politics* (Princeton University Press, 2010), 30–39.

²²Jonathan D. Caverley, "United States Hegemony and the New Economics of Defense," *Security Studies* 16, no. 4 (December 2007): 598–614, <https://doi.org/10.1080/09636410701740825>.

²³Matthew A. Evangelista, *Innovation and the Arms Race: How the United States and the Soviet Union Develop New Military Technologies* (Ithaca, NY/London: Cornell University Press, 1988).

²⁴Although geared toward explaining military doctrine rather than force structure, Barry R. Posen, *The Source of Military Doctrine: France, Britain, and Germany Between the World Wars* (Ithaca: Cornell University Press, 1984) identifies a similar dichotomy in organizational theory (internal) versus balance of power (external) explanations based on much of the same research cited here.

²⁵Graham T. Allison and Frederic A. Morris, "Armaments and Arms Control: Exploring the Determinants of Military Weapons," *Daedalus* 104, no. 3 (1975): 99–129, <https://www.jstor.org/stable/20024348>.

²⁶Theo Farrell, *Weapons Without a Cause: The Politics of Weapons Acquisition in the United States* (London: St. Martin's Press, 1997).

²⁷Robert Higgs, "Hard Coals Make Bad Law: Congressional Parochialism Versus National Defense," *Cato Journal* 8, no. 1 (1988): 79–106.

²⁸Baron Solly Zuckerman, *Nuclear Illusion and Reality* (Collins, 1982).

²⁹Robert McNamara, "Remarks by Secretary of Defense Robert S. McNamara," Speech (San Francisco, September 1967); Waltz, *Theory of International Politics*.

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,³⁰ although others believe a strict regulatory environment limits this.³¹ Separately, re-election incentives may explain weapon developments that generate jobs or shore up nationalism³² despite disagreement about the empirical record.³³ 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 development³⁴ and autocratic concerns about regime security.³⁵ 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,³⁶ although this perspective has been challenged by further empirical examinations of the same Cold War case studies.³⁷ More sociological theories have posited that status concern explains particular weapons acquisitions like high-technology aircraft or naval carriers but only in limited

³⁰James R. Kurth, “Why We Buy the Weapons We Do,” *Foreign Policy* 0, no. 11 (1973): 33–56, <https://doi.org/10.2307/1148035>.

³¹Jocelyn Mawdsley, “Armaments Decision-Making: Are European States Really Different?” *Comparative Strategy* 37, no. 4 (August 2018): 260–71, <https://doi.org/10.1080/01495933.2018.1497319>.

³²Ralph G. Carter, “Senate Defense Budgeting, 1981–1988: The Impacts of Ideology, Party, and Constituency Benefit on the Decision to Support the President,” *American Politics Quarterly* 17, no. 3 (July 1989): 332–47, <https://doi.org/10.1177/1532673X8901700306>; Guy D. Whitten and Laron K. Williams, “Buttery Guns and Welfare Hawks: The Politics of Defense Spending in Advanced Industrial Democracies,” *American Journal of Political Science* 55, no. 1 (January 2011): 117–34, <https://doi.org/10.1111/j.1540-5907.2010.00479.x>.

³³James M. Lindsay, “Testing the Parochial Hypothesis: Congress and the Strategic Defense Initiative,” *The Journal of Politics* 53, no. 3 (August 1991): 860–76, <https://doi.org/10.2307/2131583>.

³⁴Eckart Kehr, *Battleship Building and Party Politics in Germany, 1894–1901: A Cross-section of the Political, Social and Ideological Preconditions of German Imperialism* (University of Chicago Press, 1975); Benjamin O. Fordham, “The Domestic Politics of World Power: Explaining Debates over the United States Battleship Fleet, 1890–91,” *International Organization* 73, no. 2 (2019): 435–68, <https://doi.org/10.1017/S0020818318000449>.

³⁵Christopher Way and Jessica L. P. Weeks, “Making It Personal: Regime Type and Nuclear Proliferation,” *American Journal of Political Science* 58, no. 3 (2014): 705–19, <https://doi.org/10.1111/ajps.12080>.

³⁶Zuckerman, *Nuclear Illusion and Reality*.

³⁷Donald MacKenzie and Graham Spinardi, “The Shaping of Nuclear Weapon System Technology: US Fleet Ballistic Missile Guidance and Navigation: I: From Polaris to Poseidon,” *Social Studies of Science* 18, no. 3 (August 1988): 419–63, <https://doi.org/10.1177/030631288018003002>.

empirical cases.³⁸

While domestic politics certainly influences acquisition decisions, production capacity, and innovation patterns, their implications for the overall composition of a state’s military and the dimension of interest (military specialization) is less clear.³⁹ These theories do not generate testable predictions like whether, for example, states with an influential military-industrial complex are more likely to have a highly specialized force structure or whether one should expect states with divided governments or protectionist politicians to have a less specialized military.⁴⁰ Domestic institutions may create biases toward the status quo by imposing constraints on changes to one’s military, but that stickiness explains consistency rather than the changes observed within a country over time.⁴¹

Given the indeterminacy of domestic political explanations for *aggregate* distributions of military capabilities, conventional wisdom has largely coalesced around “external cause” theories where variation across militaries is explained by the perceived best response to security threats.⁴² For neo-realists, this external threat motivation predicts little variation across militaries beyond that attributable to geography and economic capacity. As Waltz⁴³, put it, the anarchic self-help system means “contending states imitate the military innovations contrived

³⁸Dana P. Eyre and Mark C. Suchman, “Status, Norms and the Proliferation of Conventional Weapons: An Institutional Theory Approach,” in *The Culture of National Security: Norms and Identity in World Politics*, ed. Peter J. Katzenstein (New York, NY: Columbia University Press, 1996), 79–113; Lisel Hintz and David E. Banks, “Symbolic Amplification and Suboptimal Weapons Procurement: Explaining Turkey’s S-400 Program,” *Security Studies* 31, no. 5 (December 2022): 826–56, <https://doi.org/10.1080/09636412.2022.2153733>.

³⁹Robert J. Art, “Bureaucratic Politics and American Foreign Policy: A Critique,” *Policy Sciences* 4, no. 4 (December 1973): 467–90, <https://doi.org/10.1007/BF01728472>.

⁴⁰Edward Rhodes, “Do Bureaucratic Politics Matter? Some Disconfirming Findings from the Case of the U.S. Navy,” *World Politics* 47, no. 1 (October 1994): 1–41, <https://doi.org/10.2307/2950678>.

⁴¹Morton H. Halperin, Priscilla Clapp, and Arnold Kanter, *Bureaucratic Politics and Foreign Policy* (Washington DC: Brookings Institution, 1974).

⁴²Stephen M. Walt, *The Origins of Alliances* (Ithaca ; London: Cornell University Press, 1987), 263–66; João Resende-Santos, *Neorealism, States, and the Modern Mass Army* (Cambridge University Press, 2007); William D. Nordhaus, John R. Oneal, and Bruce Russett, “The Effects of the International Security Environment on National Military Expenditures: A Multicountry Study,” *International Organization* 66, no. 3 (July 2012): 491–513, <https://doi.org/10.1017/S0020818312000173>.

⁴³*Theory of International Politics*, 127.

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.”⁴⁴ Importantly, this similarity in military profile is true even when states face a common enemy. 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.⁴⁵ Rather than resort to alliances, “states rely relentlessly both on arming and on imitating the successful military practices of peer competitors.”⁴⁶ 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 states acquires the military capabilities they deem necessary (and feasible) for their national security.^{47,48}

Even when the threat-response model diverges from the neo-realist assumption of like-units and sameness, such theories predict specialization but not by whom, when or to what measurable degree.⁴⁹ Many of the cases of specialization observed in Section 1 are unexplained because

⁴⁴For more contemporary theories of military emulation and convergence, see Miriam Fendius Elman, “The Foreign Policies of Small States: Challenging Neorealism in Its Own Backyard,” *British Journal of Political Science* 25, no. 2 (1995): 171–217, <https://www.jstor.org/stable/194084>, João Resende-Santos, “Anarchy and the Emulation of Military Systems: Military Organization and Technology in South America, 1870–1930,” *Security Studies* 5, no. 3 (March 1996): 193–260, <https://doi.org/10.1080/09636419608429280>, Emily O. Goldman and Richard B. Andres, “Systemic Effects of Military Innovation and Diffusion,” *Security Studies* 8, no. 4 (1999): 79–125, <https://doi.org/10.1080/09636419908429387> [82–83], John J. Mearsheimer, *The Tragedy of Great Power Politics* (New York : London: W. W. Norton & Company, 2001), 166–67, and Joseph M. Parent and Sebastian Rosato, “Balancing in Neorealism,” *International Security* 40, no. 2 (October 2015): 56–65, https://doi.org/10.1162/ISEC_a_00216.

⁴⁵Posen, *The Source of Military Doctrine*, 36–37.

⁴⁶Parent and Rosato, “Balancing in Neorealism,” 52.

⁴⁷Geoffrey Till, “Maritime Strategy and the Twenty-First Century,” *Journal of Strategic Studies* 17, no. 1 (March 1994): 176–99, <https://doi.org/10.1080/01402399408437545>.

⁴⁸Although 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.

⁴⁹An extensive literature has detailed shortcomings of the like-unit assumption (e.g. Nicholas G. Onuf, *World of Our Making: Rules and Rule in Social Theory and International Relations* (Columbia, SC: University of South Carolina Press, 1989), Adam Watson, *The Evolution of International Society: A Comparative Historical Analysis* (Routledge, 1992), Barry Buzan, Charles A. Jones, and Richard Little, *The Logic of Anarchy: Neorealism to Structural Realism* (New York: Columbia University Press, 1993), John Gerard Ruggie, ed., *Multilateralism Matters: The Theory and Praxis of an Institutional Form* (Columbia University Press, 1993), Hendrik Spruyt, *The Sovereign State and Its Competitors: An Analysis of Systems Change* (Princeton

they are cases of omitting or over-producing military capabilities in ways that seem to produce, rather than address, vulnerability given a state's immediate security threats. Albania did not build open-water patrol vessels because of fear of Portuguese revisionism, nor did the US omit minesweepers because the threat of mines in strategic waterways had gone away. Specialization has known benefits, but this does not explain why states seem to put security second in forgoing the benefits of diversification or specializing in patterns we cannot identify or that threat-response doesn't seem to explain.

3 A theory of specialization within alliances

3.1 Costs and benefits of specialized defense

In allocating resources to defense, states face a constrained optimization problem where the set of resources available to accomplish this task are finite, involving a zero-sum balance between allocating resources toward many capabilities or toward a few.⁵⁰ Investing in a diversified military portfolio is efficacy-optimizing because it reduces a state's overall vulnerability, but at a relatively higher economic cost. In contrast, investing in a specialized military portfolio

University Press, 1994), Daniel Deudney, "Binding Sovereigns: Authorities, Structures, and Geopolitics in Philadelphian Systems," in *State Sovereignty as Social Construct*, ed. Thomas J. Biersteker and Cynthia Weber (Cambridge University Press, 1996), 190–239, Alexander Wendt and Daniel Friedheim, "Hierarchy Under Anarchy: Informal Empire and the East German State," *International Organization* 49, no. 4 (1995): 689–721, <https://doi.org/10.1017/S0020818300028484>, Darel E. Paul, "Sovereignty, Survival and the Westphalian Blind Alley in International Relations," *Review of International Studies* 25, no. 2 (1999): 217–31, <https://www.jstor.org/stable/20097591>, David A. Lake, "The New Sovereignty in International Relations," *International Studies Review* 5, no. 3 (2003): 303–23, <https://www.jstor.org/stable/3186572>, David A. Lake, "Escape from the State of Nature: Authority and Hierarchy in World Politics," *International Security* 32, no. 1 (June 2007): 47–79, <https://doi.org/10.1162/isec.2007.32.1.47>, and J. C. Sharman, "International Hierarchies and Contemporary Imperial Governance: A Tale of Three Kingdoms," *European Journal of International Relations* 19, no. 2 (June 2013): 189–207, <https://doi.org/10.1177/1354066111425262>).

⁵⁰I 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 Todd Sandler and Keith Hartley, *The Political Economy of NATO: Past, Present and into the 21st Century* (Cambridge University Press, 1999) and Arne Martin Fevolden and Kari Tvetbråten, "Defence Industrial Policy – a Sound Security Strategy or an Economic Fallacy?" *Defence Studies* 16, no. 2 (April 2016): 176–92, <https://doi.org/10.1080/14702436.2016.1169893>.

is efficiency-optimizing because it comes with economies of scale and improved integration, but at the risk of not having capabilities it may need. Understanding the relative costs of different defense portfolios along this spectrum is important for understanding not only the consequences of a particular choice, but also why the certainty with which a reader believes one is commonly observed is matched only by the certainty with which another reader believes that distribution should rarely be observed.

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.

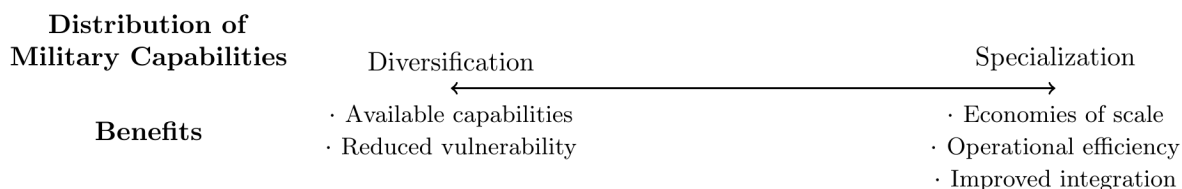


Figure 1: Varieties of a state's distribution of military capabilities.

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.⁵¹ For example, Germany has reduced the need for redundant infrastructure by centralizing car and light truck production all within

⁵¹Stefan Markowski and Peter Hall, "Challenges of Defence Procurement," *Defence and Peace Economics* 9, no. 1-2 (March 1998): 3-37, <https://doi.org/10.1080/10430719808404892>.

the Bundeswehr-Fuhrparkservice GmbH which allows them to produce newer but less varied vehicles more quickly.⁵² 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 their marginal costs because of learning by doing.⁵³ 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.⁵⁴

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.⁵⁵

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,

⁵²Thomas Overhage, “Pool It, Share It, or Lose It: An Economical View on Pooling and Sharing of European Military Capabilities,” *Defense & Security Analysis* 29, no. 4 (December 2013): 323–41, <https://doi.org/10.1080/14751798.2013.842712>.

⁵³Steven Postrel, “Islands of Shared Knowledge: Specialization and Mutual Understanding in Problem-Solving Teams,” *Organization Science* 13, no. 3 (June 2002): 303–20, <https://doi.org/10.1287/orsc.13.3.303.2773>.

⁵⁴There are, of course, still differences in accrued economies of scale from indigenous production as opposed to purchasing foreign equipment for one’s own military. Given the difficulty in acquiring large-scale data on the domestic producers of different component parts in multi-national arms production arrangements, this paper simply argues that there are some positive economies of scale in specialization, even for arms buyers, and leaves future research to identify the difference in degree across these two mechanisms of making versus buying.

⁵⁵Alexander Lanoszka and Jordan Becker, “The Art of Partial Commitment: The Politics of Military Assistance to Ukraine,” *Post-Soviet Affairs* 39, no. 3 (2023): 6–10, <https://doi.org/10.1080/1060586X.2022.2162758>.

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.⁵⁶

In contrast to specialization, the benefits of diversification concern the security gains of a full-spectrum military that makes combined arms warfare possible.⁵⁷ States that engage in a full-spectrum approach to warfare instead of specializing benefit from having more of the capabilities needed to defend themselves 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.”⁵⁸ 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 have 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.”⁵⁹

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

⁵⁶Heather Penney, “Modernizing UAV Export Policy for Effective Coalition Forces,” *Air Force Magazine*, May 2020.

⁵⁷Biddle, *Military Power*.

⁵⁸Allan R. Millett, Williamson Murray, and Kenneth H. Watman, “The Effectiveness of Military Organizations,” *International Security* 11, no. 1 (1986): 52, <https://doi.org/10.2307/2538875>.

⁵⁹Jon R. Lindsay and Erik A. Gartzke, “Politics by Many Other Means: The Comparative Strategic Advantages of Operational Domains,” *Journal of Strategic Studies* 45, no. 5 (2022): 346, <https://doi.org/10.1080/01402390.2020.1768372>.

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.”⁶⁰ 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.⁶¹

Former US Chairman of the Joint Chiefs of Staff Colin Powell⁶² 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.⁶³ After World War II, India’s Naval Plan Paper⁶⁴ made the case for a “balanced naval task force” which was later explained by Vice Admiral Parry⁶⁵ as a move to reduce India’s

⁶⁰Eric Hammel, *The Road to Big Week: The Struggle for Daylight Air Supremacy Over Western Europe, July 1942 – February 1944* (Pacifica, CA: Pacifica Military History, 2010).

⁶¹Erik A. Gartzke, Jeffrey M. Kaplow, and Rupal N. Mehta, “The Determinants of Nuclear Force Structure,” *Journal of Conflict Resolution* 58, no. 3 (April 2014): 484–85, <https://doi.org/10.1177/0022002713509054>.

⁶²*My American Journey* (Random House Publishing Group, 2010), 157.

⁶³Chaim Herzog, *The War of Atonement: The Inside Story of the Yom Kippur War* (New York: Simon and Schuster, 2018).

⁶⁴“Naval Plan Paper No. 1-Costs of Future Royal Indian Navy” (Document, November 1947).

⁶⁵“India and Sea Power,” *USI Journal* LXIX, no. 334 (1949): 17–27.

vulnerability with a navy “containing all types of ships and aircrafts, on the sea, over the sea, and under the sea”.

3.2 Alliances increase the expected benefits of specialization

Even well-resourced states experience difficulty excelling at all forms of conflict simultaneously. 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 diversification and specialization through security cooperation.⁶⁶ 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.^{67,68} 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 militarily, you can

⁶⁶This theory is derived from business organization research on inter-firm cooperation (Ranjay Gulati, Nitin Nohria, and Akbar Zaheer, “Strategic Networks,” *Strategic Management Journal* 21, no. 3 (March 2000): 203–15, [https://doi.org/10.1002/\(SICI\)1097-0266\(200003\)21:3%3C203::AID-SMJ102%3E3.0.CO;2-K](https://doi.org/10.1002/(SICI)1097-0266(200003)21:3%3C203::AID-SMJ102%3E3.0.CO;2-K); Stephan Meier, Matthew Stephenson, and Patryk Perkowski, “Culture of Trust and Division of Labor in Nonhierarchical Teams,” *Strategic Management Journal* 40, no. 8 (2019): 1171–93, <https://doi.org/10.1002/smj.3024>).

⁶⁷James D. Morrow, “Alliances, Credibility, and Peacetime Costs,” *Journal of Conflict Resolution* 38, no. 2 (June 1994): 270–97, <https://doi.org/10.1177/0022002794038002005>; Brett Ashley Leeds, “Do Alliances Deter Aggression? The Influence of Military Alliances on the Initiation of Militarized Interstate Disputes,” *American Journal of Political Science* 47, no. 3 (July 2003): 427–39, <https://doi.org/10.1111/1540-5907.00031>.

⁶⁸I 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, “Alliances and Asymmetry,” 907–9).

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 Michael E. Smith⁶⁹ 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 actors 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.”⁷⁰ Similarly, the 2002 Prague Summit outlined 8 areas over which NATO states could try to specialize, which the 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.”⁷¹⁷² 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.

⁶⁹“Strategic Cooperation: Everybody Wins,” *United States Naval Institute. Proceedings; Annapolis* 139, no. 3 (March 2013): 56–61.

⁷⁰John G. Morgan and Charles W. Martoglio, “The 1,000-Ship Navy: Global Maritime Network,” *United States Naval Institute. Proceedings; Annapolis* 131, no. 11 (November 2005): 14–17.

⁷¹Magnus Christiansson, “Pooling, Sharing and Specializing — NATO and International Defence Cooperation,” in *NATO Beyond 9/11: The Transformation of the Atlantic Alliance*, ed. Ellen Hallams, Luca Ratti, and Benjamin Zyla, New Security Challenges (London: Palgrave Macmillan UK, 2013), 181–86, https://doi.org/10.1057/9780230391222_9.

⁷²David Auerswald and Stephen Saideman, *NATO in Afghanistan: Fighting Together, Fighting Alone* (Princeton, NJ: Princeton University Press, 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.

Hypothesis: Specialization of defense capabilities should increase with the presence of militarily-capable defense allies.

Alliances that vary in their structure and purpose will also vary in the mechanism by which they incentivize specialization.⁷³ Specialization may be the product of high interest alignment resolving coordination problems or hierarchy reducing the risk of opportunism coercively or contractually.⁷⁴ 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 as well as the economic benefits put forth by hierarchy theorists.

⁷³Brett Ashley Leeds, Michaela Mattes, and Jeremy S. Vogel, "Interests, Institutions, and the Reliability of International Commitments," *American Journal of Political Science* 53, no. 2 (2009): 461–76, <https://www.jstor.org/stable/25548129>; Michaela Mattes, "Reputation, Symmetry, and Alliance Design," *International Organization* 66, no. 4 (October 2012): 679–707, <https://doi.org/10.1017/S002081831200029X>.

⁷⁴J Andrés Gannon, "Use Their Force: Interstate Security Alignments and the Distribution of Military Capabilities" (PhD thesis, UC San Diego, 2021).

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.⁷⁵ 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.⁷⁶ The index is constructed using the rDMC dataset detailing annual counts of 69 different military platforms across all states from 1970-2014.⁷⁷

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 neo-realist baseline assumption that states behave as like-units under anarchy and should consequently seek similarly diverse military capabilities subject to resource constraints.⁷⁸ 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

⁷⁵The 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 (Stephen G. Brooks and William C. Wohlforth, "The Rise and Fall of the Great Powers in the Twenty-first Century: China's Rise and the Fate of America's Global Position," *International Security* 40, no. 3 (January 2016): 7–53, https://doi.org/10.1162/ISEC_a_00225).

⁷⁶While 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.

⁷⁷Gannon, "Planes, Trains, and Armored Mobiles."

⁷⁸This assumption simply sets 0 as a common reference point for the index. Even if we accept the common wisdom that all states specialize to some degree given optimization towards the most salient threats, the index still provides a way to compare relative degrees of specialization across observations. I choose the neorealist assumption of full-spectrum convergence because even those who believe observing specialization is obvious and intuitive have no clear prior about the *degree* of specialization we should expect to see.

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.⁷⁹ In aggregate, this can be represented as $d_j = \sum_{i=1}^N (p'_{ij} \ln \frac{p'_{ij}}{q_i})$ 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.⁸⁰

From this, I calculate the functional entropy of each country’s military using a trait-based similarity measure drawn from Rao’s⁸¹ 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; $D = (d_{kl})$ is the matrix of functional dissimilarity between the technologies, and d_{kl} is the functional dissimilarity between countries k and l .^{82,83} Because specialization is measured relative to other states in a given year, the measure is conducive to comparative evaluations across actors, but not necessarily over time. A state could become

⁷⁹I include all branches of state militaries, including paramilitary branches like coast guards, for consistency across observations and because many states use or could use paramilitary forces internationally, even if in a non-military capacity like disaster relief or quasi-military capacity like gray zone conflict (Lyle Morris, “China Welcomes Its Newest Armed Force: The Coast Guard,” *War on the Rocks*, April 2018; J Andrés Gannon et al., “The Shadow of Deterrence: Why Capable Actors Engage in Contests Short of War,” *Journal of Conflict Resolution* 68, no. 2-3 (2024): 230–68, <https://doi.org/10.1177/00220027231166345>).

⁸⁰This bipartite network structure is modeled after its use in ecological research (Ruben Alarcón, Nickolas M. Waser, and Jeff Ollerton, “Year-to-Year Variation in the Topology of a Plant–Pollinator Interaction Network,” *Oikos* 117, no. 12 (2008): 1796–1807, <https://doi.org/10.1111/j.0030-1299.2008.16987.x>).

⁸¹“Diversity and Dissimilarity Coefficients: A Unified Approach,” *Theoretical Population Biology* 21, no. 1 (February 1982): 24–43, [https://doi.org/10.1016/0040-5809\(82\)90004-1](https://doi.org/10.1016/0040-5809(82)90004-1).

⁸²Sandrine Pavoine, “Adiv: An r Package to Analyse Biodiversity in Ecology,” *Methods in Ecology and Evolution* 11, no. 9 (2020): 1106–12, <https://doi.org/10.1111/2041-210X.13430>.

⁸³As this measure of functional entropy is developed by Sandrine Pavoine et al., “From Phylogenetic to Functional Originality: Guide Through Indices and New Developments,” *Ecological Indicators* 82 (November 2017): 196–205, <https://doi.org/10.1016/j.ecolind.2017.06.056>, its formula is provided verbatim. In the original statistical ecology application, this measure uses M. O. Hill, “Diversity and Evenness: A Unifying Notation and Its Consequences,” *Ecology* 54, no. 2 (1973): 427–32, <https://doi.org/10.2307/1934352> numbers to measure the dissimilarity between biological species based on observed traits, accounting for the rarity of those traits.

more specialized relative to itself in earlier years, but if all other states do the same – because of consistent acquisition of a new technology, for example – then that state’s specialization index will remain constant.

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 possesses. 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 of specialization as deviation from a weak prior assumption of minimal deviation from the median portfolio. 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 to 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.

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.⁸⁴

⁸⁴Almost all states possess certain capabilities like light transport aircraft and search and rescue helicopters.

A diversified force just means that one’s military is proportioned similarly to everyone else’s. Similarly, a specialized military is not synonymous with weakness in an absolute sense, it instead means a state has a high quantity of overproductions and underproductions relative to what we would expect given the rest of their portfolio and that of the world. Even the United States has specialized, with famously risky and consequential under-productions including the lack of minesweepers during the 1984 Iran-Iraq Tanker War,⁸⁵ nuclear, chemical, and biological (NBC) reconnaissance vehicles at the start of the 2003 Iraq War,⁸⁶ and icebreakers over the past two decades.⁸⁷

Figure 2 shows the distribution of this index across all observations on a normalized scale with mean zero and standard deviation 0.5⁸⁸ where higher values represent more specialization and values of or near 0 represent the neo-realist expectation of emulation and convergence.⁸⁹ To demonstrate the construct validity of this measure, the three cases highlighted in Figure 2

This is consistent with accounts of basic infrastructure ensured by “critical assets” (Janne Haaland Matlary and Øyvind Østerud, eds., *Denationalisation of Defence: Convergence and Diversity* (Aldershot, England ; Burlington, VT: Ashgate, 2007)) and identifies the importance of accounting for economic capacity to ensure the specialization index is not simply measuring the luxury of economic choice.

⁸⁵Marc R. DeVore, “A Convenient Framework: The Western European Union in the Persian Gulf, 1987–1988 and 1990–1991,” *European Security* 18, no. 2 (June 2009): 227–43, <https://doi.org/10.1080/09662830903460087>.

⁸⁶Anna Geis, “Burdens of the Past, Shadows of the Future: The Use of Military Force as a Challenge for the German ‘Civilian Power’,” in *The Militant Face of Democracy: Liberal Forces for Good*, ed. Anna Geis, Harald Müller, and Niklas Schörning (Cambridge University Press, 2013), 241–55.

⁸⁷Jonathan N. Markowitz, *Perils of Plenty: Arctic Resource Competition and the Return of the Great Game* (New York: Oxford University Press, 2020), 77–78.

⁸⁸Andrew Gelman, “Scaling Regression Inputs by Dividing by Two Standard Deviations,” *Statistics in Medicine* 27, no. 15 (July 2008): 2865–73, <https://doi.org/10.1002/sim.3107>.

⁸⁹The original formula for the index described above scales the index between [0, 1] inclusive with high values representing more specialization. However, its values are difficult to interpret since the ecological context for which that scale was developed observes pure specialization like an animal consuming only one type of plant in its diet and that plant being one no other animal consumes. The analogous case of a country possessing only one military platform and that being a platform no one else possesses is not realistically feasible. This linear transformation is consistent with prior research creating novel indices whose upper bound is theoretically ambiguous like government transparency (James R. Hollyer, B. Peter Rosendorff, and James Raymond Vreeland, “Measuring Transparency,” *Political Analysis* 22, no. 4 (October 2014): 413–34, <https://doi.org/10.1093/pan/mpu001>), leader willingness to use force (Jeff Carter and Charles E. Smith, “A Framework for Measuring Leaders’ Willingness to Use Force,” *American Political Science Review* 114, no. 4 (2020): 1352–58, <https://doi.org/10.1017/S0003055420000313>), and latent interstate hostility (Zhanna Terechshenko, “Hot Under the Collar: A Latent Measure of Interstate Hostility,” *Journal of Peace Research* 57, no. 6 (November 2020): 764–76, <https://doi.org/10.1177/0022343320962546>).

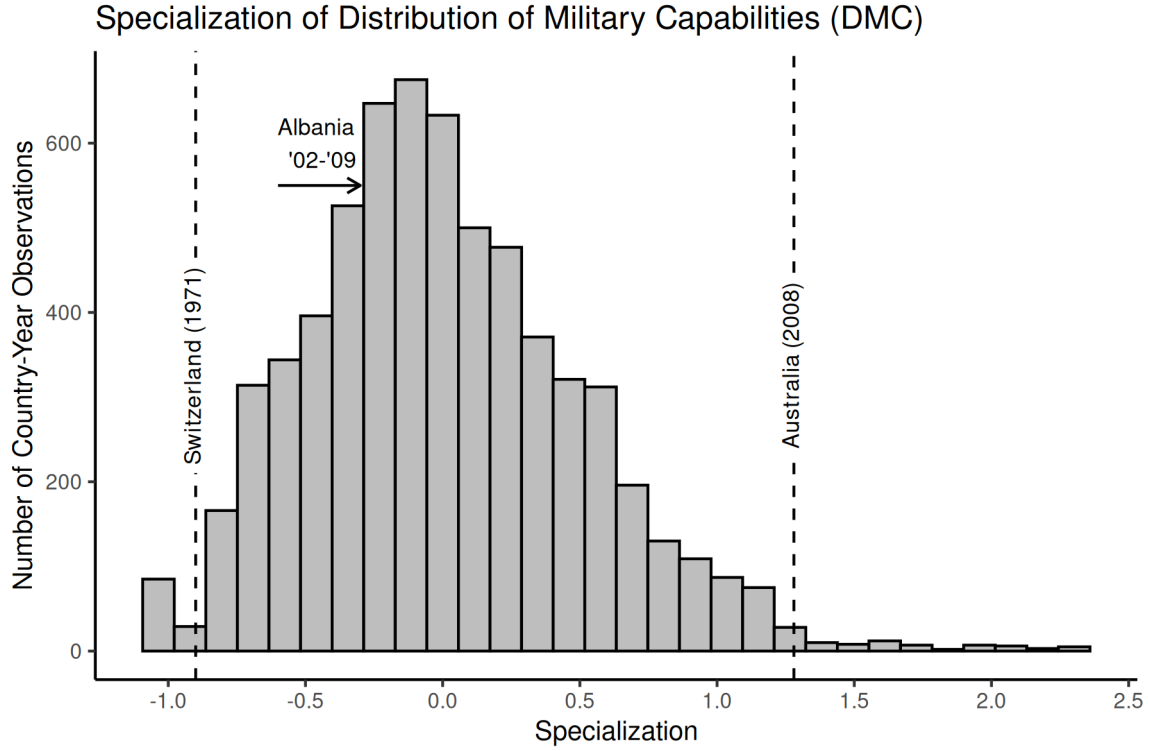


Figure 2: Distribution of country-year military specialization scaled at mean 0 and standard deviation 0.5 with higher values representing more specialization.

are detailed here and simulations using synthetic observations are detailed in the appendix. A well understood example of a diversified military is Switzerland, whose neutrality is formally codified in a defense doctrine (*défense générale/Gesamtverteidigung*) whose title literally translates to “General Defense.”⁹⁰ As a neutral country, they are self-reliant for their defense which means their response to external threats must involve the full spectrum of capabilities within geographic and economic constraints.⁹¹ The index confirms this, as in 1971, their specialization score is -0.9 which is in the bottom 5th percentile globally, and they remain below 0 for all but 3 years in the dataset. On the opposite end of the spectrum, Australia has a

⁹⁰George J. Stein, “Total Defense: A Comparative Overview of the Security Policies of Switzerland and Austria,” *Defense Analysis* 6, no. 1 (March 1990): 17, <https://doi.org/10.1080/07430179008405428>.

⁹¹Thomas Bernauer, Vally Koubi, and Fabio Ernst, “Does Neutrality Make a Difference? Explaining Patterns of Swiss Defense Spending in 1975–2001,” *Defence and Peace Economics* 20, no. 5 (October 2009): 413–22, <https://doi.org/10.1080/10242690802051537>.

specialization score of 1.28 in 2008 (98th percentile) which reflects the recent development of a specialized expeditionary force tailored toward strategic lift and ground forces while lacking the ability to reliably undertake freedom of navigation operations.⁹²

Albania's specialization at the turn of the century illustrates how to interpret changes in value on the scale. Following NATO's 2002 Prague Summit, Albania released their AAF Structure and Implementation Plan for 2002-2010 that, together with the Military Strategy Project, began a series of military reforms to facilitate Albania's integration into NATO.⁹³ Albania sought specialization in sea patrol for shipping lane protection and anti-smuggling efforts in explicit coordination with the United States and NATO which entailed eliminating all air force assets not aimed at surveillance and humanitarian missions (all fixed wing aircraft were cut) and doubling the size of maritime and patrol surveillance capabilities for Adriatic Sea anti-terrorism and interdiction capabilities.⁹⁴ By the middle of the decade Albania would have 11 torpedo craft, 9 patrol craft, 2 minesweepers, and 2 corvettes and by 2009 their coastal patrol fleet was 50% larger than it had been before the Prague Summit.⁹⁵ This emphasis on patrol and coastal combatants and elimination of combat aircraft increased Albania's specialization by 0.62 standard deviations between 2002 and 2009.

In sum, this measure provides prime facie evidence both that many states specialize their militaries and that there is significant variation in the amount of specialization. The states at the low end of the spectrum are diversified, yet only 14% of observations are more than one standard deviation below the mean and 227 observations are more than two standard deviations above the mean.

⁹²Joanne Wallis and Anna Powles, "Burden-Sharing: The US, Australia and New Zealand Alliances in the Pacific Islands," *International Affairs* 97, no. 4 (July 2021): 1057, <https://doi.org/10.1093/ia/iab081>.

⁹³Hendrickson, Campbell, and Mullikin, "Albania and NATO's 'Open Door' Policy."

⁹⁴Vincent Morelli et al., "NATO Enlargement: Albania, Croatia, and Possible Future Candidates" (Washington, D.C.: Congressional Research Service, October 2008).

⁹⁵Nathan M. Polak, Ryan C. Hendrickson, and Nathan G. D. Garrett, "NATO Membership for Albania and Croatia: Military Modernization, Geo-Strategic Opportunities and Force Projection," *The Journal of Slavic Military Studies* 22, no. 4 (November 2009): 502–14, <https://doi.org/10.1080/13518040903355745>.

4.2 Independent variable and controls

The independent variable measures a state's alliance relationships.⁹⁶ 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)⁹⁷ and (2) the ratio between a state's CINC score and the sum of their alliance CINC scores (including itself).⁹⁸ For both variables, higher values indicate 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.⁹⁹

Section 2 identifies a variety of factors that could explain some variation in military specialization. I include these as control variables to identify whether an association between alliances and specialization exists even when accounting for other explanations. The models control for regime type, coding a country as a democracy if they score higher than 6 on the 21-point Polity

⁹⁶Data on state participation in defensive alliance pacts is provided by the Alliance Treaty and Provisions (ATOP) dataset, version 5 (Brett Ashley Leeds et al., "Alliance Treaty Obligations and Provisions, 1815-1944," *International Interactions* 28, no. 3 (July 2002): 237-60, <https://doi.org/10.1080/03050620213653>).

⁹⁷Matthew DiGiuseppe and Paul Poast, "Arms Versus Democratic Allies," *British Journal of Political Science* 48, no. 4 (2016): 981-1003, <https://doi.org/10.1017/S0007123416000247>.

⁹⁸Songying Fang, Jesse C. Johnson, and Brett Ashley Leeds, "To Concede or to Resist? The Restraining Effect of Military Alliances," *International Organization* 68, no. 4 (October 2014): 775-809, <https://doi.org/10.1017/S0020818314000137>; Jesse C. Johnson, Brett Ashley Leeds, and Ahra Wu, "Capability, Credibility, and Extended General Deterrence," *International Interactions* 41, no. 2 (March 2015): 309-36, <https://doi.org/10.1080/03050629.2015.982115>.

⁹⁹Brett V. Benson and Joshua D. Clinton, "Assessing the Variation of Formal Military Alliances," *Journal of Conflict Resolution* 60, no. 5 (August 2016): 866-98, <https://doi.org/10.1177/0022002714560348>.

V index. Democracies may spend less on defense,¹⁰⁰ build more capital-intensive militaries,¹⁰¹ and be more¹⁰² or less¹⁰³ 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 or recent conflict experience may change patterns of innovation.¹⁰⁴ The models control for GDP, as resource-constrained states may be unable to invest in a diverse array of military capital¹⁰⁵ or may shift defense funds from platforms to personnel due to unemployment.¹⁰⁶ I control for CINC scores, as states harboring global ambitions may invest more in power projection capabilities.¹⁰⁷¹⁰⁸

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 linear regressions with varying parameters. All models are fit using one of the two different independent variables

¹⁰⁰Benjamin O. Fordham and Thomas C. Walker, “Kantian Liberalism, Regime Type, and Military Resource Allocation: Do Democracies Spend Less?” *International Studies Quarterly* 49, no. 1 (2005): 141–57, <https://www.jstor.org/stable/3693628>.

¹⁰¹Erik A. Gartzke, “Democracy and the Preparation for War: Does Regime Type Affect States’ Anticipation of Casualties?” *International Studies Quarterly* 45, no. 3 (2001): 467–84, <https://doi.org/10.1111/0020-8833.00210>.

¹⁰²DiGiuseppe and Poast, “Arms Versus Democratic Allies.”

¹⁰³Erik A. Gartzke and Kristian Skrede Gleditsch, “Why Democracies May Actually Be Less Reliable Allies,” *American Journal of Political Science* 48, no. 4 (October 2004): 775–95, <https://doi.org/10.1111/j.0092-5853.2004.00101.x>.

¹⁰⁴Nina A. Kollars, “War’s Horizon: Soldier-Led Adaptation in Iraq and Vietnam,” *Journal of Strategic Studies* 38, no. 4 (June 2015): 529–53, <https://doi.org/10.1080/01402390.2014.971947>.

¹⁰⁵Diehl, “Substitutes or Complements?”

¹⁰⁶Jordan Becker, “Rusty Guns and Buttery Soldiers: Unemployment and the Domestic Origins of Defense Spending,” *European Political Science Review* 13, no. 3 (August 2021): 307–30, <https://doi.org/10.1017/S1755773921000102>.

¹⁰⁷Jonathan N. Markowitz and Christopher J. Fariss, “Power, Proximity, and Democracy: Geopolitical Competition in the International System,” *Journal of Peace Research* 55, no. 1 (January 2018): 78–93, <https://doi.org/10.1177/0022343317727328>.

¹⁰⁸In 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 (Nathaniel Beck, “Of Fixed-Effects and Time-Invariant Variables,” *Political Analysis* 19, no. 2 (2011): 119–22, <https://www.jstor.org/stable/23011256>).

- (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 the models using country-clustered standard errors to account for the non-independence between observations in panel data. As some or all states may shift away from high-quantity legacy systems towards high-quality expeditionary warfare systems,¹⁰⁹ I model time trends using either cubic year polynomials or year fixed effects.¹¹⁰ Summary statistics for all model variables are provided in Appendix Table A1.

Table 1 shows the results of fully-specified models for each independent variable with each time trend control. Models 1 and 2 demonstrate allied military spending is positively associated with military specialization. Using allies' CINC ratio to operationalize the independent variable, Models 3 and 4 similarly find a positive association with military specialization. In all cases, the positive association is statistically significant at at least the 0.05 level. The results are consistent across a variety of additional model specifications provided in the appendix, like alternate standard error clustering, standardizing all regression coefficients, reverting the transformed dependent variable to its original bounded scale, and additional model types like fractional logit, beta, zero-inflated beta, and ordered beta regressions that are appropriate for the bounded nature of the original dependent variable.¹¹¹ In aggregate, these results provide 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.¹¹²

¹⁰⁹Terry Terriff, Frans Osinga, and Theo Farrell, *A Transformation Gap?: American Innovations and European Military Change* (Stanford University Press, 2010).

¹¹⁰David B. Carter and Curtis S. Signorino, "Back to the Future: Modeling Time Dependence in Binary Data," *Political Analysis* 18, no. 3 (June 2010): 271–92, <https://doi.org/10.1093/pan/mpq013>.

¹¹¹Robert Kubinec, "Ordered Beta Regression: A Parsimonious, Well-Fitting Model for Continuous Data with Lower and Upper Bounds," *Political Analysis* 31, no. 4 (July 2022): 519–36, <https://doi.org/10.1017/pan.2022.20>.

¹¹²I omit interpretation of control variable coefficients since the absence of second-hand confounders produces omitted variable bias (Luke Keele, Randolph T. Stevenson, and Felix Elwert, "The Causal Interpretation of Estimated Associations in Regression Models," *Political Science Research and Methods* 8, no. 1 (January 2020): 1–13, <https://doi.org/10.1017/psrm.2019.31>; Christoph Dworschak, "Bias Mitigation in Empirical Peace and Conflict Studies: A Short Primer on Posttreatment Variables," *Journal of Peace Research* 61,

Table 1: Coefficient estimates for OLS regression models.

	Military Specialization			
	(1)	(2)	(3)	(4)
Allies' Mil Spend. (log)	0.018*	0.018***		
	(0.009)	(0.001)		
Allies' CINC Ratio			0.303*	0.302***
			(0.143)	(0.052)
Democracy	-0.026	-0.026**	-0.002	-0.002
	(0.041)	(0.010)	(0.042)	(0.011)
Interstate War (5yr lag)	0.014	0.014	0.029	0.031
	(0.073)	(0.056)	(0.070)	(0.055)
GDP (log)	0.151***	0.151***	0.164***	0.164***
	(0.013)	(0.005)	(0.013)	(0.004)
CINC	2.239	2.244***	2.489	2.490***
	(2.130)	(0.307)	(2.294)	(0.467)
Num.Obs.	3900	3900	3900	3900
Time trend	Cubic poly	Year FE	Cubic poly	Year FE
Robust SE	Yes	Yes	Yes	Yes
AIC	10453.6		10471.8	
BIC	34845.2		34863.5	

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Recognizing the non-random assignment of alliance membership as well as a plausible endogenous process whereby specialization makes alliance membership more likely, we urge the

no. 3 (April 2023): 462–76, <https://doi.org/10.1177/00223433221145531>). Those interested in comparing model variables can see the standardized coefficients in the appendix.

reader to interpret these results as consistent with theoretical expectations, rather than evidence of causality. Quantitative models of observational panel data are limited in their ability to address these concerns, so further research should validate this claim qualitatively by, for example, process tracing specialization during the waves of NATO expansion.

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 is associated with a 0.05 unit increase in a state's military specialization; roughly the difference in Japan's military specialization between 1982 (1.15) and 2000 (1.19). Despite what is traditionally understood as a lopsided division of security responsibilities, in light of the US alliance, Japan specialized its security responsibilities intentionally.¹¹³ 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 Reagan¹¹⁴ stressing "the desirability of an appropriate division of roles between Japan and the United States". Figure 3 illustrates how one result of this strengthened alliance was a more specialized Japanese military. 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. To protect SLOCs, Japan focused on far-from-shore naval capabilities like large destroyers, minesweepers, and attack submarines and to provide logistical support to offensive US operations it increased its paramilitary aircraft from 7 to 34 and expanded its logistics and support fleet from 0 to 30. The figure illustrates how when computing an aggregation across all these capabilities, Japan's military in 2000 was more different from the world average than it was in 2000. 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

¹¹³Shio Ando, "Empirical Analysis of the Defense Interdependence Between Japan and the United States," *Defence and Peace Economics* 26, no. 2 (March 2015): 223–31, <https://doi.org/10.1080/10242694.2013.793531>.

¹¹⁴"Visit of Japanese Prime Minister Suzuki," {{US State Department Bulletin}}, June 1981, 3.

aircraft.¹¹⁵

¹¹⁵James L. Schoff, “How to Upgrade U.S.-Japan Defense Cooperation,” Policy Outlook (Washington, DC: Carnegie Endowment for International Peace, January 2014).

Changes in Japan's Military, 1982 to 2000

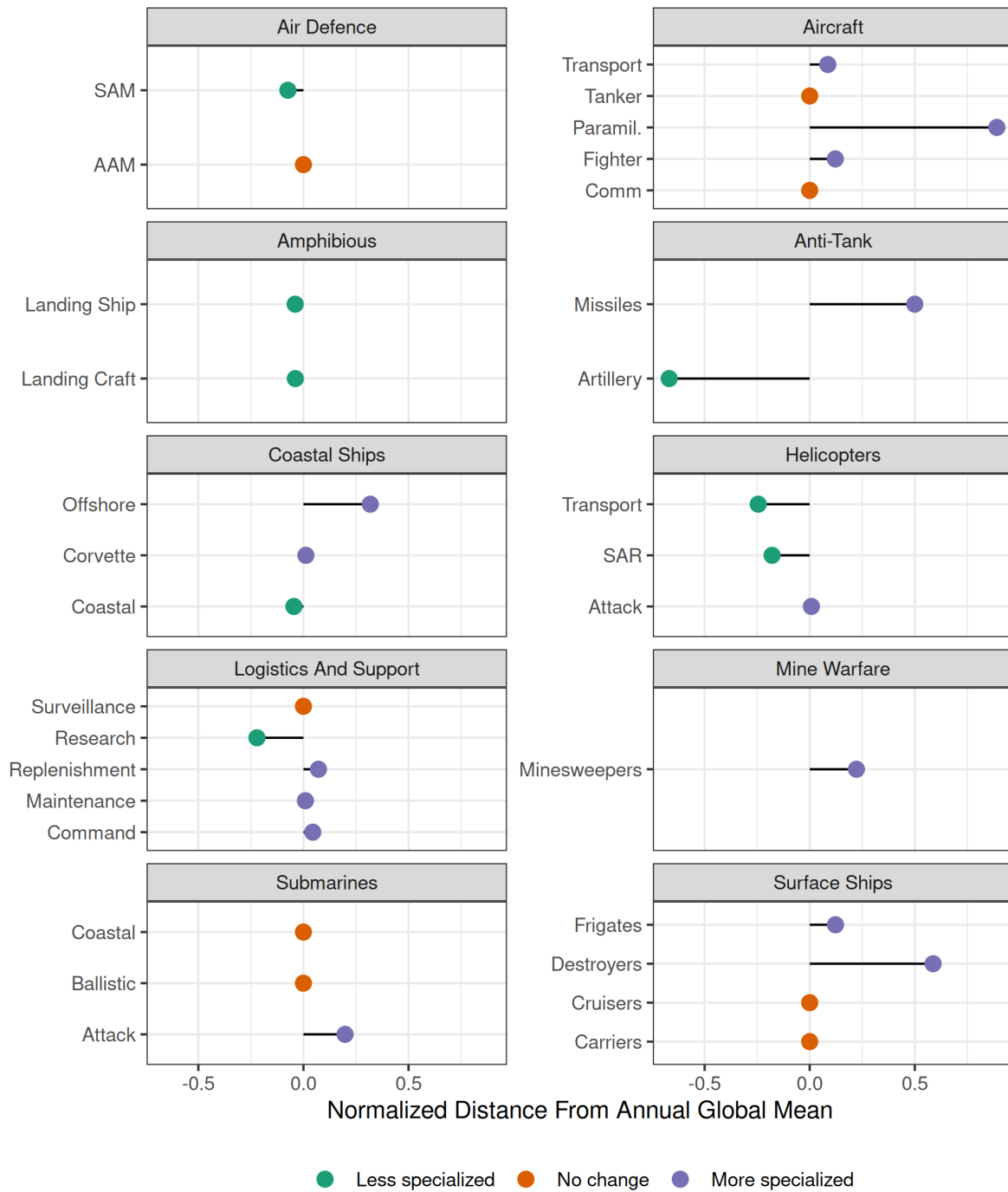


Figure 3: Capabilities Japan did not possess (eg ballistic missiles and drones) are omitted. Positive values indicate a higher deviation from the global mean in 2000 than 1982 while negative values indicate Japan became more similar to the average country. The sum of the positive values exceeds the sum of the negative values, indicating Japan's increase in specialization.

This example is presented to illustrate the marginal effect of a stronger alliance relationship and what a 0.05 increase in specialization might look like in reality. But of course, changes in Japan's alliances, nonetheless that with just the US, cannot explain all the specialization we observe in this time period. This example also demonstrates other potential explanations as avenues for future research. Japan's anti-tank artillery appear to be replaced by anti-tank missiles, for example, possibly representing technological innovation decisions afforded to highly developed countries. Furthermore, the figure compares Japan's military to the global average as a simplified visualization that maps onto the more complex algorithm used to develop the dependent variable. But that does not tell us whether Japan's increased specializations are all complementary with the shifts happening in the US military or whether they are emulating them. Some can be identified anecdotally, since the US reduced minesweepers while Japan maintained more than the global average and the US tripled its air defence platforms while Japan opted to have closer to the average state. On the other hand, Japan's increased specialization in maritime destroyers and fighter aircraft seems to be specialization that could be seen as redundant with recognized US strengths in large naval vessels and air to air combat. This could be the product of emulation, although it would only explain alliance-induced emulation rather than the total variation we see in degrees of specialization, or it could represent the fact that the US and Japan have multiple allies and non-identical national interests that may mean there is unexplained variation based on the type of alliance.¹¹⁶ As the dependent variable is monadic, pairwise similarities in *type* of specialization cannot be determined here, simply a state's relative degree of specialization. But the significance of this observation identifies an important avenue for future research - the degree to which specialization at the dyad or alliance-level is complementary.

¹¹⁶Nadiya Kostyuk, "Allies and Diffusion of State Military Cybercapacity," *Journal of Peace Research* 61, no. 1 (February 2024): 44–58, <https://doi.org/10.1177/00223433241226559>.

5 Conclusion

Variation in the composition of militaries across time and space is the result of political decisions by states to spend defense dollars dissimilarly.¹¹⁷ This paper’s two central contributions concern identifying and explaining that, first in precisely measuring one important dimension on which military portfolios vary - their degree of specialization - and second in putting forth one novel explanation for part of that variation - alliances.

By advancing discussion from burden-sharing *costs* to burden-sharing *configurations*, new perspectives on the value of alliances emerge. Contra neorealist pessimism about cooperation under anarchy, relying on other states for your security is neither infrequent nor inefficient. Specialization is evidence that relying on partners for defense happens frequently since alliance participants more often accept the risks of forgoing a diversified force and instead specialize in capabilities seemingly ill-suited to their immediate security but compatible with collective security. Doing so requires a belief that alliances allow them to gain the benefits of specialization and diversification in ways they could not if providing for their security alone.

Specialization also questions the inefficiency of external balancing, as it explains a mechanism by which alliances provide “greater security with fewer resources but more coordination”¹¹⁸ in a way that questions pessimistic accounts in ongoing debates about the economic consequences of alliances¹¹⁹ and burden-sharing.¹²⁰ In contextualizing the economic implications of

¹¹⁷Becker et al., “Disaggregated Defense Spending.”

¹¹⁸Anders Fogh Rasmussen, “Building Security in an Age of Austerity,” Keynote {{Speech}} (Munich, Germany, February 2011).

¹¹⁹Joshua Alley and Matthew Fuhrmann, “Budget Breaker? The Financial Cost of US Military Alliances,” *Security Studies* 30, no. 5 (October 2021): 661–90, <https://doi.org/10.1080/09636412.2021.2021280>; Alexander Cooley et al., “Estimating Alliance Costs: An Exchange,” *Security Studies* 31, no. 3 (May 2022): 510–32, <https://doi.org/10.1080/09636412.2022.2101324>.

¹²⁰John R. Oneal and Paul F. Diehl, “The Theory of Collective Action and NATO Defense Burdens: New Empirical Tests,” *Political Research Quarterly* 47, no. 2 (June 1994): 373–96, <https://doi.org/10.1177/106591299404700208>; Brian Blankenship, “The Price of Protection: Explaining Success and Failure of US Alliance Burden-Sharing Pressure,” *Security Studies* 30, no. 5 (December 2021): 691–724, <https://doi.org/10.1080/09636412.2021.2018624>.

specialization and diversification to the defense portfolio context, this paper provides a way to alleviate concerns that alliances are nothing more than wasteful spending. Allies can turn to specialization to ensure that spending is efficient while still being efficacious. As UK Secretary of Defence Philip Hammond¹²¹ explained, the answer to economic pressure lies in “prioritizing ruthlessly, specializing aggressively, and collaborating unsentimentally.”

In addition to being a political economy story, this finding has important implications for national security. Efficiencies gained across partners can mean more collective security per dollar. Rather than redundancy across contributors, cooperating states can excel at their particular cog in a collective security machine. Specialization can be way to strengthen existing alliances by demonstrating ones value and ability to make an enhanced contribution.¹²² 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.”¹²³

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.”¹²⁴ Then US ambassador to NATO Ivo Ivo Daalder¹²⁵ 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. Although this issue has received much recent attention, it is far from new. US dissatisfaction with British and French nuclear forces was, in part, because this redundancy with the US nuclear deterrent was accompanied by a “reluctance to pay for adequate conventional

¹²¹“NATO: The Case for Collective Defence in the 21st Century,” Speech (The Atlantic Council, January 2012).

¹²²J Andrés Gannon and Daniel Kent, “Keeping Your Friends Close, but Acquaintances Closer: Why Weakly Allied States Make Committed Coalition Partners,” *Journal of Conflict Resolution* 65, no. 5 (May 2021): 889–918, <https://doi.org/10.1177/0022002720978800>.

¹²³Brett Ashley Leeds and Sezi Anac, “Alliance Institutionalization and Alliance Performance,” *International Interactions* 31, no. 3 (July 2005): 185, <https://doi.org/10.1080/03050620500294135>.

¹²⁴David A. Lake, “Anarchy, Hierarchy, and the Variety of International Relations,” *International Organization* 50, no. 1 (1996): 15, <https://www.jstor.org/stable/2706997>.

¹²⁵“Renewed Ambitions for NATO,” June 2013.

forces.”¹²⁶ While the US was upset that Europe wasn’t specializing, Europe was upset that they were. During the 1999 Kosovo War, the US contributed airborne command and control, aerial refueling, and precision-guided munitions while European allies were relegated to ground forces and post-conflict reconstruction since they only had 4 heavy airlift as compared to the more than 300 the US possessed.¹²⁷ This specialization in ground forces prompted the former German ambassador to the EU von Kway¹²⁸ to voice concern that Europeans would become “the Hessians of the Americans”, illustrating the complex politics involved in specialization by alliance members. While identifying group-level specialization as a division of labor is beyond the scope of this paper, the findings here suggest that the historical record could be better empirically measured and the causes of shifts in the division of labor more properly identified.

Similarly, concerns about Chinese and North Korean aggression have put Japan and South Korea’s respective alliances with the US front and center.¹²⁹ To the degree that Japan has specialized their military, their ability to unilaterally defend themselves in the event of attack may be compromised.¹³⁰ President Suk-yeol’s statement in January 2023 that South Korea may need their own nuclear deterrent caused worries in Washington that one consequence of alliance discontent could be reduced specialization that manifests as nuclear armament.¹³¹ Since then, the US-ROK Washington Declaration and US-Japan-ROK Trilateral joint statement have mitigated those worries and South Korea is returning its focus on road-mobile missile launchers and passive defense capabilities, but the broader context illustrates how scholars and practi-

¹²⁶Robert W. Komer, “Maritime Strategy Vs. Coalition Defense Military and Political Policy,” *Foreign Affairs* 60 (1981/1982): 1124–44.

¹²⁷Bruno Tertrais, “ESDP and Global Security Challenges: Will There Be a ‘Division of Labor’ Between Europe and the United States?” in *The EU’s Search for a Strategic Role: ESDP and Its Implications for Transatlantic Relations*, ed. Esther Brimmer (Washington, DC: Center for Transatlantic Relations, 2002), 119.

¹²⁸“Interview in The Financial Times with Dietrich von Kway, Outgoing German Ambassador to the European Union,” August 1999.

¹²⁹Katrin Fraser Katz, Christopher Johnstone, and Victor Cha, “America Needs to Reassure Japan and South Korea,” *Foreign Affairs*, February 2023.

¹³⁰Takuya Matsuda, “Japan’s Emerging Security Strategy,” *The Washington Quarterly* 46, no. 1 (January 2023): 85–102, <https://doi.org/10.1080/0163660X.2023.2190218>.

¹³¹Jennifer M. Lind and Daryl G. Press, “South Korea’s Nuclear Options,” *Foreign Affairs*, April 2023.

tioners can glean insight about hedging by thinking about the armament decisions actors forgo or overproduce as a result of alliance relationships.¹³² More generally, if states feel confident in the defense capabilities of their allies, we should see them continue to specialize their militaries. Conversely, allies beginning to diversify 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 or capability aggregation insufficient to deter aggression or win a war. Although the empirical model assumes that more capable alliance partners are more reliable ones, that may not always be the case. Whether an alliance is perceived as credible by its members should influence each state's willingness to rely on its partners by specializing so the determinants of alliance credibility could explain further variation in military specialization.¹³³

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,¹³⁴ particularly if research extended to other time periods less dominated by asymmetric and institutionalized alliances than the post-1970 period analyzed here like the more symmetrical and less formalized Triple Entente.¹³⁵ Differences across alliances in joint war planning,¹³⁶ the threat environment,¹³⁷ and degree of domination¹³⁸ may influence who specializes in what and the degree to which specialization by partners produces a coordinated and complementary division of labor. Furthermore, strong alliance partners may not necessarily be reliable ones; although the analysis here focuses on allied partner capability, whether an

¹³²Graham T. Allison, "Why Biden and Yoon's Agreement Is a Big Deal," *Foreign Policy*, March 2024.

¹³³Joshua Alley, "Alliance Participation, Treaty Depth, and Military Spending," *International Studies Quarterly* 65, no. 4 (December 2021): 929–43, <https://doi.org/10.1093/isq/sqab077>.

¹³⁴Brett V. Benson, *Constructing International Security: Alliances, Deterrence, and Moral Hazard* (Cambridge University Press, 2012).

¹³⁵Patricia A. Weitsman, "Alliance Cohesion and Coalition Warfare: The Central Powers and Triple Entente," *Security Studies* 12, no. 3 (2003): 98–108, <https://doi.org/10.1080/09636410390443062>.

¹³⁶Paul Poast, *Arguing about Alliances: The Art of Agreement in Military-Pact Negotiations* (Ithaca: Cornell University Press, 2019), 174–75.

¹³⁷Emerson M. S. Niou and Sean M. Zeigler, "External Threat, Internal Rivalry, and Alliance Formation," *The Journal of Politics* 81, no. 2 (April 2019): 571–84, <https://doi.org/10.1086/701724>.

¹³⁸Alexander Lanoszka, "Beyond Consent and Coercion: Using Republican Political Theory to Understand International Hierarchies," *International Theory* 5, no. 3 (November 2013): 382–413, <https://doi.org/10.1017/S1752971913000249>.

alliance is perceived as credible by its members should influence each state's willingness to rely on its partners by specializing credibility.¹³⁹ Future work could also look at the size of alliances,¹⁴⁰ specialization across issue areas like diplomacy or economics,¹⁴¹ or different kinds of security alignments like defense cooperation agreements (DCAs)¹⁴² and ad-hoc coalitions.¹⁴³

Importantly, the driving force behind specialization in an alliance may shape the type of specialization we observe; which alliance partners specialize, in what capabilities, and to what extent. Although a systematic validation or adjudication of causal mechanisms is beyond the scope of this paper, its theory and findings along with existing research about the varieties of defense cooperation opens up avenues for thinking about different ways that alliances may encourage specialization. Specialization may simply require overcoming coordination problems, in which case alliances resolve information asymmetries by institutionalizing communication and information processing through the creation of standard operating procedures like NATO's Standardization Agreements (STANAGs) that ensure interoperability of munitions and logistics.¹⁴⁴ US Navy Rear Admiral Smith¹⁴⁵ noted "what is unavoidably true is that, in the absence of an institutionalized habit of pooling our naval resources in steady-state planning, the best of intentions will not result in meaningful implementation of a cooperative strategy." Alternatively, specialization may be the product of intra-alliance bargaining over who produces what defense capabilities given they vary in public and private benefits.¹⁴⁶ A dominant

¹³⁹Alley, "Alliance Participation, Treaty Depth, and Military Spending."

¹⁴⁰Benjamin O. Fordham and Paul Poast, "All Alliances Are Multilateral: Rethinking Alliance Formation," *Journal of Conflict Resolution* 60, no. 5 (August 2016): 840–65, <https://doi.org/10.1177/0022002714553108>.

¹⁴¹Brandon J. Kinne and Jonas B. Bunte, "Guns or Money? Defense Co-operation and Bilateral Lending as Coevolving Networks," *British Journal of Political Science* 50, no. 3 (July 2020): 1067–88, <https://doi.org/10.1017/S0007123418000030>.

¹⁴²Brandon J. Kinne, "The Defense Cooperation Agreement Dataset (DCAD)," *Journal of Conflict Resolution* 64, no. 4 (2020): 729–55, <https://doi.org/10.1177/0022002719857796>.

¹⁴³Sarah Kreps, *Coalitions of Convenience: United States Military Interventions After the Cold War* (New York: Oxford University Press, 2011); Rosella Cappella Zielinski and Paul Poast, "Supplying Allies: Political Economy of Coalition Warfare," *Journal of Global Security Studies* 6, no. 1 (2021): 1–7, <https://doi.org/10.1093/jogss/ogaa006>.

¹⁴⁴James G. March and Herbert Alexander Simon, *Organizations* (Hoboken: John Wiley & Sons, 1958).

¹⁴⁵"Strategic Cooperation."

¹⁴⁶Papayouanou_intraalliancebargainingbosnia_1997?

state may force a subordinate partner to specialize in certain assets that help the dominant state project power while reducing moral hazard problems by ensuring the subordinate state is dependent on the dominant state for defense, as the Soviet Union did with Romania during the Cold War.¹⁴⁷ As an alternative to coercion, an alliance could specialize to create mutual interdependence since relying on each other for defense capabilities can constitute a form of mutual hostage-taking whereby mutual vulnerability disincentivizes defection, thus resolving credible commitment problems.¹⁴⁸

Despite fear of exploitation being most salient where survival is at stake, specialization is evidence states can manage uncertainty about cooperation under anarchy by increasing its expected benefits. Even if states do design their militaries primarily to deal with external threats, this is conditioned by their alliance relationships in a way that demonstrates novelty in the value of the latter. This does not negate the conventional wisdom that militaries are primarily structured to counter foreign threats, but it does question a 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 very purposes of alliances is to change states' defense spending and their military portfolio. Rather than think about arms and allies are distinct strategies for security - one of which may be better than the other - we should recognize that the arms a state develops are a function of the arms of its allies.

¹⁴⁷George Christian Maior and Sebastian Huluban, "From Hardware to Software Reforms in Romania's Civil-Military Relations," *Baltic Defence Review* 2, no. 8 (2002): 21.

¹⁴⁸Oliver E. Williamson, "Credible Commitments: Using Hostages to Support Exchange," *The American Economic Review* 73, no. 4 (1983): 519-40, <https://www.jstor.org/stable/1816557>.