ARMS WRESTLING: THE STRATEGIC IMPLICATIONS OF DEFENSE INDUSTRIAL CAPACITY.

A Dissertation

Presented to the Faculty of the Graduate School

of Cornell University

in Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy

by

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May 2021

ARMS WRESTLING: THE STRATEGIC IMPLICATIONS OF DEFENSE INDUSTRIAL CAPACITY.

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Cornell University 2021

This dissertation explores the determinants of state defense industrial capacity, advancing a theory to explain its variation between countries and across time. Defense industrial capacity is conceptualized as having two aspects: procurement capacity (the capacity of the state to acquire a military force structure tailored to its strategic requirements), and gatekeeper capacity (the capacity of the state to leverage defense industrial production to achieve international influence). Variation in both aspects of defense industrial capacity are argued to rest on two factors: the structural position of the state within both domestic and international defense industrial networks (which affects the balance of influence of weapons producers versus customers), and the breadth of military technological requirements (affecting the ease of emulation and hence the incentive to innovate). It is contended that changes in these factors drive shifts in state defense industrial capacity, via cycles in defense industrial demand linked to the evolution of the international strategic environment. The utility of this theoretical framework is demonstrated through application to four cases. The first two centre on Great Britain. Between 1888 and 1900, the strong structural position of the British state combined with widely distributed technological capabilities resulted in an effective procurement response to the Franco-Russian strategic challenge, while limiting the ability of Britain to exploit its global defense industrial position for influence. Conversely, the rising centrality of producers reduced the procurement autonomy of the British state between 1904 and 1913, encouraging a strategically

counterproductive qualitative naval arms race with Germany. The subsequent two cases focus on the US experience from the late Cold War onward. Between 1979 and 1997 the US government harnessed its domestic defense industrial influence to leverage more complex military technological requirements in the service of innovation, increasing strategic pressure on the Soviet Union and deepening US centrality within the global defense industrial network. However, from 2002 to 2010 the structural position of the US government was eroded, allowing private preferences for innovation to shape military procurement out of step with post-9/11 strategic requirements. The dissertation concludes with a consideration of the applicability of the theory to contemporary US-China strategic dynamics.

BIOGRAPHICAL SKETCH

Matthew Hill was awarded a Master of Arts in Government from Cornell University in 2015, and a Master of Arts (with High Distinction) in Strategic Studies from the Australian National University in 2010.

Prior to his graduate studies, he completed a Bachelor of Arts (with 1st Class Honors) in Philosophy, Politics and Economics from the University of Otago in 2007.

For Rebecca, Paul, and Evie.

ACKNOWLEDGEMENTS

I would like to acknowledge the investment of my committee — Professor Peter Katzenstein, Professor Sarah Kreps, and Professor Richard Bensel — in this project. Without their unstinting patience and constructive feedback over the half-decade, this project would never have come to fruition. For this, they have my sincere appreciation.

In addition, Professor Jonathan Caverley was gracious enough to serve as external reviewer, and this dissertation benefited significantly from his incisive feedback. Likewise, Professor Emerita Judith Reppy took the time to provide extensive comments on later stages of the dissertation, and I am extremely grateful for the opportunity to tap into her vast expertise on the the subject of military innovation.

I also want to note the contributions of friends and colleagues, from Ithaca to Wellington, who have provided encouragement and feedback on aspects of this project. Likewise, my parents — Ian and Barbara Hill — and my siblings — Emma and Andy — have been an immense source of support, both moral and practical (including being kind enough to read over full drafts).

My deepest thanks goes to my wife Rebecca and our two children, Paul and Evie. The process of writing a dissertation imposes a temporal and emotional burden on those in close proximity. For their love and understanding over the years, I am eternally grateful.

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INTRODUCTION

> *[T]he key, in my mind, is to ensure an alignment between a defense that leverages our strengths — like our robust and independent business and academic communities — and that reflects our nation's values and long-standing traditions... and a defense that is effective in a changing world. How to align all that, and how we achieve that alignment isn't new. We find the alignment in open partnership... by working together.* — Ashton Carter, former US Secretary of Defense[1]

On April 23rd 2015, then-US Secretary of Defense Ashton Carter traveled to Stanford University, on the doorstep of Silicon Valley, in a bid to recruit the California technology industry into Washington's "third offset strategy" of defense industrial innovation. This strategy aspired to meet emerging challenges to US military dominance posed by the rise of great power rivals — most notably the People's Republic of China — by developing new weapons technologies that would allow Washington to retain an enduring qualitative military advantage. Crucially, as Carter emphasized, the success of this venture would hinge on the federal government's relationships with both traditional defense companies that serve as systems integrators as well as innovative providers of innovative dual-use component technologies. Thus, in the eyes of US officials, sustaining the technological foundations of military power required negotiating a contested nexus between state customers and private producers.

Six months later, another senior defense figure made his petition for closer defense industrial cooperation, this time in Washington, DC, Yet Michael Fallon was not a

[1] Carter (2015).

Beltway resident. As the United Kingdom's Secretary of State for Defence, Fallon was visiting the US capital to reiterate his country's support for the American-led global coalition to suppress the so-called Islamic State. In doing so, he made clear the connection between Britain's international strategic alignment and transatlantic defense industrial ties. UK-US relations, he noted, demonstrate

> . . . a level of industrial integration that is unique. It surely makes sense for both of us to benefit from the industrial expertise that exists in our countries. . . By doing so we are becoming an even stronger partner with our most steadfast ally, the United States.[2]

These events highlight how domestic and international defense industrial relations are bound up with strategic dynamics. Washington recognized that the future global balance of military capabilities between itself and Beijing was contingent on the nature of its procurement relationship with private producers. Similarly, the British state had come to accept that its global influence and military capacity rested to a significant degree on leveraging transnational linkages to access American defense industrial resources. In both cases we observe the manifestation of a particular form of state capacity in action: defense industrial capacity.

It is this capacity that has motivated this research. Specifically, this dissertation addresses two questions:

- First, what are key determinants of the defense industrial capacity of great powers?
- Second, how does defense industrial capacity vary, both over time and between great powers?

[2]Fallon (2016).

1.1 *The significance of defense industrial dynamics*

International relations scholars have paid only fitful attention to the strategic implications of defense industrial dynamics.[3] This deficit is both concerning and surprising. Since bronze was first cast into axe heads and wood shaped into prows, political leaders have grasped the practical strategic significance of military production. These considerations have only intensified with the maturation of both industrial capitalism and the modern Westphalian international system. As state capacity developed in tune with economic sophistication, the demand and supply for advanced weapons technology became increasingly inter-meshed in the form of permanent defense industries.[4] At the same time, the character of these industries is now bound up with global politics, and the structure of the transnational economy.[5]

Academic study of these issues has bifurcated between a focus on external drivers of defense industrial capacity, and domestic determinants. With regards to the former, the arms race and military innovation literature have established a foundation for examining how states draw on domestic defense industrial resources to respond to a change in their external strategic circumstances, and how these choices then reverberate internationally. Conversely, analyses centered on domestic political, bureaucratic, and economic drivers have tended to see the origins and implications through the lens of the emergence, justification, and reproduction of military-industrial complexes.[6] While a number of analyses have sought to integrate elements of what Kenneth Waltz termed 'first image' international structural and 'second image' state-level dynamics into a single explanation, they have nonetheless rested on an assumption of a fixed structure of institutions that integrate state and defense-industrial actors

[3]Notable exceptions include for example the work of Ethan Kapstein, Keith Krause, Marc DeVore, and Stephanie Neuman. See Kapstein (1991); Krause (1992); DeVore (2013); Neuman (2006).

[4]Smit (2006).

[5]Kassimeris and Buckley (2010); Grinberg (2014).

[6]Glaser (2000), p. 253. See in particular Mary Kaldor's analysis of the Cold War as an international compact between US and Soviet military-industrial complexes orientated towards internal stabilization of their respective political economies. Kaldor (1990).

in determining the orientation of military procurement.[7] What is needed, however, is a dynamic account of how states engage with their defense industrial networks to respond to changes in their external strategic circumstances, and how these choices reverberate both internationally via strategic competition, but also trans-nationally through global arms linkages between producers and state customers.

In this dissertation I pick up this challenge. In contrast to accounts centered on either international strategic competition between unconstrained strategic leviathans or the unchecked ambitions of military-industrial complexes, I seek to explore state defense industrial capacity as a product of 'arms wrestling' for influence between states and defense producers across both the domestic and international stages. Specifically, I seek to advance a theory of the state's strategic defense industrial capacity as a product of what Robert Putnam termed a two-level game, played both within the domestic and global defense industrial networks.[8] This defense industrial capacity can be conceived as having two facets, *procurement capacity* and *gatekeeper capacity*. Procurement capacity represents the relative capacity of the state to effectively govern the transformation of domestic societal resources into systems of weapons that provide relative military advantage. Conversely, gatekeeper capacity embodies the relative capacity of the state to influence global flows of weapon systems and technologies, and hence the distribution and alignment of international military power.

Explaining variation in defense industrial capacity requires us to theorize the dynamic interaction of organizations, within networks of defense industrial relations that stretch from the domestic to the global. It also requires understanding how these networks are shaped by the technology of their era, and the implications of the

[7] On Waltz's conception of levels of explanations in international relations theory, see Waltz (1954). On efforts to hybridize these insights, see for example Matthew Evangelista's classic analysis of divergent Soviet and US approaches towards arms innovation. Evangelista (1988).

[8] The concept of the two-level game as pioneered by Putnam focused on the interplay between domestic and international negotiation. See Putnam (1988). Limited — but suggestive — efforts have sought to use this framework to explore defense procurement relations. See Raymond (2018).

feedback dynamics that can emerge between them.[9] I theorize that defense industrial capacity rests on the *structure of defense industrial networks* that link weapons producers and state customers. Such networks underpin the balance of bargaining power that defines the relative capacity of producers and buyers to shape each other's behavior. Defense industrial capacity is also conditioned by *the breadth and depth of technological requirements underpinning weapons production.* The greater the range and sophistication of technologies embodied in weapons systems, the greater the need for defense producers to develop and sustain specialized and resource-intensive military systems integration capabilities.[10] Ultimately, technological requirements determine the significance of the international distribution of these technological integration capabilities, and hence the prospects of the emulation and diffusion of military technology across changes in specific weapon systems.[11]

Changes in the state's strategic environment generate shifts in demand for military force structure, with implications for weapons procurement, and by extension for the state's engagement in the global arms network. The state's ability to effectively respond — its defense industrial capacity — is thus a critical element in its ability to realize "competitive strategies": the development and leveraging by the state of persistent comparative advantages in state capacity that shape the behavior of their peers within the international system.[12] State defense industrial capacity to respond strategic changes is shaped by the interaction of new external challenges with the structure of defense industrial networks, as well as the international distribution of military technological integration capabilities. While the impact of these changes in defense industrial capacity can redound to the advantage of defense bureaucracies,

[9] Bijker and Pinch (1987), pp. 33-35.
[10] Johnson (2003), p. 40.
[11] See Gilli and Gilli (2019); Krause (1992).
[12] Rosen (2012). The concept of competitive strategies developed out of US strategic analyst Andrew Marshall's efforts to identify the key relative strategic advantages possessed by the United States and the Soviet Union during the Cold War. See Marshall (1972).

empowering them with respect to weapons producers, they can also serve to undermine the bureaucracies' latitude and influence. As a consequence, defense industrial capacity varies across different countries and across different times. Rather than ascribing this variation to the operation of macro-level national political and economic orders, we must view it as a historically specific dynamic within a particular network structures. The aim of this dissertation is to provide a systematic approach to the identification and interpretation of these processes.

1.2 *Dissertation outline*

This dissertation proceeds to outline a theoretical framework for exploring these questions regarding the sources of — and shifts in — defense industrial capacity. In Chapter 2, I elaborate on the two facets of defense industrial capacity: procurement capacity, which represents the capacity of the state to effectively channel procurement budgets through the domestic defense industrial network to meet its security challenges; and gatekeeper capacity, which embodies the ability of the state to harness the global defense industrial network to advance its international strategic position. I outline a theoretical account of the foundations of defense industrial capacity as residing in two key variables: the structural position of the state within defense industrial networks, and the breadth and depth of military technological requirements that define the challenge of developing the capacity to integrate those technologies into military systems.

Subsequent chapters focus on exploring this theory in the empirical context of two major cases across a period spanning the late 19th to the early 21st centuries. Chapter 3 centers on an examination of Britain's experience of leveraging defense industrial capacity from the 1880s through to the turn of the 20th century. Britain successfully harnessed its defense industrial network to respond to rising Franco-Russian naval

power by emphasizing quantitative expansion over significant technological innovation. This played to Britain's strengths in the scale and efficiency of its flexible and innovative private industrial sector. However, the ease of emulation — a function of the limited range of key technological requirements for naval procurement, and hence the wide access to the necessary technological integration capabilities among the great powers — meant that London was not able to effectively utilize its position within the global defense industrial network to shape access to naval weapons to advance its strategic interests.

Following on from this case, Chapter 4 examines British procurement capacity from 1902 through to the outbreak of the First World War. Facing a new security challenge from the emergence of German naval power, the British state once again engaged in a procurement build up. However, shifts in the structural balance of Britain's domestic defense industrial network had empowered private producers to exert greater influence over the direction of this build-up in favor of qualitative innovation. Under conditions of limited military technological requirements and widely distributed technological integration capabilities, this focus was rapidly emulated by Germany and other powers. This failure of British procurement capacity was mirrored in the persistent weakness of its gatekeeper capacity. Broad based access to key industrial technologies meant that London faced little prospect of effectively controlling the diffusion of military technology internationally, a reality that contributed to its unwillingness to develop the institutional tools to regulate military exports.

The following chapters shift the empirical focus to the experiences of the United States in the late 20th and early 21st centuries. In Chapter 5, I analyze the US response to the increase in the Soviet Union's capabilities. Amid a rapid expansion in the breadth and depth of military technological requirements that favored the advanced systems integration capacities that were a Western competitive advantage, as well as the ad-

vantageous structural position of the US state within its defense industrial network, Washington was able to exert procurement capacity to pursue renewed qualitative innovation in defense procurement. This centered on the development of networks of sensors, weapons, and command and control systems that later became known as the Revolution in Military Affairs. Washington reaped an enduring procurement advantage from this approach, reflecting the challenging task of emulation this imposed on a less technologically advanced Soviet Union. It also gave rise to substantial gatekeeper capacity advantages. In the face of the significant improvements in US military capabilities attendant on this procurement shift, and facing the limited prospects for diffusion imposed by limited access to advance technologies, countries increasingly turned to Washington as a source for critical defense imports. Having developed the institutions to control the exports of weapons technologies, the United States was able to structure access to advance its strategic interests.

Chapter 6 caps off the empirical investigation by exploring US defense industrial capacity in the early 21st century in the wake of the 9/11 terrorist attacks. I argue that the military demand imposed by these events was channeled through a defense industrial network in which supply had become substantially more consolidated, reducing Washington's relative dominance of the procurement agenda. Instead, producers were able to promote their own preferences, in this case for continued qualitative innovation, despite the mismatch with US strategic requirements that were increasingly focused on less technologically-intensive counter-terrorism and counter-insurgency campaigns. As a result, Washington spent considerable resources raising the military technological bar, at a time when it faced no competitor of equivalent qualitative or quantitative military capacity. The reduced effectiveness of US procurement capacity during this period was, however, offset by the sustaining of strong gatekeeper capacity. Ongoing innovation generated a persistent demand for US military exports that allowed Washington to exert its institutionalized regulatory powers to shape access to further

entrench its key partnerships and interests worldwide.

The concluding chapter of this dissertation draws discussion back into contemporary focus, by exploring the implications of utilizing the theoretical framework to analyze US-China defense industrial competition. This — necessarily surface level — exploration is suggestive of the broader applicability of the framework. It also provides an opportunity to identify some of its potential extensions.

CHAPTER 2

A THEORY OF DEFENSE INDUSTRIAL CAPACITY

This chapter lays out an initial framework for assessing the defense industrial capacity of states. I conceive of defense industrial capacity as the ability of the state to leverage its defense industrial relationships to achieve strategic advantage relative to its competitors. I first define defense industrial capacity as having two aspects: procurement capacity (the capacity of the state to acquire a military force structure that is tailored to its strategic requirements), and gatekeeper capacity (the capacity of the state to leverage its defense industrial production to achieve international influence).[1]

I theorize that variation in both aspects of defense industrial capacity rests primarily on two factors: the structural position of the state within both domestic and international defense industrial networks, and the breadth and depth of military technological requirements. I argue that changes in these factors drive shifts in state defense industrial capacity, via the operation of the defense industrial cycle.

[1]Existing studies of international variation in state capacity to generate military power have tended to focus on macro-social dynamics, such as the spread of industrialization, or national economic and political regimes. See for example Goldman and Andres (1999). In conceiving of defense industrial capacity at both the international and the domestic levels, I am heeding recent calls within the international relations literature to craft theoretical bridges between macro-level dynamics within international security and the global economy, and micro-level changes in the specific patterns of social and economic activity within countries. See for example Oatley (2019); Mabee (2007). This division also echoes that of authors in the network analysis literature, in that it distinguishes between the inward focus on the constitution and governance of networks, and the outward focus on their integration into other, broader networks. See for example Manuel Castells's distinction between programming and switching aspects of power. Castells (2011), p. 776.

2.1 *Procurement capacity*

Procurement capacity is embodied in the state's ability to effectively engage with its domestic defense industrial network to procure a military force structure appropriate to its security environment.[2] While the scale of national resources available to the state provides the outer bounds of the quantity and sophistication of weapons that it can generate, they do not determine whether those weapons actually provide a capability to address the state's strategic requirements.[3] The efficacy with which states are able to direct force structure development towards external exigencies is thus critical to their successful production of military capabilities that can advance the state's security interests.

This reflects the fact that the strategic potential of a military force structure is inherently contingent on the relative military advantage it provides vis-à-vis adversaries. As the arms race and military innovation literatures have contended, state preferences regarding military force structures are shaped by the competitive nature of the strategic environment faced by the state. Military force structures are what the economic literature terms 'tournament goods': because advantage in a military competition leads to zero-sum distributions of gains between winners and losers, even a marginal advantage can prove decisive.[4] Thus unlike most economic goods, the value of weapons to the state comes not from their objective performance characteristics, but their performance relative to the force structures deployed by others.[5] As a consequence, weapons procurement decisions are shaped by — and in turn shape — the

[2]I take such significant changes as being defined by material shifts in the global distribution of power, as well as the overt, large-scale deployment of violence by actors against the state and its equities. I acknowledge that below these thresholds, perceptions of military threat will vary substantially requiring a more nuanced account of the social construction of security challenges c.f. the constructivist approach to international security threats. See for example Weldes (1999). But for the purposes of this dissertation, the character of changes in the security challenges facing the state are of such a clear and material nature that they can be taken as objectively presenting themselves to state leaders and broader society.

[3]Aron (1966), pp. 64-65. See also Lambert (2012), p. 22.

[4]K. Hartley and Solomon (2016); Kirkpatrick (2008). See also Dafoe (2015), p. 22.

[5]Marshall (1972), pp. iix-ix.

actions of others, giving rise to a particular "logic of competition."[6] Building on the military innovation and arms trade literatures, I distinguish between state procurement decisions based on the balance they strike between improving the qualitative sophistication of a military force structure on the one hand, and its quantitative expansion on the other.[7]

Depending on the nature of the strategic environment they face, states will extract different degrees of strategic advantage from varying mixes of qualitative or quantitative improvements in force structure. Because these mixes are not fully fungible across the range of strategic challenges that the state faces, there is the potential for inefficient — and potentially extremely costly — security outcomes.[8] Interstate warfare places different pressures on force structure compared to irregular or asymmetric challenges. In conventional military competition, a qualitatively second-rate — though somewhat larger — force structure is liable to struggle against a more advanced opposing force structure. Conversely, in a range of other military contingencies, quantity is a more decisive factor. Sub-state asymmetric security challenges such as insurgency are personnel intensive, due to the need to secure information through face-to-face interactions with the local populations, and to exert effective control over wide areas.[9] While the qualitative and quantitative characteristics of force structures are malleable in both cases (subject to declining marginal strategic utility), the specific range of substitutibility will vary with the nature of the strategic challenge. Sufficiently large advantages in qualitative character or quantitative scale

[6]See Glaser (2010), Chapter 9; Barnett (2008), pp. 8-11.

[7]The distinction between quantitative versus qualitative force structure development draws on Samuel Huntington's seminal articulation of strategic competition in arms races. See Huntington (1958). See also Ekman (2014), pp. 5-6.

[8]For brevity's sake I will hereafter refer simply to quantitative versus qualitative differences in force structure. This should, however, be taken as strictly in reference to force structures that focus on the massing of formations and weapons, versus investing in their technological sophistication. It is not intended as a direct judgment of the skill and training of military personnel (though more complex, capital-intensive force structures tend to require more highly educated and trained personnel.).

[9]Lyall and Wilson (2009), p. 68; Sechser and Saunders (2010), p. 484.

can still generate military success across a range of strategic requirements.[10] But the efficacy with which that advantage is generated will be vastly lower than the optimal balance of quantitative and qualitative characteristics, thus representing a much greater fiscal and strategic burden on the state. Navigating these choices through procurement capacity thus represents a form of competitive strategy: the ability to inflict fiscal costs on other parties on the basis of relative differences in efficiency in mobilizing defense industrial networks.[11]

Efforts to navigate the competitive implications of qualitative versus quantitative force structure decisions were clearly present in the Obama Administration's efforts to articulate the force structure requirements of the Third Offset strategy. The Department of Defense under Defense Secretary Carter identified the status quo of US force structure as increasingly challenged by the diffusion of precision-guided weapons, including anti-access and area denial (A2AD) capabilities intended to prevent Washington from projecting power into key strategic regions. Washington was tracking the adoption of these capabilities by rising powers, particularly China.[12] As a result, Carter directed the Pentagon to pursue a shift away from large stocks of legacy weapon systems, towards a more qualitatively sophisticated design capable of penetrating A2AD defenses. This subsequently came to form the core of the Third Offset strategy.[13]

Importantly, the security imperatives facing defense customers are not automatically decisive in shaping military force structures. As Judith Reppy has noted, the social and political context of defense procurement matters to the choices made by states.[14] Private defense producers have their own commercial interests that define their own

[10] Arregun-Toft (2005), pp. 2-3.
[11] Marshall (1972).
[12] Watts (2013b), pp. 24-28.
[13] Similar considerations animated debates over various US Air Force force structure mixes vis-à-vis Soviet airpower in mid-1980s. See Pierrot (1985).
[14] Reppy (1990), pp.102-103.

procurement imperatives; in a political economy defined by capitalist democratic institutions, the ultimate focus of defense procurement is decided by the balance of influence between defense producers and their customers in engaging with each other, and the political entities that tax and appropriate funds for defense purposes.[15] While different institutions manifest this power dynamic in a different fashion, authoritarian and state-owned military complexes are similarly shaped by the interests of the producers and the buyers of weapon systems.[16] Procurement capacity is thus produced and reproduced in day-to-day competition and cooperation between producers and state customers, as the latter attempt to exert governance over the former within the domestic defense industrial network.[17]

2.2 *Gatekeeper capacity*

Gatekeeper capacity, in contrast, is embodied in the state's capacity to harness flows of weapons technologies through the global defense industrial network to advance the state's international strategic interests. The most direct manner in which this can occur is through the control of weapons exports and licensed production, which, while conducted by producers, is authorized within the context of bilateral state-to-state relationships. The overtly political nature of international arms exports create the potential for the supplier to exploit access to weapons as a form of bargaining power

[15]This is the core thesis of Adams (1981).

[16]As Andrei Markevich and Mark Harrison have argued, "[a]lthough the Soviet economy was generally unlike western market economies, markets for military equipment have specific features that tend to be similar everywhere. In all countries, agents on both sides of the market place are powerful and well connected. On one side, a senior government minister manages a monopsony. On the other side are large-scale producers with claims on government funding that carry additional weight because these concerns are too important as producers and employers to be allowed to fail." Markevich and Harrison (2006), pp. 114-115.

[17]This is an instance of what John Hobson has termed "competitive-cooperation". Hobson (1997), p. 11. This notion shares much in common with Michael Mann's conception of the infrastructural power of the state, the extension and institutional embedding of the relationships of state organizations throughout society. See Mann (1988), pp. 6-9. Regarding the constant nature of the struggle of power, see Carpenter (2010), p. 19, ft. 22.

to directly shape customer behavior.[18] Jonathan Caverley has argued that states with particularly large footprints within the global defense industry hold asymmetric influence over access to key technologies, and hence over the choices made by firms and other states alike.[19] Through their dominant positions, key global suppliers can signal that arms flows are subject to political or strategic conditions on the choices recipients make. The intended result is to compel other states to align their actions with the supplier country's strategic interests.

States can also seek to harness access to weapons as a form of indirect structural power. By bolstering and shaping the military capacity of their partners, states can aspire to influence the wider international balance of power through arms transfers. This allows the state to shape global access to, and the distribution of, military capability within the international security system without imposing explicit strategic provisos.[20] These exchanges, while potentially subject to supplier state authorization, nonetheless center primarily on a relationship between the recipient state and the arms-producing firm. In this, as Theodore Moran has argued, weapons producers can operate as the instruments of international strategic competition, projecting state influence without an overt state presence.[21]

The strategic deployment of gatekeeper capacity is illustrated by US efforts to expand defense industrial ties with India. In 2012, Washington inaugurated the Defense Technology and Trade Initiative, aimed at supporting the penetration of US military exports into India. Sales over the following years surged from US$200 million in 2009 to US$2 billion in 2013.[22] These efforts further escalated with then-President Obama

[18] Krause (1991). See also Paul (1992).
[19] Caverley (2007).
[20] See Krause (1990); Krause (1991). As Keren Yarhi-milo et al. contend, while arms exports complement formal security ties, they can also extend beyond them, and in some case act as substitutes if there is a fundamental underlying alignment of strategic interests. See Yarhi-milo, Lanoszka, and Cooper (2016).
[21] Moran (1990).
[22] Hardy (2014).

and Prime Minister Modi's January 2015 inauguration of a Joint Working Group on Aircraft Carrier Cooperation. This group of high-level policy makers sought to explore specific ways in which US expertise and technology with respect to the construction and operation of aircraft carriers could be utilized in the development of India's next generation carrier. The United States has unique technologies and industrial experience with respect to the production of large, nuclear, Catapult Assisted Take-off But Arrested Recovery aircraft carriers. This provided it with the potential to shape the global diffusion of a strategically significant naval capability. In exploring the prospects for selectively diffusing this technology to New Delhi, Washington was harnessing an intensifying defense industrial relationship to a clear strategic objective: empowering India to offset growing Chinese naval power projection into the Indian Ocean.[23]

In addition to altering the international distribution of military capabilities, states with significant gatekeeper capacity can shape how weapons buyers balance their strategic interests. Through what Keith Krause has termed the "hegemonic power" of arms exports, influential states can indirectly shape the incentives facing their defense industrial clients.[24] When presented with potential military capability advantages through importing lower cost and higher quality weapon systems, arms recipients may also face negative implications for state autonomy if those weapons entail dependence on logistics and technical support for those weapons. By presenting states with such a trade-off, arms exporters are effectively altering the strategic incentives facing arms recipients. Customers who anticipate that their strategic choices may threaten the interests of a major supplier may curtail — on their own initiative — those actions, in order to avoid threatening their access to key military supplies. Similarly, recipients may also pursue or deepen institutionalized security relationships with their dominant

[23]Tellis (2015).
[24]Krause (1991), pp. 325-331.

arms supplier to avoid the risk of abandonment.[25]

Over time, these decisions can accrete into patterns of strategic alignment, which interweave the sourcing of arms with patterns of security cooperation. These patterns can also shape — and be shaped by — transnational shifts in interests within domestic defense industrial networks, as local defense producers either emerge to challenge external arms-importers, or are co-opted into their own supply chains. To the extent that states are able to utilize gatekeeper capacity to shape their defense industrial relationships with foreign defense industries to generate strategic advantage, we can observe the defense industrial equivalent of Albert Hirschman's conception of trade as a tool of coalition building, in which those that benefit become a "commercial fifth column", whose defense industrial interests align them with the strategic interests of their trading partner.[26]

2.3 *The sources of defense industrial capacity*

Assessing the extent of defense industrial capacity raises a subsequent question: what is the source of that capacity? I argue that procurement and gatekeeper capacity are a product of the structure of the defense industrial network and the international distribution of technological capabilities required for defense production.

[25] As a consequence, defense industrial relationships form a key — but understudied — aspect of the autonomy-capability trade-off states make in orientating themselves within the wider internationals security system. See Morrow (1991).

[26] Hirschman (1945), p. 29; see also Abdelal and Kirshner (1999); Helen Milner describes a similar mechanism with respect to trade policy, where more internationally exposed firms tend to advocate in support of continued openness. See Milner (1988).

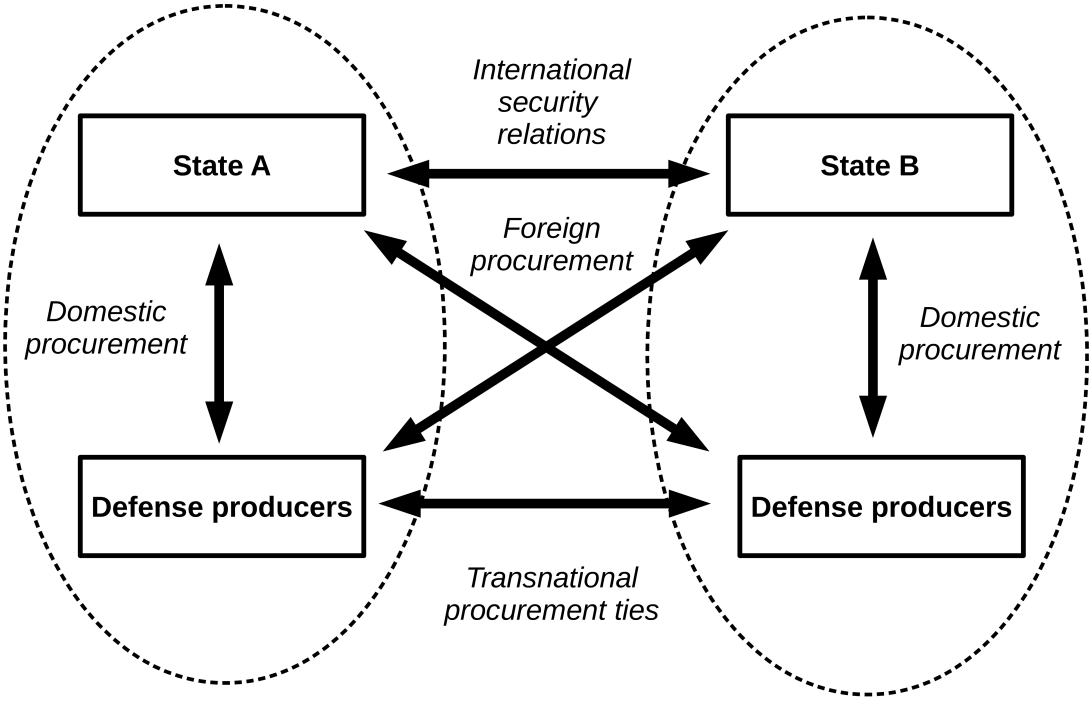

Figure 2.1: Defense industrial structure and pathways to influence.

2.3.1 *The role of defense industrial network structure*

I posit that a state's defense industrial capacity is shaped by its structural position within defense industrial networks. These networks represent webs of relationships that link defense producers and customers. In capitalist economies, they encompass state relationships with private producers across two overlapping sub-networks. The domestic defense industrial network represents the structure of relationships between defense industrial actors within a given country. The global defense industrial network encompasses the structure of transnational ties between domestic defense industrial networks. These relationships, and the pathways to influence via procurement and gatekeeper capacity, are illustrated in Figure 2.1.

The structure of defense industrial relationships, and their implications for the balance of power between state and non-state actors, is often assumed rather than analyzed. Statist and neo-realist analyses have asserted an asymmetry in power between state

customers and individual producers which grants states relative autonomy to harness weapons manufacturers to advance their procurement capacity.[27] In such accounts, weapons producers operate as the pawns of international strategic competition, the object of state action in the pursuit of autonomy and influence.[28] Conversely, analyses in the liberal or Marxist traditions have emphasized the challenges to state control over defense industrial affairs, grounded in the capacity of private firms to either penetrate the political process, or operate trans-nationally beyond the reach of individual national administrations.[29] From these perspectives, the structural position of firms allows them to log-roll with state bureaucratic entities to achieve their interests, giving rise to concerns that national policy is captured by a "military-industrial complex."[30]

In contrast to these perspectives, I argue that structural position is both variable and malleable, forming the ever-evolving basis for a series of "two-level games" that encompass international security and defense industrial relationships, internal arms procurement within domestic defense industrial networks, and a weave of transnational linkages between arms producers and their customers.[31] Organizations, whether firms or state bureaucracies, are defined by the network of relationships that situate them

[27]Such analyses follow in the tradition of statist international political economy charted by Stephen Krasner. For the foundational account, see Krasner (1978).

[28]Moran (1990).

[29]See for example Vernon and Kapstein (1991); Moravcsik (1991); Adams (1981).

[30]The prominence of this account term stems from its popularization by President Dwight D. Eisenhower. See Eisenhower (1961).

[31]As noted previously, the concept of the two-level game devised by Robert Putnam has seen only limited exploration within the context of the international arms trade. Gregory Raymond deploys Putnam's terminology, but largely restricts his analysis to the interplay of domestic Australian procurement debates, and its external strategic perceptions. Strikingly absent is a discussion of transnational defense industrial integration with the United States and its implications for Australian strategic trade-offs. See Raymond (2018) and Putnam (1988). Putnam's model hybridizes domestic political economy approaches with more state-centric analyses. This is largely compatible with neoclassical realist approaches towards international relations, which I also draw on. See for example Christensen (1996), Chapter 2, and Lobell (2009). This dynamism in the nature of the structural forces shaping the balance of influence between state and society distinguishes my approach from those analyses — whether focused on external or internal determinants of defense industrial responses — that emphasize structurally fixed relationships.

vis-à-vis one another.[32] Position within the topography of relationships across the domestic defense industrial network serves to grant both defense producers and customers the capacity to influence one another's behavior.[33] As William Winecoff characterizes it, "[p]rominent positions bequeath power over the broader network to the nodes that occupy them, such as a capacity to initiate (or curtail) certain types of activities."[34] This influence can be direct and transactional, manifest in relative advantages in bargaining between entities which can be achieved by consciously leveraging network structure. Such leverage manifests the market power that comes from centrality as either a key supplier or customer. Influence can also be indirect and inherent in the structure of the network itself.[35] This can involve shaping the underlying range of choices available to different actors. For example, firms that develop defense products with closed and proprietary technical standards that embody networks effects (whose value increases with the number of customers that adopt those products, such as communications and encryption services) can have an outsized influence over international procurement choices.[36]

My focus on the structure of relationships between defense producers and customers does not imply that the wider political and economic institutional context of the state is irrelevant. This context is significant to understanding the specific form in which influence manifests through those relationships. However, I contend that institutional context is not itself determinate of the magnitude or direction of that influence within defense industrial networks.[37] For example, a greater unification of formal political powers in the hands of a strong executive will result in the locus

[32]Abdelal (2015), p. 557; Oatley (2019).
[33]Culpepper (2015).
[34]Winecoff (2015), p. 14.
[35]Bell (2012); Farrell and Newman (2015); Culpepper (2015).
[36]See Zervos and Swann (2009), pp. 30-32.
[37]As David Rowe et al. have argued, "Unfortunately, there is no 'grand theory' of institutions that lends itself to simple, parsimonious theorizing. Most important arenas of social behavior are governed by multiple, overlapping institutions that can interact in complex ways." Rowe, Bearce, and McDonald (2002), p.555.

of defense industrial influence emerging in the interaction of producers with defense bureaucracies. Thus, the balance of influence over procurement priorities will be manifested directly in interaction and bargaining between the respective interests of producers and state buyers. Conversely, a wider distribution of formal powers — to include, for example, a significantly active role of the legislature in defense procurement — shifts the locus of the contest of influence to include the indirect efforts of defense producers and military bureaucracies to shape the agenda of legislative appropriations committees and other actors. Under these circumstances, producers and customers seek to project influence by seeking common cause with legislative interests, as defined by the local political economic concerns of parliamentarians.[38] In both cases, the balance of influence remains a product of the network structure of the defense industrial network; institutions, for their part, define the character of its manifestation.

This contrast is captured in the differences in how defense industrial capacity is manifested in unified Westminster parliamentary democracies such as the United Kingom, where Parliament's engagement in shaping procurement decisions is largely restricted to approval of overall defense budgets, in contrast to the separation of legislative and executive powers in the United States, which places Congressional decision-making at the heart of negotiations over specific force structure trade-offs. Nonetheless, in both cases the structural concentration of defense industrial producers represents the decisive factor in relative balance of influence vis-à-vis the state with respect of procurement priorities. This analysis is not bound simply to democracies, though this is the primary focus of this dissertation. Variation in the concentration of political authority across autocracies, from the strong centralized control exerted by party-

[38]This provides a mechanism for pork-barrel politics to emerge as part of procurement trade-offs. See for example Gholz and Sapolsky (1999), pp. 5-6. It can also represent a vector for the transmission of voter interests for force structures that minimize their collective exposure to the costs of military mobilization. See for example Caverley (2014), Chapter 1.

state systems such as the People's Republic of China (PRC), to the looser, federated forms of control exerted in monarchical systems epitomized by Wilhelmine Germany, have offered different points of access and hence focal points for influence to be transacted.[39] However, the fundamental differences in state procurement capacity remain conditional on the structure of the defense industrial network, and the relative position of defense industrial producers vis-à-vis state customers. The greater the range of producers to source weapons from, the lower the state's dependence on any one entity, and the better its opportunities to pressure or influence them to align with its strategic objectives. Thus, to reiterate, I expect that state defense industrial capacity fundamentally hinges on relative structural positions within the defense industrial network.

2.3.2 *The implications of the breadth and depth of military technological requirements*

In addition to the role of network structure, I contend that state defense industrial capacity is shaped by the depth and breadth of technological requirements necessary for the production of major weapon systems. As noted previously, states value more advanced military technologies primarily because of the potential strategic advantages those technologies can provide over their adversaries. The arms racing and military innovation literature has demonstrated that these external pressures create a strong competitive incentive for states to emulate or otherwise adapt to new military technological innovations, which are then internally channeled and modified through the interaction of the state with domestic actors and institutions.[40]

[39]Regarding the institutional context of pre-World War I Germany, see Rosecrance and Stein (1993). On the influence of centralized political power on defense procurement in the PRC, see Cheung (2008), Chapters 2-4.

[40]See for example Taliaferro (2006). This is not to say that there are not other sources of demand for advanced weapons. Normative drivers can also have a strong impact. See Suchman and Eyre (1992). However, these pressures serve to exacerbate the underlying rational, competitive drivers of weapons acquisition.

The depth and breadth of military technological requirements impact on the ease and rapidity of technological diffusion and emulation.[41] Relative international access to the full range of military-required technologies thus shapes the conditions under which the state's decision to pursue technological innovation benefits its procurement and gatekeeper capacity. Within the domestic defense industrial network, innovations whose technological requirements are diverse and sophisticated are likely to offer a greater challenge to emulation, and hence can create persistent military advantages for states that are difficult for their rivals to match[42] By the same token, such innovation can also provide the domestic defense industrial network with an enduring advantage as a supplier within the global defense industrial network, since the full range of technologies embodied in their products do not easily diffuse. Indeed, as Stephanie Neuman has observed, there appears to be "an inverse relationship between the complexity of a military item and the number of states producing it."[43] This ability to control the diffusion of technology represents an enabling condition for state-led influence through their domestic defense industrial network and into the global defense industrial network. Conversely, innovations which draw on a limited range of technological competencies that are widely distributed internationally will be harder to translate into lasting advantages, within either the domestic or the global defense industrial networks.

But state capacity to emulate technology is not fixed. The military innovation literature has acknowledged that state-level factors condition the capacity of states to emulate.[44] Foundational to these prospects are the barriers to emulation imposed by

[41]It is important here to distinguish between military technological requirements, and the qualitative sophistication of military force structure. The former is a question of the specific range of technological capacities required to produce major weapons systems. Conversely, the qualitative sophistication of military force structure is a question of the performance capabilities of the weapons themselves, identified relative to the pre-existing state of the military force structure, and to the force structures of others.

[42]This advantage is particularly extreme relative to poorer developing countries. See for example the discussion in Brzoska and Lock (1988).

[43]Neuman (1984), p. 175.

[44]For example, Kimberly Zisk argues that military leaders looking to maintain institutional rele-

limits on the international distribution of necessary technological capacities. States whose economies encompass a full range of military-required technologies, and the capability to integrate them into weapon systems, possess the material bases for emulation. States with a more narrowly founded technological structure are likely to face greater challenges.

The precise range and depth of technological competencies required to emulate or adapt to the production of advanced military systems is contingent and evolves over time. Historically, a limited pool of specific technologies was critical to military production. For example, the capacity to produce firearms during the early modern period from the 15th-18th centuries largely centered on skills and technical knowledge associated with the the casting and working of bronze and iron.[45] However, as technology has evolved, so too have the nature and breadth of military technological requirements. As Stuart McCutchan observed, "[j]ust 20 or 30 years ago, the airplane was the thing, or the ship was the thing, now those things are just nodes in the network and the network is the thing."[46] This reflects the transformation of weapons into what the technology and business studies literature refers to as Complex Product Systems (CoPS).[47] According to Virginia Acha et al., such systems

> "are defined as high cost, engineering-intensive products, systems, networks and constructs. The term 'complex' is used to denote the high number of customized components, the breadth of the knowledge and skills required, and the extent of new knowledge involved in development and production."[48]

vance will change their doctrinal commitments in reaction to perceived changes pursued by potential rivals. See Zisk (1993). On other internal constraints on military technological emulation, see also Krause (1990). On the role of organizational and institutional limits to emulation, see Horowitz (2010).

[45] See Krause (1992), Chapter 2.

[46] Merle (2003), cited in Zervos and Swann (2009).

[47] Dosi et al. (2002)

[48] Acha et al. (2004), p. 507.

As the breadth and depth of technological capabilities required for defense industrial production varies over time, so, too, does the level of challenge states face in reconciling their economic endowments with military requirements. The impact of changes in the breadth of technology requirements for military production has been identified as a key explanatory factor in the military diffusion literature.[49] Changes in these requirements stem from the growth in both the overall diversity and the interdependence of technical knowledge and production capacities required to produce military systems. In particular, these changes result in the increasing salience of systems integration and engineering capabilities in weapons system design and production. As modern weapons systems, like other CoPS, have become increasingly multi-functional, they have imposed increasingly onerous technical and organizational requirements on defense producers.[50] Defense producers as systems integrators need competencies across a wider range of technologies, and a capacity to design and manage the interface between an increasingly diverse and complex set of components.[51] This has resulted in steeper barriers to the emulation of innovation, prolonging and increasing the strategic benefits of qualitative innovation in military force structures.

[49]See for example Gilli and Gilli (2019), pp. 149-155. Their account parallels previous analyses of technological change and its impact on military procurement. See Peck and Scherer (1962), pp. 42-43. Similar arguments regarding the nature and implications of changing military technological requirements were also emphasized in an influential 1980 briefing by Frank Spinney, an official within the Office of the Secretary of Defense. See Spinney (1980), slide 8.

[50]For example, as Peter Dombrowski et al. have observed, "the hulls of the *Arleigh Burke* destroyers are the size of those of traditional cruisers. Individual ships of that class are intended to fight antisubmarine and antiair warfare battles at the same time as they prepare for (and perhaps execute) land attack/strike missions. The result is that the design bristles with antennas, squeezes an enormous amount of equipment into a confined space, and relies on weapon systems (like vertical launch tubes) that can handle many types of missiles. The core competencies in naval architecture and complex craftsmanship that make the *Arleigh Burke*–class ships tremendously capable are evident as well in the construction of aircraft carriers, amphibious ships, attack submarines, and even combat-support ships." See Dombrowski, Gholz, and Ross (2002), p. 35.

[51]Significantly, this progression towards greater breadth and depth of technological requirements on the part of defense producers as military systems integrators is accompanied by an increase in the outsourcing of component technology production, much of which is increasingly standardized and dual use. This has resulted in a dual movement in the global defense economy, where an increasingly diverse range of component suppliers are integrated transnationally into production networks, at the same time as the number of systems integrators is thinning out and becoming more concentrated on core markets, due to the increasing barriers to entry imposed by the expanding technological requirements. See Dosi et al. (2003).

Both changes in network structure and in the breadth of military-required technological competencies separately offer insight into defense industrial dynamics. Yet neither alone can fully explain empirical variation across time and space, a task that lends itself towards an eclectic framework that melds various analytic perspectives and paradigms.[52] An eclectic approach treats defense industrial capacity as a product of both the state's position within the relational structure of the defense industrial network, and military technological requirements that condition those relationships. Rather than viewing the social domain of defense industrial relations as a static "iron triangle", I view it as a protean — and complex — arrangement of competitive and cooperative relationships.[53] In conceiving the domain of defense industrial capacity in this fashion, I am heeding recent calls within the international relations literature to craft theoretical bridges between macro-level dynamics at the level of international security, and global economic integration and micro-level changes in the specific constitution of social and economic activity within countries.[54]

2.4 *The defense industrial cycle*

A great power's defense industrial capacity shifts over time as its structural position within both domestic and international defense industrial networks evolves against the backdrop of the breadth and depth of military-required technological capacities. The result is a defense industrial cycle, consisting of two conceptually distinct (though potentially overlapping) stages. This process is outlined in Figure 2.2.

[52]Sil and Katzenstein (2010). This approach is convergent with efforts to develop a new Political Economic of Complex Interdependence. See Oatley (2019).

[53]Adams (1981); on the applicability of analytic eclecticism to such problems, see Oatley (2015).

[54]Mabee (2007).

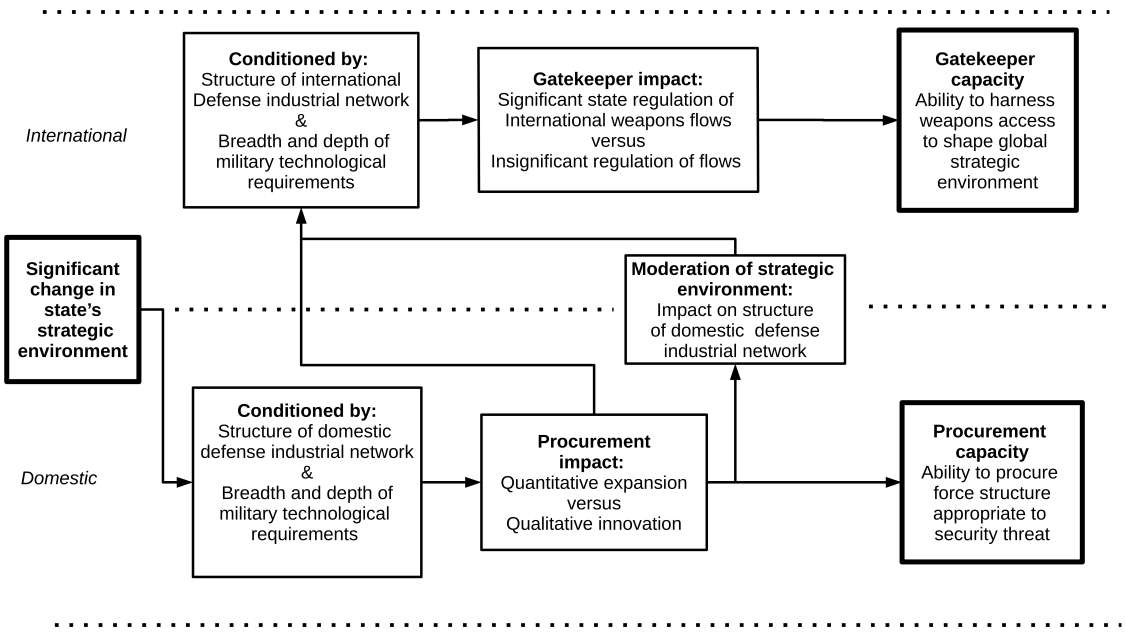

Figure 2.2: The defense industrial cycle.

2.4.1 *Stage one: Procurement impact*

The defense industrial cycle opens with a change in the state's strategic circumstances.[55] State leaders periodically are confronted by adverse changes in their external security environment, due to significant shifts in the international balance of power, or through direct attacks by external actors. Such negative shifts in the state's security circumstances in turn drive an increased demand for military capability to offset those changes.

The focus of the resulting procurement response is subject to contestation between defense industrial producers and state buyers of weapons systems. Producers and defense officials face different imperatives regarding how to respond to a change in a country's strategic environment. These imperatives are shaped by the breadth and depth of military technological requirements, which impacts on the potential for emulation by rivals, as well as the distinctive objectives motivating producers and

[55]The literature on military innovation has long recognized the salience of external security challenges as a key driver of military innovation. See Rosen (1988).

customers of weapons. For defense officials, their primary interest is the maintenance of an external balance of power that sustains state interests, and is thus a function of the nature of the security challenges faced by the state. Firms' preferences, in contrast, are orientated around maximizing long-run profits, and are thus focused on upgrading productive and technological capacities.

Consequently, it is the intersection of the international distribution of military-required technological capabilities with the specific nature of the strategic challenge that defines state procurement imperatives. The nature of external strategic challenges provide the realist baseline against which the influence of defense industrial producers can be assessed.[56] If the security challenges reflect a shift in the military capabilities of another state or set of states, then the state response can be simplified down to a choice between emphasizing a quantitative expansion of forces on roughly the existing technological model, or the qualitative technological innovation in the nature of forces fielded. Under conditions where military-required technologies are limited and are widely distributed among major powers, defense officials will be leery of pursuing innovation, knowing that any innovations they or other powers deploy will rapidly diffuse between them with little lasting benefit to either party.[57] Conversely, under conditions in which the required technologies are diverse and distributed on a narrow international basis, other major powers will face considerable cost accessing and integrating them. Consequently, states have the prospect of leveraging innovation to gain a lasting strategic advantage.[58] This calculus shifts when states face a security challenge from sub-state actors. Such challenges tend to embody generic military technologies. The result is a requirement for large

[56]As Charles Glasser has argued, "[m]any assessments of the impact of internal causes can be sharpened by first asking what arms buildup, if any, the state should have engaged in, given its goals and the conditions it faced." Glaser (2000), p. 259.

[57]This echoes the strategic logic of the arms race literature that state preferences will be shaped by the strategic responses of others. See Glaser (2000), ft. 1.

[58]Goldman and Andres (1999), pp. 80-81; Gilli and Gilli (2016).

constabulary forces, rather than advanced weapons, regardless of the military technological frontier.

In contrast, producer procurement imperatives are persistently orientated towards qualitative innovation. Firms prefer the state to support qualitative innovation because it serves to both sustain their existing technological and industrial capacities, and underwrite their efforts to maintain their position on the technological frontier. This allows firms to retain and extend their competitive advantages, not merely in military production, but in adjacent civilian sectors. Indeed, firms often pursue and promote qualitative innovation in military technology precisely because such innovation can support their efforts to upgrade technologically.[59] Thus the technological entrepreneurship of producers seeking to promote novel technological solutions to strategic challenges can shape the nature of a state's response to strategic challenges.[60]

The key question then is: whose imperative defines the procurement agenda following a significant shift in a state's strategic circumstances? I contend that this is a function of the existing structural position of the state relative to producers within the defense industrial network (see Figure 2.3). In networks with fewer, more technologically integrated producers, their density of relationships with state buyers is likely to be higher, and hence commercial imperatives towards innovation will have greater weight in shaping state priorities. Conversely, in networks where states draw on a wider range of substitutable producers, relationships will be weaker and hence will have less weight relative to state imperatives focused on the optimal defense response to security crises. The resulting implications of these procurement decisions for the military capability generated from the resources expended defines the consequences for state procurement capacity.

The procurement impacts of strategic shifts are enduring, but the elevated tempo of

[59] On the role of military contracts in civilian technological upgrading, see Heinrich (2002).
[60] Evangelista (1988), pp. 12-13.

Breadth and depth of military technological requirements		*Structural position within defense industrial network*	
		Stronger state structural advantage	**Weaker state structural advantage**
	Limited technological requirements	Greater salience of state imperative for quantitative force structure expansion under conditions of rapid adversarial adaptation and emulation i.e. *UK 1888-1900 – weak innovation*	Greater salience of producer imperative for qualitative technological innovation under conditions of rapid adaptation and emulation i.e. *UK 1904-1913 – strong innovation*
	Broad technological requirements	Greater salience of state imperative for qualitative technological innovation under conditions of slow emulation i.e. *US 1979-1997 – strong innovation*	Greater salience of producer imperative for qualitative technological innovation under conditions of slow emulation *i.e. US 2002-2010 – strong innovation*

Figure 2.3: Procurement capacity.

the response is not itself permanent. Following a moderation in its external strategic environment, a state will tend to reduce the resources devoted to military procurement.[61] Reductions in force structure requirements affect the range of producers that the network can sustain.[62] The greater the reduction in state demand, the smaller the number of producers that can profitably engage within the defense industrial network while meeting the fixed costs of production. Consequently, a reduction in the scale of state demand will affect the number of potential suppliers, and hence the range of alternative suppliers the state can engagem with. Conversely, changes in the qualitative sophistication of force structure requirements imposes its own implications for network structure. The increasing breadth of military technological requirements necessitates increased fixed costs associated with developing and sustaining the spe-

[61]Farrell and Terriff (2002), p. 3.
[62]Neuman (2010).

cialized knowledge base, human capital, and systems integration capabilities to enable production. This increases pressure on producers to consolidate. Consequently, the degree of qualitative sophistication also impacts on the range of producers engaged in the network.

The intersection of both of these factors encourages varying degrees of consolidation of the domestic defense industrial network as defense producers seek to rationalize fixed costs through achieving scale economies.[63] This in turn impacts on the relative structural position of the state and producers. Higher levels of innovation and a greater decline in overall procurement will drive a proportionally greater level of producer consolidation. Conversely, relatively more modest levels of innovation and a more limited reduction in the scale of procurement will drive more limited producer consolidation.

2.4.2 *Stage two: Gatekeeper impact*

The effects of a significant change in the state's strategic circumstances are not isolated merely to the procurement impact on the domestic defense industrial network. Processes of diffusion — shaped by the breadth and depth of military technological requirements and the structure of the global defense industrial network — govern the pace at which the initial procurement effects of a change in the state's strategic circumstances percolate through to generate gatekeeper capacity implications within the global defense industrial network. As noted, under conditions where military-required technological capabilities are limited and widely distributed, diffusion is likely to be rapid. Consequently, domestic defense producers will seek to simultaneously address both domestic and international demands, with the result that the procurement and gatekeeper impacts of security challenges intermingle. Conversely, when the breadth

[63] Bitzinger (1994), p. 173.

of military technological requirements are extensive and closely held, external demand is subordinated to the state's immediate internal procurement requirements; technology is allowed to be sold externally once domestic state demands are met, and the procurement and gatekeeper impacts of strategic challenges are likely to occur distinctly and sequentially.

Regardless of whether the gatekeeper impact follows or overlaps with the procurement impact of a change in a state's strategic circumstances, the key factor shaping its gatekeeper capacity remains the structural position of the domestic defense industrial network relative to the global network. Changes in relative procurement capacity impact foreign demand for imported weapons. In the abstract, all states would prefer to produce arms internally, because arms imports opens the state up to interdependence, and hence vulnerability to interruption of supplies at a time of critical need.[64] But autarky comes at a cost: autonomy trades off against procurement cost efficiency.[65] And changes in the relative cost of generating military capability in one country affects the specific procurement trade-offs that the other country faces, by altering the attractiveness of domestic production versus substitution into arms imports from a more efficient producer. Consequently, increases in the productive scale of a great power's domestic defense industrial network (the sum of the scales of its defense producers) increases the scale economies it enjoys internationally, and hence its relative competitiveness as a defense industrial supplier internationally.[66] This in turn increases the structural centrality of that great power versus small powers within the global defense industrial network, as they increase their dominance of global arms exports. The result is a reshaping of defense industrial relationships, and hence of the potential for gatekeeper capability to be exerted by the state.

[64]Krause (1990), p.693.

[65]Moravcsik (1991).

[66]See Neuman (2010). The size of the domestic defense industrial market that producers can tap into gives them an advantage in digesting the consequences of rising procurement costs driven by increasing military technological complexity.

		Structural position within defense industrial network	
		National structural advantage	**National structural disadvantage**
Breadth and depth of military technological requirements	**Limited technological requirements**	Strong relative position within global defense industrial network, but rapid diffusion of innovation limits international influence over customers. i.e. *U.K. 1888-1913 – weak influence*	Weak relative position within global defense industrial network combined with rapid diffusion of innovation generates moderate dependency on weapons suppliers. *i.e. Italy and Japan, 1888-1900 – moderate dependency*
	Broad technological requirements	Strong relative position within global defense industrial network combined with significant barriers to technological diffusion to grant high levels of international influence over customers. i.e. *U.S. 1979-2010 – strong influence*	Weak relative position within global defense industrial network combined with significant barriers to technological diffusion to generate significant levels of dependency. i.e. *U.K. and Japan, 1979-2010 – high dependency*

Figure 2.4: Gatekeeper capacity.

Conversely, the breadth and depth military-required technologies shapes the ability of the state to leverage its structural centrality within the global defense industrial network into gatekeeper capacity. A broader and more sophisticated range of technological requirements makes emulation of military advances more difficult, as was noted above. This creates a greater incentive for countries to purchase weapons rather than copy them, and as a consequence gives states an opportunity to shape the flow of weapons internationally. The result is to increase the geopolitical stakes around arms exports, encouraging states to develop the regulatory institutions to control access to those exports in line with their strategic interests. The strategic risks associated with relying on international flows of weapons technologies also encourage both producers and customers to embrace more institutionalized forms of security cooperation, in order to assuage the risk of sudden changes in weapons access or usage. Open market institutions offer the state few levers on which to pull to constrain or channel foreign exports and technology transfer. Conversely, the greater the embeddedness of state control over the defense industry, the greater the state's influence over the direction and character of defense industrial transfers. Over time, a narrower international distribution of military technological capacities can thus fundamentally shape how dependent arms recipients pursue their international security interests.

Consequently, the intersection of the centrality of domestic defense industrial networks within the global network, and the breadth of military technological requirements define state gatekeeper capacity (see Figure 2.4). Higher centrality, combined a broader range of required technological capabilities, unlocks both regulatory and socializing avenues of gatekeeper capacity for the state to influence the international system. However, weaker centrality and less constraining military technological requirements do not afford similar advantages.

2.5 *Case selection*

In order to empirically evaluate this theory, I engage in in-depth case study analysis centered around four significant changes in British and American strategic circumstances from the 19th through the 21st centuries.

Why focus on Britain and the United States from a cross-temporal perspective? These states have been home to two of the most significant capitalist defense industrial networks in history. At times both have claimed global hegemony based significantly on their military-industrial prowess. Understanding the causes and consequences of the variation of the defense industrial networks across these two states is thus significant for advancing our understanding of international security dynamics. In addition, studying these two defense industrial networks across time allows me to control for broad commonalities in democratic capitalist political and economic institutions in order to focus on specific differences in the distribution of military-required technologies and defense industrial network structures, thus improving the credibility of the conclusions drawn.[67] Finally, these cases were chosen because they cover the full variation in the dependent variables — the strategic consequences of the structure of defense industrial networks and of the breadth and depth of military technological requirements — for both state procurement and gatekeeper capacities.[68]

First, I explore examples in which limited military technological requirements facilitated rapid diffusion of military technologies, and thus dis-incentivized the state from pursuing innovation (or effectively harnessing it to advance its influence abroad). Britain's experience between 1888 and 1900 is illustrative of how a strong structural position amid widely distributed industrial and technological capabilities facilitated a

[67] C.f. the methodological approach of Sydney Tarrow. See Tarrow (2010). I also note that this also serves to bracket the scope conditions of this research. As Steven Rosen has observed, however, fundamental differences in political cultures and institutions render grand theorizing on general processes of innovation difficult to sustain. Rosen (1988).

[68] This serves to avoid the risk that the conclusions drawn from this study will be biased by selecting on the dependent variable. Geddes (1990); George (2005).

restrained state response to strategic competition, by consciously limiting innovation that the Admiralty were aware would rapidly diffuse to competing powers. At the same time, the absence of unique advantages in technological and industrial capabilities also resulted in London's limited ability to regulate the participation of British firms in the global arms trade, and hence its limited capacity to project gatekeeper capacity. Conversely, Britain's limited defense industrial capacity between 1904 and the eve of the First World War highlights the consequences of a negative shift in the structural dominance of the state. During this period, London's preference for technological stability was overridden by private sector enthusiasm for innovation, leading to a costly and inconclusive naval arms race. At the same time, the ease of diffusion stymied London's capacity to develop embedded institutional controls to effectively shape defense industrial exports to advance its interests abroad.

Second, there are cases that demonstrate the potential for tightly held industrial and technological advantages to motivate high levels of innovation and to sustain state procurement and gatekeeper capacity. Facing resurgent Soviet military power, the experience of the United States between 1979 and 1997 highlights the potential for a much more effective harnessing of defense industrial capacity to generate asymmetric strategic advantages. Indeed, this underpinned the application of competitive strategies thinking to the US-Soviet arms race.[69] A strong advantage in access to the expanding breadth of novel technological capacities led Washington to promote qualitative technological innovation to gain a persistent strategic edge over the Soviet Union. At the same time, this technological advantage encouraged US officials to buttress regulatory institutions, harnessing external defense industrial ties to American strategic interests worldwide. In the case of the United States between 2002 and 2010, we witness the converse case. US procurement capacity was constrained by the waxing structural position of the US defense industry, a consequence of the

[69] Marshall (1972).

rapid sector consolidation witnessed following the end of the Cold War. As a result, Washington's capacity to align procurement to its strategic requirements was limited, with efforts redirected towards conventional technological investment at a time when it faced significant non-traditional threats. In contrast, however, the strength of these producers — combined with the US government's embedded relationship with them — facilitated significant American gatekeeper capacity, allowing it to continually shape global defense industrial relationships and strategic ties in accordance with its interests.

2.6 *Conclusion*

Seeking to reconcile the strategic challenges experienced in the international security arena, states face varying pressures to mobilize defense industrial capacity through their engagement with producers within defense industrial networks. By focusing on the particular structure of defense industrial networks, and the breadth and depth of military technological requirements, I have sought to conceptualize defense industrial capacity as having two key facets. First, procurement capacity represents the ability of states to exert governance over defense producers to manage the focus of defense procurement in line with their strategic requirements. Second, gatekeeper capacity embodies the influence states can harness over their peers through the transnational integration of the defense economic network into the global defense economy.

Both of these aspects of defense industrial capacity rest upon common foundations: the breadth and sophistication of military technological requirements, and the structure of relationships within defense economic networks. I have sought to theorize shifts in defense industrial capacity as resulting from the efforts of states to negotiate the effects of significant changes in their strategic circumstance through their engagement with both domestic and international defense industrial networks.

In the following chapters, I will proceed to apply this theoretical framework to the analysis of four key cases. First, I will seek to elucidate the evolution of Britain's defense industrial capacity through the late 19th and early 20th centuries. Second, I will explore the efforts of the United States to advance its defense industrial capacity from the dying decades of the Cold War and into the 21st century.

CHAPTER 3

STATE DOMINANCE IN ACTION: BRITAIN, 1888-1900

> *The building-slip is the real birthplace of our sea supremacy: the very inception of our naval efficiency* — Herbert Russell[1]

This chapter seeks to explain the trajectory of British defense industrial capacity in response to changes in London's strategic requirements over the last decade and a half of the 19th century. I argue that Britain's procurement and gatekeeper capacities shifted in response to changing strategic pressures on Britain's naval force structure precipitated by an erosion of its relative advantage over France and Russia in the late 1880s. These pressures percolated through the British defense industrial network, then characterized by a state-centric market, against the backdrop of a limited set of naval technological requirements that were widely accessible internationally.

In line with the expectations of the theoretical framework outlined in Chapter 2, this change in the international balance of naval power resulted in the British government preferring a quantitative rather than qualitative-focused procurement response. Crucially, however, I argue that this approach was contingent on a second, domestic-level dynamic: the dominant position of the British government within the domestic structure of its defense industrial network. This domestic position denied an internal domestic challenge from private producers to the procurement priorities of the Admiralty.

The result was that Britain undertook the expansion of its naval capacity centered on a large number of new battleships that, while characterized by incremental, specific in-

[1] Russell (1904).

novations in the limited range of key component technologies, exhibited fundamental continuity in overall technological design with the Admiralty's longstanding doctrinal concept of decisive, close-range naval combat between rival battle lines of capital ships. Due to the limited breadth of key technologies needed to produce naval systems, this new design was rapidly emulated by Britain's rivals. However, by playing to the productive strengths of its defense industrial sector to produce ships efficiently at low cost and in large quantities, Britain was able to effectively offset the challenge posed by its emerging rivals: a clear demonstration of strong procurement capacity.

The leading position of Britain's naval industries placed it at the center of a global battleship production network. However, in light of the limited technological requirements of contemporary naval production and their relatively wide distribution, the British government had little prospect of constraining the diffusion of new designs, and hence faced limited pressure to develop the regulative institutions to attempt to do so. As a consequence, London's inability and unwillingness to harness its advantageous position within the international defense industrial network in order to shape naval arms flows underscored the weakness of its gatekeeper capacity.

This wave of the British naval industrial cycle began to ebb by the turn of the century, Britain's procurement response restored its force structure edge over Franco-Russian naval power. At the same time, increasing concerns over the fiscal burden of defense spending (not just naval, but exacerbated by wider commitments to the Boer War) drove demands for strategic and hence defense industrial retrenchment. Nonetheless, the seeds of a new crisis were planted, in the form of rising German naval power.

3.1 *The security challenge of Franco-Russian naval power*

What precipitated the shifts in Britain's naval industrial capacity during the 1890s? Building on the pioneering work of Arthur Marder, historians have traced the impetus for changes in British naval procurement in the late Victorian era to shifts in the international naval balance of power driven by Russian and French efforts to modernize their naval capabilities.[2]

These concerns were the culminating point of long-running shifts in official strategic assessments during the second half of the 19th century, as Britain experienced a sustained decline in its relative national power.[3] The increasing Russian influence in the Middle East and Eastern Europe, epitomized by the Great Eastern Crisis of 1875-1878, bolstered the British government's preoccupation with the security of its sea lines of communication through to India.[4] French activism in North Africa, the Mediterranean, and South East Asia aroused similar concerns. As the custodian of a globe-spanning empire, British leaders from 1860s pursued a policy of limited retrenchment, diplomatic compromise, and strategic deterrence aimed at forestalling conflict with rising industrial challengers in North America, Asia, and Europe.[5] At the same time, British leaders reiterated a longstanding commitment to the so-called 'Two Power Standard' articulated by Lord Castlereagh in 1817 that Britain's fleet should be the match of any combination of two foreign powers.[6] Consequently, as Britain's strategic circumstances changed, it sought both to defuse potential tensions with rising powers, and to retain a naval edge over them.

France and Russia were strategic challengers to Britain's continental and imperial interests, but through to the late 1860s, Britain's naval advantage was largely unopposed. This reflected its initial advantage in industrialization over other major

[2]Marder (1940), p. 120.
[3]Lobell (2000), pp. 95-96.
[4]Papastratigakis (2010).
[5]Macdonald and Parent (2018), Chapter Three; Kennedy (1981), p. 47.
[6]Parkinson (2014), loc. 195-208.

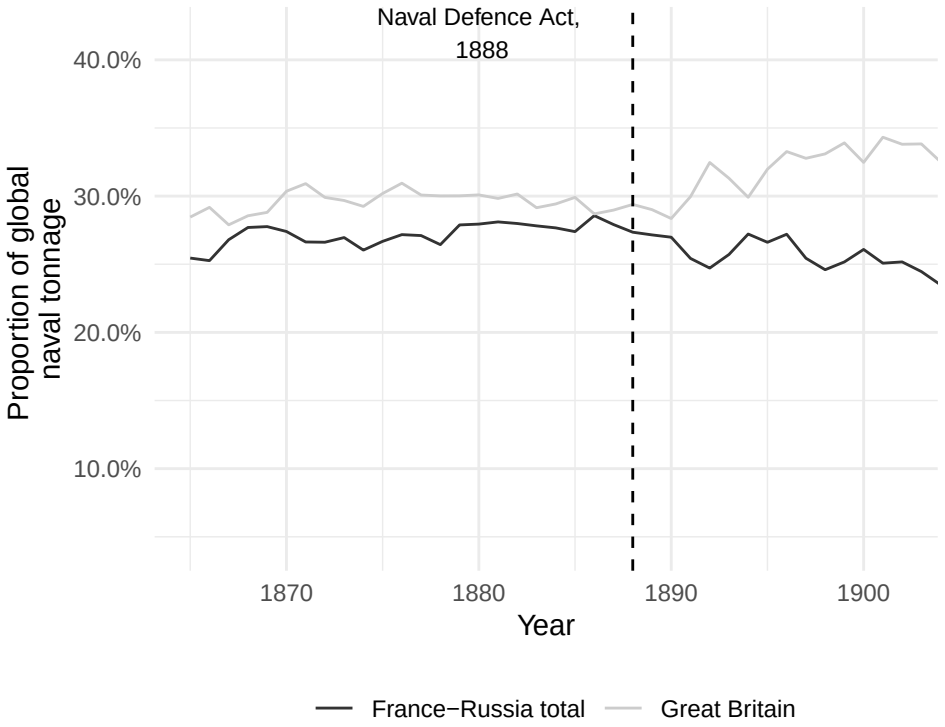

Figure 3.1: Britain's share of global naval tonnage relative to that of the combined French and Russian navies, 1865-1902. *Source: Crisher and Souva (2014).*

powers, both in terms of the adoption of steel production, and modern shipbuilding techniques. However, as these technologies rapidly diffused through Europe, Britain's naval advantage began to erode (see Figure 3.1). Through the 1870s and the early 1880s, France and Russia began to leverage their emerging industrial bases to upgrade and expand their navies. British defense attaches in Paris and Saint Petersburg observed a significant increase in naval production rates that spoke to the objective decline of Britain's naval advantage.[7] This increasing strategic wariness regarding the changing global balance of power culminated in the decision by the government of Lord Salisbury to dramatically increase naval procurement, in the form of the National Defence Act (NDA) of 1889 and its successor, the 1893 Spencer Program.[8]

[7]Parkinson (2008), pp. 49-51.
[8]Mullins (2016), pp. 48-53.

3.2 *The implications for procurement capacity*

How did the increase in procurement expenditure translate into the specific procurement choices and outcomes manifest in the NDA? In responding to the perceived improvement in the military capabilities of its traditional rivals, Britain's procurement agenda was determined both by the state's decisive structural position within the domestic defense industrial network, and the limited breadth of naval technological requirements which inclined the state to prefer quantitative expansion over limited qualitative innovation.

3.2.1 *Structural position and influence*

The impact of the Franco-Russian challenge to Britain's naval dominance was channeled by the existing state-centric structure of the British defense industrial network. State dominance rested on two factors: the size and flexibility of the supply-side of the market, and the relatively fragmented nature of that market along technology lines. In order to map the structure of the British domestic network (as well as its international connections), I have created a global capital ship production dataset, featuring all contractors known to be actively contributing to the production of capital ships (i.e., battleships and later battle-cruisers) worldwide between 1888 and 1913.[9] Using this dataset, I can trace the growth and decline of active British naval producers during this period. As Figure 3.2 illustrates, the British naval industrial sector through the late 1880s and early 1890s continued to be defined by both the large range of sup-

[9]Henceforth referred to as Hill (2015). Data is drawn from prominent secondary sources, notably Friedman (2015), Parkes (1956), as well as from the primary Parliamentary source, House of Commons (n.d.), and the corporate production records transcribed by Peebles (1986). Epkenhans (1991) provides detailed transcriptions of the surviving production records of German producers, and these are supplemented by technical summaries from Osprey's series on German capital ships; see Staff (2012a); Staff (2012c); Staff (2012b); Staff (2014). Data on wider international trends draw on contemporaneous specialist industrial press accounts of international naval construction, especially those offered by Gillmor (1905), Barberis (1912), and various editions of Brassey (n.d.). These sources are supplemented by valuable information collated by Johnston and Buxton (2013).

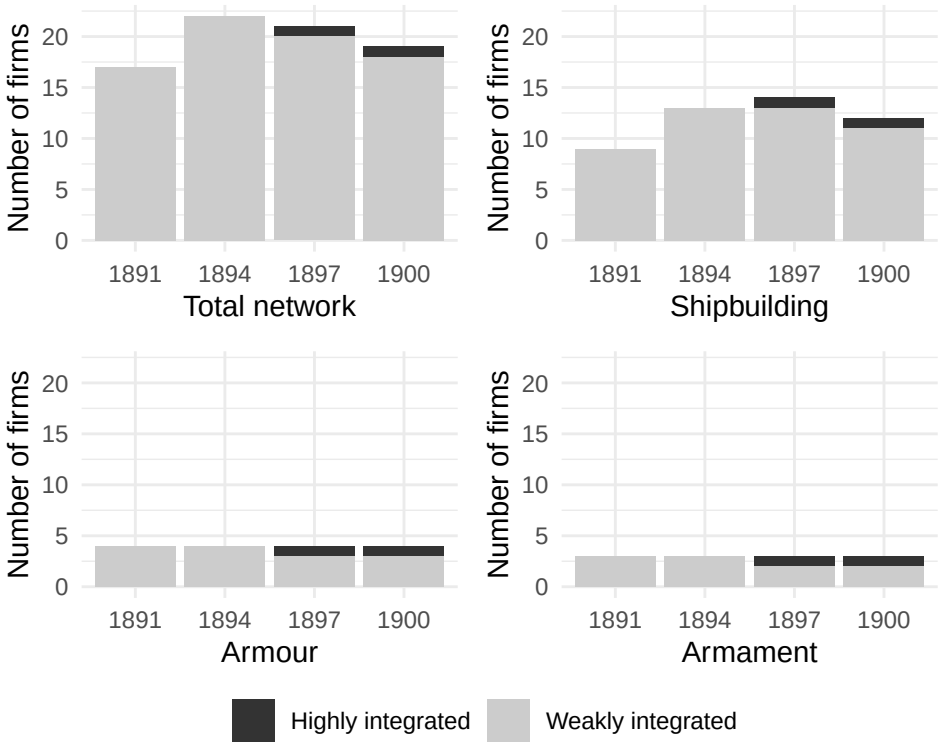

Figure 3.2: Number of UK naval producers with active capital ship contracts and their level of vertical integration, 1891-1900. *Source: Hill (2015). For specific details on this dataset, see ft. 9*

pliers, and their horizontal fragmentation across different component technologies.

During this period the Admiralty enjoyed access to a wide range of suppliers, including not only the government-owned Royal Dockyards and the Royal Gun Factory at Woolwich, but also a burgeoning and flexible private industrial sector. British firms were able to enter into the defense industrial network easily due to the relatively limited breadth of military technological requirements.[10] As a result, signs of increased procurement demand from the British government in the late 1880s attracted an inflow of new suppliers. The absence of strong barriers to entry challenged the security

[10]A key bridge for many firms was metallurgy. Producers that had a good knowledge of the processes and chemistry associated with the transition from iron to steel production (notably John Brown) were well positioned to then apply that knowledge to the development and production of armor plating. Similarly, those firms with a background in civilian shipbuilding (such as Armstrong Whitworth) were able to also pivot into naval construction as demand rose. See Johnston and Buxton (2013). The Admiralty was well aware of the close linkages between civilian and military shipbuilding, and indeed assumed that firms would pivot to civilian production if naval orders declined, reducing the need for the Admiralty to provide sustained contractual support to its industrial base. See Arnold (2011), pp. 58-59. See also Trebilcock (1969), pp. 486-487.

and structural position of existing incumbents, limiting their capacity to shape the focus of the resulting wave of naval procurement via the NDA. Conversely, the British government occupied a near-monopsonist position within its domestic defense industrial network, absorbing the vast bulk of domestic defense industrial production.[11]

The Admiralty also benefited from the fragmentation of British private producers across technology sectors. This was largely a consequence of the relatively low levels of capital intensity associated with British industrial production as it evolved through the first wave of the industrial revolution, which encouraged the emergence of a wide range of small and medium-sized engineering firms, whose scale meant they focused on particular technological tasks.[12] This relatively fragmented structure of British defense industrial production in the 1880s resulted in a situation where most shipbuilders did not yet have the scale of capital to engage in the construction of gun mounts, nor armor plate producers to construct propulsion machinery. As a result, the British government was the unifying coordinating point for naval production, what could be termed the proto-systems integrator of the era.

Finally, under conditions of unified political institutions, the Admiralty's structural position meant that it was able to transact its force structure requirements directly with industry. The Admiralty — like the War Office — was deeply engaged with Parliament during this period in the shaping of naval procurement policy.[13] However, the unitary nature of the British state meant that Parliament's influence over procurement debates was largely limited to the magnitude of procurement expenditure, as opposed to the specific composition of the naval build-up. The interaction of both of these factors meant that through the 1890s the Admiralty enjoyed a dominant struc-

[11]Trebilcock (1977), pp. 21-23. As Trevor Dawson, head of Vickers Sons and Maxim Ltd., observed to the Commission on Government Factories in 1907, his firm was dependent on British Government contracts for between two-thirds and three-quarters of its sales. See Murray et al. (1907).

[12]Part of the reason British firms remained smaller than their Continental and US counterparts was the challenges of accessing capital, in a competitive market define by tight profit margins and an immature industrial financing sector. See Landes (1969); Pollard (1957), in particular pp.433-438.

[13]Rowe, Bearce, and McDonald (2002), pp. 557-558.

tural position within the British domestic naval industrial network, which effectively provided it with unchallenged influence over the trajectory of naval design. This advantage left the Admiralty with a substantially free hand to shape procurement priorities. This structural asymmetry exposed firms to opportunistic behavior by the state. While the British government of the early 1890s had a number of alternative private sources of key battleship technologies, those suppliers had few choices but to deal with the state. The result was that the state felt free to play off various producers, encouraging investments only to drip feed orders. This situation of vulnerability and exposure generated uncertainty that represented an increasing transaction cost for firms in engaging in arms production for the state.[14]

3.2.2 *Naval technological requirements and force structure preferences*

The structural dominance of the British government thus ensured it held sway over the ultimate shape of Britain's naval procurement program. But what determined the focus of the program British officials favored? Historical analyses of the period suggest their views were shaped by two key dynamics: the diagnosis of Britain's specific operational requirements in light of the evolving strategic environment, and the Admiralty's understanding of the limited breadth of naval technological requirements, and hence the potential ease of military emulation of innovations by other states.[15]

It is clear that internal Admiralty considerations of Britain's naval operational requirements during the late 1880s favored a quantitative increase in capital ship numbers. During this period naval intelligence assessments indicated that despite London's overall naval preponderance, Britain's trade — and British capital ships — were increasingly vulnerable to new offensive concepts.[16] This challenge was most clearly

[14]Williamson (1979).
[15]Mullins (2016).
[16]Parkinson (2008), p. 81.

espoused in the French "*jeune École*" doctrinal concept that emphasized using fast cruisers armed with torpedoes to attack British capital ships and convoys at range with potentially little warning.[17] However, rather than pursue a qualitative reorientation of its force structure focused on combating those threats on the open seas, the Admiralty doubled down on its traditional strategy that harked back to the age of Nelson: establishing a tight, capital ship-led blockade of key enemy ports with the aim of destroying their fleets before they could sally forth to damage British strategic and trading interests. This strategy did not ignore the changes in French and Russian force structure but sought to respond to them within its existing doctrinal framework. As a consequence, the Admiralty's operational approach was adjusted to favor an "observational" rather than a "close" blockade: one in which smaller cruisers and other picket vessels would provide a close watch on an enemy's ports, in order to cue the offshore fleet of capital ships to any attempts at egress.[18]

Pursuing this strategy would still require changes in British force structure. The experience of major naval maneuvers in 1888 underscored that the primary procurement focus would have to be quantitative expansion of the Royal Navy's battleship force to match the demands of this strategy. As Roger Parkinson notes, the finding of the annual fleet maneuvers:

> ... was that for a blockade to be effective it should be conducted by a much larger force in proportion to the blockaded fleet than had previously been thought necessary... The truth behind the Naval Defence Act was a five to three blockade ratio for battleships, and this helped define the parameters of a massive building programme.[19]

Confidential internal Admiralty analysis in August 1888, and the parliamentary report

[17] Benbow (2008), pp. 208-209.
[18] Grimes (2012), pp. 20-22.
[19] Parkinson (2014), loc 373.

on the naval maneuvers themselves tabled in February 1889, reinforced the point that operational innovations were increasing Britain's naval requirements, requiring large scale naval procurement.[20] Thus in making adjustments for the changing strategic environment imposed by the foreign adoption of new innovations, the Admiralty's operational requirements heading into to the NDA reiterated the importance of a traditional capital ship-led blockade for containing potential foreign naval threats.[21]

At the same time, the Admiralty's particular response to this challenge appears to have been informed by its negative assessments of the desirability of pursuing qualitative innovation against the backdrop of the increasingly widespread distribution of the limited range of key industrial technologies undergirding naval production, which enabled the rapid diffusion of new military technical advances to Britain's adversaries. The generic technological innovations of the Industrial Revolution had generated a range of military spin-off technologies.[22] While military technology had advanced substantially during the second half of the 19th century, it remained concentrated around a limited range of core technologies — steel, shipbuilding, and chemical engineering — that were only weakly differentiated from civilian technology. As Clive Trebilcock has noted, this allowed for rapid diffusion of technological insights from the military to the civilian sectors.[23] It also implied difficulties for states in controlling diffusion, so much so that it challenged the desirability of investing in innovation in the first place. For British officials, it was difficult to justify costly innovation without a commensurate sustained military advantage. Conversely, it was taken as a given that Britain had an enduring advantage as a more efficient naval producer than its rivals. The assessment that qualitative advantage was easily aped, while quantitative disparities were entrenched informed British Admiralty's conservative orientation towards

[20]Sumida (1989), Chapter 1; Parkinson (2014), loc. 296.
[21]Redford (2010), pp. 869-870.
[22]Trebilcock (1969).
[23]Trebilcock (1973).

strategic competition. In summarizing this perspective, the long-standing Director of Naval Construction Sir William H. White contended that:

> It is always possible for the Admiralty to know exactly what is being done abroad in all classes of ships, to wait until foreign vessels have been laid down, then to complete designs which shall be superior in offensive and defensive power, and to complete the vessels as soon as their possible foreign rivals.[24]

As a consequence, defense officials emphasized the advantages the status quo implied for Britain's position within the international security system. This reinforced the Admiralty's policy to pursue a quantitative as opposed to a qualitative shift in force structure.

In contrast to the priorities of Admiralty officials, established private producers were less enamored by a primarily quantitative procurement focus. The Admiralty valued access to private producers in part because if facilitate better access to iterative improvements in core naval technologies than the state-owned producers such as the Royal Dockyards or the Royal Gun Factory at Woolwich.[25] The private producers, however, were often in the position of being able to develop more advanced technology solutions than the Government had appetite for. This had been the case most notably several decades earlier with respect to Armstrong's efforts to promote breach-loaded guns during the Crimean War.[26] The Admiralty's reluctance to innovate (born of strategic concerns rather than conservatism) continued through the 1880s and 1890s. While the British government was willing to embrace marginal technical shifts, it is likely that concerns about diffusion inhibited pursuit of the more substantive re-conceptualization of naval technologies that the private producers were capable of

[24]William H. White (1906).
[25]Arnold (2012b), p. 74; Arnold (2012a).
[26]Bastable (1992).

achieving.[27]

For their part, producers were not simply hungering after qualitative change for its own sake. Given their substantial commercial subsidiaries and interests, Admiralty funding for the deployment of more advanced military technology held the prospects of spinning off benefits for their civilian manufacturing divisions.[28] This was particularly significant given the growing competitive pressures on British private manufacturers from increasingly advanced foreign challengers, most notably from Germany[29] But the structural weakness of the firms within the defense industrial network stymied their ability to effectively press for change.

3.2.3 *Quantitative over qualitative change*

This constellation of public and private priorities, whose salience was conditioned by the existing defense industrial network, had implications for how the external security challenge of Franco-Russian naval modernization impacted on state defense industrial capacity.

The Admiralty's prioritization of quantitative over qualitative force structure change was manifested in the substance of the NDA of 1889, an unprecedented piece of legislation that defined and bound naval procurement via an Act of Parliament for the five-year period it covered. At its heart, the NDA focused on the expansion of British force structure to meet the requirements of its strategic doctrine of blockade led by capital ships, and fleet-to-fleet engagement. The Act authorized the expenditure of £21,500,000 over five years, to build 10 battleships, 42 cruisers, and 18 torpedo boats.[30] And this proved not to be the full sum of Britain's procurement reaction.

[27]This concern had informed the Admiralty's reservations about adopting the steam engine for naval use in the first half of the 19th century. See Horowitz (2010), pp. 134-135.
[28]Trebilcock (1969).
[29]Irving (1975).
[30]Mullins (2016), p. 3.

Reciprocal naval expansion on the part of Russia and France prompted a further extension of Britain's naval procurement in the form of the Spencer Program of 1894, which authorized the construction of a further seven battleships over five years (alongside 20 cruisers and over 100 smaller ships). The focus of this procurement expansion was undoubtedly on expanding the scale of Britain's naval force structure: as John Sumida notes, "the vessels provided by the Naval Defence Act nearly doubled the number of effective battleships and cruisers available to the Royal Navy."[31]

At the same time, while this procurement program embodied notable iterative changes in the technological character of Britain's capital ship, it did not represent a substantial qualitative change in the nature of Britain's naval force structure. Eight of the battleships that formed the core of the NDA procurement wave were of the *Royal Sovereign* class, the initial manifestation of the pre-*Dreadnought* battleship. They exhibited the evolutionary nature of the dominant design of the Royal Navy's capital ships: a technological system that integrated and stabilized a range of crucial component armament and armor technologies, while allowing for iterative improvements.[32] Designed by the Admiralty Director of Naval Construction and premier British naval architect Sir William H. White, the primary distinction between the *Royal Sovereign*-class and their predecessors was the integration into one design of a particular set of component technologies and the substantially greater size of the vessels themselves.[33]

The pre-*Dreadnought* weapon system represented an evolutionary combination of four key component technologies and a system design that focused on bringing them to bear in the classic Nelsonian close engagement. First, there was the ship platform itself, consisting of an all-steel hull. Second, was the mature Vertical Triple Expansion (VTE) engine, combined with high-pressure boilers and efficient gearing machinery for propulsion. Third, ship protection consisted of armor with advanced metallurgi-

[31]Sumida (1989), p. 15.
[32]Henderson and Clark (1990).
[33]Brown (1997), loc. 5042.

cal properties, initially composite iron/steel armor, then later alloyed steels treated according to the Harvey and Krupp processes. Finally, there was a combination of medium and large caliber guns situated in mechanized turret mountings linked to interior magazines, combined with various fire control mechanisms.[34] The pre-*Dreadnought* further evolved in the form of the follow-on nine ship *Majestic*-class appropriated as part of the Spencer Program of 1894.[35] These were distinguished by the transition from compound (iron and steel) armor to Harvey all-steel armor, and the presence of fully enclosed turrets for the larger 12-inch main armament. Ongoing evolution would see Harvey process armor replaced with Krupp process armor in the *Canopus* class of battleships from 1896.

The Admiralty's preference for limited, iterative improvement in capital ship design as embodied in the pre-*Dreadnought*-type battleships was ultimately prescient. While the emergence of this novel capital ship form was initially a shock to France and Russia, it did not impose a fundamental barrier to naval competition. The restricted range of technological competencies needed to engage in naval production imposed only a weak barrier to Britain's competitors in deploying their existing productive skills to match the updated designs deployed by the Royal Navy.[36] As a result, Paris and Moscow were able to rapidly adopt the technological developments embodied by this limited British innovation.

However, this did not mean that either France or Russia were equal to the strategic procurement response initiated by London. Despite qualitative emulation, both powers faced difficulty in matching the quantitative scale that Britain was able to bring to bear in producing capital ships. This reflected in part fiscal limitations, but was also significantly a consequence of the cost efficiency and scale Britain enjoyed

[34]Parkinson (2014), loc. 558.
[35]Parkinson (2014), loc. 559; Brown (1997), loc. 5095.
[36]Gilli and Gilli (2019), p. 176.

as the world's pre-eminent shipbuilder.[37] London was able to rapidly ramp up its production of pre-*Dreadnoughts* through the early 1900s, a pace of production that its rivals struggled to match, given their competing financial requirements to sustain a scaling up of their armies to offset emerging German continental power.

3.3 *Implications for gatekeeper capacity*

In addition to the implications for British procurement capacity, the security challenge posed by Franco-Russian naval modernization also affected London's gatekeeper capacity. The nature of this impact was again conditioned by the limited range of technologies required to engage in naval production, and the structural position of the Britain within the global defense industrial network. Specifically, the increasing spread of industrial technologies and productive capacity meant that the procurement impact of Britain's response to its changing strategic circumstances percolated rapidly over into a weak gatekeeper impact. For its part, the British government had little incentive to develop the institutional means to regulate diffusion, and little prospect of succeeding in doing so even if it had. At the same time, the low level of innovation pursued by the British government, which rapidly diffused internationally, only moderately (and temporarily) bolstered the competitive advantage of British firms abroad. The British domestic defense industrial network already enjoyed a dominant structural position within the global defense industrial network and met external demand even as it was responding to domestic procurement requirements. As a result, Britain's structural centrality, in the presence of increasingly widespread industrialization, served to shape the procurement agenda for other states, but afforded the British government little capacity to control emulation.

[37] Friedman (2014), pp. 195-199.

3.3.1 *International structural position and the naval technological requirements*

British naval producers already enjoyed a central position within the wider global defense industrial network during the 1880s, as is shown in Figure 3.3. Britain's share of global naval producers across all key technologies was considerably higher than its competitors, and in most cases compared favorably to the total number of other producers worldwide. The inauguration of the British procurement cycle in 1888 initially reinforced the modest benefit of Britain's position within the global naval industrial network. By 1896, Britain enjoyed an increased advantage in the proportion of total naval producers worldwide, which reflected both the greater cost efficiency of British producers, as well as their ability to act as a conduit to the latest evolution in international naval technologies.

Nonetheless, Britain's structural centrality did not equate to hegemonic control over access to key military-required technological capabilities. Indeed, the limited range of key technologies necessary for naval production, and their increasingly widespread diffusion, facilitated the rapid emulation of the pre-*Dreadnought* design. As Gilli and Gilli note (echoing the earlier analyses by Trebilcock and Walters cited above), there was a low level of fundamental difference between civilian and military technologies during this period.[38] This allowed for the rapid spin-off of technologies from military to civilian usage, but also the transnational emulation of those technologies by foreign producers.[39] Absent specialized knowledge, it was relatively easy for producers to copy and retool for a new set of weapons technologies.

Arms producers went further than this, however. In the absence of technological barriers to emulation which would allow producers to retain a long term technical advantage, they were incentivized to extract maximum profit from a technical innovation by actively promoting licensed production.[40] As a result, through the 1890s

[38]Gilli and Gilli (2019); Walters (1992); Trebilcock (1973).
[39]Gilli and Gilli (2019).
[40]This represents a relatively clear manifestation of the logic of the product cycle laid out by

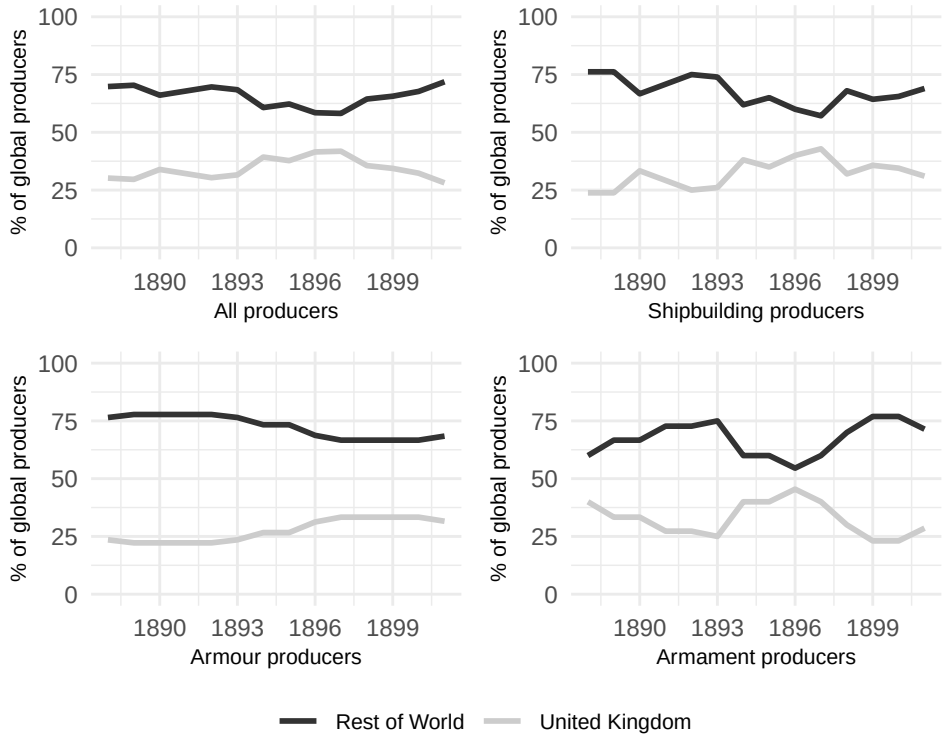

Figure 3.3: Britain's share of global producer base by technological segment, 1888-1900. *Source: (Hill 2015). For specific details on this dataset, see ft. 9. Note that this analysis aggregates the number of producers on the basis of their active involvement in any naval contracts; it does not weight the number of producers by the value or total number of contracts.*

complex patent exchange and licensing arrangements were developed that allowed British producers to legitimately use German armor manufacturing techniques, while German firms later gained access to guaranteed supplies of nickel (necessary for gun manufacture).[41] In some cases, British firms took licensing to its logical extension, taking over management of shipyards (for example, John Brown ran the New Admiralty Yard in St. Petersburg during the 1890s).[42]

British firms that embraced the Admiralty's new pre-*Dreadnought* template for capital ship design were able to rapidly on-sell versions for foreign consumption, in part because of the lack of regulative institutions governing the sale of military technology abroad. The Admiralty, and the state more generally, was animated by the *laissez-faire* tradition of nineteenth century liberalism, which advocated strict limitations on state intervention into the economy.[43] But this was more a manifestation of the technological forces conditioning the British political economy than its cause. As James Kurth has argued, *laissez-faire* regulative institutions found fertile ground in Britain due to the limited range and sophistication of early-stage industrial technologies, whose low capital demands were amenable to market coordination and weak state intervention.[44] The wide international distribution of these key technological capacities meant that barriers to diffusion were low. Thus, the British government had no reason to establish — and hence did not possess — institutions to control the export of military systems, technology, or military-related foreign investments.[45]

This weakness of regulatory intervention was manifested in the absence of formal legislative authority and a concomitant lack of institutional capacity to survey and regulate transnational defense industrial activity. The formal legal powers of Cabi-

Vernon. See Vernon (1966).

[41]Marder (1938); Boyce (1998); Boyce (1996).

[42]Walters (1992), p. 55.

[43]Trebilcock (1977), pp. 16-17.

[44]Kurth (1979).

[45]Atkin (1970); Marchisio (2012).

net to block exports of war material had been in existence since at least 1660. The structure of these regulatory powers, however, was crude, limiting the state to imposing blanket bans on armament related exports (such as the British government had imposed on France and French-occupied Europe during the Napoleonic Wars). Importantly, these powers were largely seen as wartime expedients, the domestic legal adjunct to the naval imposition of blockade. For example, in response to questions regarding control over the patent rights to guns that Armstrong was exporting as early as 1865, the government simply noted that they

> were advised that they had no exclusive power over that invention, and although it was in Sir William Armstrong's power to prevent the Government manufacturing them, it was not in the power of the Government to prevent Sir William Armstrong or any other person manufacturing those guns.[46]

While these powers were renewed as part of the Customs Act of 1879, there was no attempt to utilize these restrictions in peacetime during the late 19th Century. Perhaps more significantly, the British government lacked mechanisms for information sharing on naval armament trading. It was only in 1889 that the Admiralty requested that the Customs Department provide details of armaments shipped abroad "as soon as practicable after shipment."[47]

The formal powers of the British government continued to languish into the early 20th century. Only in 1900, facing the Boxer Rebellion in China, did the British Government seek to increase the specificity of its regulatory powers with respect to the export of armaments. The nature of the legislation reflected realization of the flaws in the powers currently available to the state. As Eton Atwater notes, Whitehall's

> legal advisors were of the opinion that the existing legislation, i.e., Section

[46]Cavendish (1865).
[47]Hanbury (1900).

> 8 of the 1879 Act, did not permit export prohibitions to particular countries, but only authorized general prohibitions applicable to all countries. In order to place an embargo on arms exports to China, it was felt that a special law would have to be passed authorizing specific prohibitions.[48]

The proximate motivation for legislating these new powers was public concern voiced in Parliament regarding the prospect that war material supplied by British firms to the Boxers threatened the lives of British troops involved in the foreign intervention against the uprising. MP John Dillon gave voice to many in stating the current situation was "a monstrous outrage."[49] Yet while the conflict on land in China provided public pressure for the legislation, the focus of parliamentary debate was inflected by broader implications. MPs expressed significant concern regarding the prospects for British naval exports to China.[50] Further, these efforts to increase state regulative powers were met with vocal concerns regarding the potential economic implications. Significant discussion centered on the potential application of the act to the regulation of steam coal exports, particularly to major Continental naval powers such as France and Germany.[51]

The legislation that eventually emerged from this process was the Exportation of Arms Act, which was passed into law on August 6, 1900. While increasing the specificity of formal powers available to the British government, its practical implications were far more limited. No export licensing system was adopted, nor were greater resources supplied to the Admiralty, Customs, and Treasury Departments to monitor arms transactions. Consequently, these organizations continued to lack the institutional capacity to engage in regulatory activity.

The result was an institutional structure that limited state capacity to insert itself

[48] Atwater (1939), p. 293.
[49] Dillon (1900).
[50] Pilkington (1900).
[51] Bowles (1900).

into the day-to-day management of private economic activity, beyond the tendering of goods and services from markets.[52] In essence, this conception saw state organizations focus on their roles as activist — albeit arms-length — customers, focused on contracting their own requirements from a deep pool of technically advanced private production capacity.[53] As a consequence, the Admiralty viewed the wider international activities of the defense industrial network as a matter of private enterprise, from which it extracted an indirect benefit only to the extent that it helped sustain the scale and diversity of the domestic defense industrial network.

The limited breadth of naval technological requirements meant that the benefits to Britain's structural position within the global defense industrial network were transitory. From the late 1890s, Britain's share of the global market of capital ships declined, both overall and within specific technology component categories, as other countries rapidly absorbed the key technologies underpinning industrial naval production. There was growing international demand to import not just the weapons produced by Britain, but also the technologies and physical capital to manufacture them domestically.[54] And in the absence of significant inherent military technological interdependence, emulation did not face a significant barrier in the form of tacit knowledge.[55] The result was the rapid diffusion of the pre-*Dreadnought* capital ship design.

[52]This is not to say the state was not involved in production. The long history of the Royal Dockyards demonstrates that the state was not averse to conducting some forms of procurement internally. But its engagement with the private sector was a relatively novel development, one conditioned by both the state's technological demands and the limits of its institutional capacity to monitor and engage with private sector producers. A more active role for the Admiralty in steering civilian production would only develop in the midst of demands for industrial mobilization during the First World War. See Hamilton (1998), pp. 60-61. See also Lyon (1977).

[53]Pollard (1952); Edwards (2015).

[54]Trebilcock (1973), p. 256.

[55]Hacker (2005), pp. 256-257.

3.4 *Britain's gatekeeper capacity consequences*

Thus, despite the temporary boost to Britain's structural position within the global defense industrial network, the widespread distribution of industrial and technological capacity internationally meant that from the late 1880s through the turn of the 20th century the British state had only a limited ability to shape its defense industrial relationships in order to advance its strategic interests. This had implications for gatekeeper capacity, which can be assessed via a combination of quantitative methods of analysis, as well as qualitative case study analysis.

3.4.1 *Evaluating the alignment of Britain's security and defense industrial networks*

A key test of a state's gatekeeper capacity is the degree to which it aligns outflows of defense materials and technology with its strategic interests. To evaluate this, I have conducted a structural analysis of the convergence of Britain's strategic interests and the pattern of its defense industrial trade between 1888 and 1903. This analysis suggests the two were partially — but imperfectly — aligned.

Using social network analysis techniques, I identify clusters — groups of states with a similar pattern of relationships — across both the network of Britain's naval industrial trading partners, and the network of its international security commitments (manifested in formal alliances relationships).[56] This analysis is presented in Figure

[56]If they are to harness gatekeeper capacity, states ought to be wary of tolerating defense industrial integration if it risks empowering an adversary or generating strategic vulnerability for the state itself. My metric of the extent of integration characterizing the defense industrial relationships between Britain and its foreign partners draws upon the global battleship production dataset introduced above. See Hill (2015). The strength of integration between countries is measured in terms of the relative number of individual production, investment, licensing, and cooperation ties between producers and suppliers, as well as among producers themselves. To capture the extent of compatibility in strategic interests, I focus on international security cooperation, as manifested in formal alliance relationships. To chart the evolution of these relationships, I have utilized data on the strength of alliance commitments from the Alliance Treaty Obligations and Provisions (ATOP) dataset produced by Brett Leeds et al. See Leeds et al. (2002). This dataset measures formal security cooperation at the level of specific commitments contained within bilateral treaties. The more extensive the specific commitments (i.e., whether they extend from consultation in the case of

3.4, which depicts the clustering patterns for alliance and naval-industrial blocs for the period 1893-1903.

Figure 3.4 suggests that Britain's position during this period is somewhat anomalous. Britain occupied its own alliance cluster with Portugal and Japan, a bloc that embodied the classic offshore balancing role London had pursued since the emergence of an international system in Europe.[57] This in turn aligned with its defense industrial ties with Japan. However, Britain was also integrated into the Central European naval-industrial bloc, indicating that the pattern of its defense industrial ties with respect to the production of capital ships extended beyond simply strategic imperatives, and was deeply integrated into that of the eastern Continental powers.

This analysis indicates that Britain's involvement in global arms exports was partially aligned with its strategic commitments. However, these structural correlations do not provide insight into the causal processes that generated this partial alignment of Britain's security interests and its defense industrial relationships, and hence the extent to which these patterns manifested state gatekeeper capacity. This will be explored in the next section.

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third-party conflict, through to explicit defensive commitments to collective security), the greater the level of strategic alignment I attribute to the dyad. This metric of shared strategic ties provides an opportunity to assess the correlation between the trajectory of shifts in Britain's naval industrial and strategic relations. In this analysis, I have chosen to utilize the Louvain method of community detection. For the specific derivation of this method, see Blondel et al. (2008). I have implemented it in the *R* software environment through the *igraph* package, version 1.0.1. See Csardi (2015). This method has been previously applied to the comparison of arms trading and foreign relations networks during the Cold War by Andrew Crooks et al., a decision justified by the algorithm's ability to harness the differential weights of relationships in specifying community structure. See Crooks et al. (2014), p. 5. Experimentation with other community-detection algorithms did not generate substantively different results, but did so at the cost of lower levels of modularity (that is, they generate less definitive community boundaries).

[57] Mearsheimer (2003), Chapter 7; see also Kennedy (1988), Chapter 4.

Figure 3.4: Britain's position in international naval-industrial versus military alliance blocs, 1888-1903. *Note: For clarity, figure only shows cluster affiliation with Britain. Source: (Leeds et al. 2002; Hill 2015.)*

3.5 *Case studies in gatekeeper capacity*

To explore the underlying relationship between defense industrial ties and strategic commitments in greater detail, I now turn to analysis of specific case studies. While the scope of the naval arms trade during this period was vast, I will focus on two cases to explore in detail its trajectory relative to strategic developments: Britain's relationships with Italy and Japan, from the 1880s through to 1900. These two cases offer important opportunities for the exploration of gatekeeper capacity. The international positions held by these two states had significant strategic implications for London's global interests. At the same time, these countries were also the object of the British naval industry's transnational integration during this period.

3.5.1 *Italian-UK relations*

The extension of the British defense industrial network into Italy in the 1880s took place against the background of an increasingly dynamic naval situation in the Mediterranean. Having secured the Triple Alliance with Austria-Hungary and Germany in 1882, Italian naval development during the 1880s and 1890s under the leadership of Berneditto Brin was directed at offsetting French power.[58] While the Triple Alliance protected Rome from the depredations of Austria-Hungary and France on land, good relations with Great Britain, whose fleets dominated the Mediterranean as they had since Nelson's time, secured the nascent Italian state by sea. Yet these relationships did not put Italian strategic ambitions into abeyance. Ruling a newly united country, the Italian government saw the acquisition of naval capacity as a means to establishing its credentials as a regional power.

Initially lacking a developed naval industry, this period saw Italy place large orders for

[58] Henderson (2014).

warships from British yards, in particular from Sir W.G. Armstrong & Co.[59] At the time, this expansion of Italian naval strength suited Britain, which saw it as a counterweight to the growing strategic challenge from resurgent French and Russian naval capabilities directed toward contesting control of the Mediterranean, and hence London's access to Asia.[60] In 1894, Saint Petersburg and Paris formally announced the Franco-Russian Alliance, extending mutual security provisions and inaugurating joint military planning. The prospect of the navies of both powers — then in the full swing of modernization — descending on the Mediterranean imperiled Britain's geostrategic interests. Italian naval power presented the prospect of a strategic reserve to Britain's overstretched forces. London thus sought to maintain a cordial relationship with Rome throughout this period. While eschewing formal alliance commitments in the face of tensions with Paris, Britain's foreign secretary, Lord Rosebery, indicated to the Austrian ambassador that "the English cabinet would not regard with indifference the defeat of Italy by France."[61]

In naval industrial terms, Italy was dependent on access to global resources, expertise, and capital during the late 19th century. As its attempt to engage in rapid industrialization revealed, Italy was reliant on imports of naval components such as steel, ordnance and armor, the physical capital to produce them, and both coal and iron ore, much of which was drawn from Britain.[62] This dependence impacted on the cost efficiency of the nascent Italian defense industrial network. The 1882 Commission for the Mechanical Industries and Shipbuilding chaired by Bernedittо Brin concluded that Italy faced elevated production costs, owing to high natural resource prices in Italy and the lack of specialization within its domestic defense industrial base, and consequently faced vulnerability with respect to the interdiction of foreign supplies.[63]

[59]Walters (1992), pp. 55-56.
[60]Papastratigakis (2010), p. 644.
[61]Quoted in Marder (1940), pp. 171-172.
[62]Trebilcock (1973), p. 268-271.
[63]Marchisio (2012), pp. 139-140.

Thus, Italian naval development occurred against the backdrop of substantial concerns regarding the weakness of its own procurement capacity.

This weakness motivated efforts to accelerate technological and industrial development, both through the channeling of contracts and direct state investment. In 1885, legislation was devised by Brin to extend the development of the Italian defense industrial network. The first major result of this drive was the formation of the Terni Steel Works as a hub for the production of munitions and armor-grade steel.[64] Rome also sought to encourage technology transfer via foreign direct investment. This led to a flood of partnerships with British firms, a process that proved essential not merely to the development of the domestic defense industry, but to advancing the broader cause of Italian industrialization.[65] British engine and machinery manufacturers reached agreements with their Italian counterparts: Maudslay and Sons, Ltd. licensed their designs to Ansaldo and Co. in 1886, and Hawthorn formed a local subsidiary with the Guppy Works, Hawthorn Guppy and Co.[66]

Most significantly, Italy attempted to draw its traditional import partner, Armstrong, into the creation of a domestic naval ordnance works. In doing so, Rome sought to exploit its own position as a major export partner, indicating that future sales would be contingent on the indigenization of production.[67] In this, it was successful. Addressing the board of Armstrong, Sir William Armstrong was reported to have made it clear the nature of the firm's dependence on its major foreign customers. For Armstrong's board,

> . . . [t]he pressure for a decision on this subject became so great that they were obliged to make up their minds whether they would undertake to establish such works in Italy, or lose their important connection with the

[64]Newbold (1914), pp. 24-28.
[65]Trebilcock (1981), pp. 346-347.
[66]Marchisio (2012), p. 154, 188.
[67]Marchisio (2012), pp. 168-171.

> government of that country. They elected, and he thought wisely, to comply with the wishes of the Italian government.[68]

With the globalization of naval technology, and the emergence of both British and foreign competitors capable of producing capital ships, Armstrong sought to extend the returns from its strengths in naval technology by laying the ground work for an ordnance factory at Pozzuoli (Armstrong-Pozzuoli) in 1886.[69] This factory was followed in 1903 by Armstrong's decision to invest in shipbuilder Ansaldo, assisting in the expansion of their shipyard at La Spezia which served to significantly expand the Italian government's capacity to construct the latest designs of capital ships domestically.[70]

The deepening of the armaments relationship between British firms and the Italian government during this period correlated with a convergence of interest between Britain and Italy in restraining Franco-Russian naval power in the Mediterranean. In parallel to Armstrong's increased investments in Pozzouli, the British and Italian governments grew closer, codified in a 'Mediterranean Agreement' in 1892 that saw the two countries confirm their friendly relations. It has been argued that these investments made by British defense industrial firms in Italy had a strategic effect on the orientation of Italian naval power. Lawrence Sondhaus has gone so far as to suggest that "[t]he heavy dependence upon British technology made it all the more unlikely that Italy would support its Triple Alliance partners in a war in which Britain would be among the opponents."[71] However, there is little clear evidence of any causal connection. Italian naval interests in closer defense industrial ties were motivated by the perceived technological and cost advantages offered by British firms that were at the technological frontier.[72] Rather than driving this engagement, Italy clearly

[68] Warren (1989), p. 75.
[69] See La Bolina (1908).
[70] Marchisio (2012), pp. 11-12; Walters (1992), p. 56.
[71] Sondhaus (1994), p. 174.
[72] In a February 1885 memorandum circulated within the Italian Ministry of Marine it was argued that Armstrong's guns should be chosen as they were half the price of those of Krupp, its principle German competitor. Cited in Marchisio (2012), pp. 171-172.

viewed strategic considerations as something to be mitigated against: Armstrong's board noted significant pressure from Rome to directly invest in production in Italy in order to mitigate any future risk of dependence on a foreign power.[73] And while the Admiralty may have reflected positively on the support provided by British firms to its Italian partner, there is no evidence that London sought to harness the transnational ties of British firms to affect grand strategic change with respect to Italy's international alignment.

3.5.2 *Japan-UK relations*

As with Italy, the rise of Japanese naval power in the late 19th century generally correlated with Britain's strategic interests. Facing increasing Russian power and intransigence in Asia, epitomized by Saint Petersburg's efforts to carve out a sphere of influence in China, and culminating in the occupation of Manchuria in 1901, London perceived increasing strategic requirements on the Royal Navy's China Squadron at the same time as its military position in the Mediterranean was also being challenged.[74]

These circumstances rendered Japan a potentially vital strategic partner. Japan had demonstrated its maturing naval capabilities through its strong performance in the Sino-Japanese War, in which it had soundly defeated a materially superior Chinese foe. Yet, following veiled joint threats from France, Russia, and Germany at the conclusion of that conflict, Tokyo was forced to accept humiliating restrictions on its war spoils. These actions represented a persistent pressure on Tokyo's regional

[73]See ft.66. In the same report to the board cited above, Armstrong noted that "[i]t is not to be supposed that a State like Italy, ranking as it did among the leading powers of Europe, should be willing to depend permanently for the supply of its war-like material upon foreign sources. Accordingly there had been a growing demand throughout that country for the establishment of works within its own territory for the manufacture of such articles as had hitherto been supplied from Elswick." cited in Warren (1989), p. 75.

[74]Papastratigakis (2010), p. 652.

strategic position, particularly from Russian power in East Asia. Japan's response was to utilize part of its 300 million yen tribute from China acquired through the Treaty of Shimonoseki to engage in a substantial naval build-up based on the 'Six-Six Fleet' concept, procuring six battleships of 15,000 tonnes, and six cruisers of 9,000 tonnes.[75] London consequently perceived Tokyo as both sharing a commonality of key strategic interests with Britain, and potentially introducing a useful naval counterweight to rising Russian power.[76]

The Six-Six Fleet concept symbolized Japan's strategic outlook and commitments to naval power and also provided an additional avenue of opportunity for the British defense industrial network to deepen its ties with Japan. Defense industrial linkages had initially been established by Thomas Blake Glover, who brokered sales of armaments between Armstrong and the various Japanese shogunates in the 1860s.[77] British entities such as Glover and Company, Edward C. Kirby and Co., the Hong Kong and Shanghai Bank, Jardine, Matheson and Co. and others assisted with projects ranging from the establishment of the Kobe Iron Works and shipyard in 1873, to the Osaka Iron Works.[78] As a consequence of these efforts, the Six-Six program led to the first domestic orders of warships, for armored cruisers, in 1896. Yet realizing Tokyo's strategic potential in the region required a naval industrial capacity that was still beyond the reach even of a rapidly-developing Japan. In response to surging demand, British firms also engaged in direct exports of warships. Given that they offered more advanced naval technology, lower cost, and faster construction times, the Imperial Japanese Navy (IJN) exerted preference towards ordering from British firms.[79] Between 1896 and 1900, Vickers, Armstrong, Thames and John Brown collectively exported six pre-*Dreadnought* battleships to Japan. It is with no exaggeration that

[75]Schencking (2005), pp. 82-89.
[76]Marder (1940), pp. 238-240.
[77]Hunter and Sugiyama (2000), pp. 12-14.
[78]Lowe (1981), pp. 62-63; Hunter and Sugiyama (2000), pp. 7-8.
[79]Inaba (2004), p. 65.

Evans notes that "British shipyards furnished the bulk of Japan's massive naval construction from 1895 to 1904"; indeed, ninety percent of the 234,000 tonnes of warships planned during the 1890s ended up being foreign-built.[80]

In contrast to the Italian case, the blossoming of defense economic ties was not incidental to the strategic relationship between London and Tokyo. Conscious of the significant opportunities offered by the Six-Six program, British defense producers assiduously promoted closer security cooperation.[81] Thus, while defense economic cooperation was not to be the sole source of the Anglo-Japanese strategic convergence, "shipbuilding in Glasgow was one element in a pattern of cooperation which developed between Britain and Japan and contributed with other factors to the creation of the Alliance" in 1902.[82]

The emerging strategic challenges Japan faced after 1895 motivated its deeper integration into a global defense industrial network in which Britain occupied a central position. By the turn of the century, defense-economic investments and financing were at the heart of Japanese industrialization.[83] In turn, defense industrial integration also spurred broader integration with the British-centric global economic order. The Anglo-Japanese Treaty of Commerce and Navigation, signed in 1894, was a landmark in the normalization of Japan's international commercial relations with the wider world. The timing of the treaty coincided with a surge of Japanese orders for British warships, leading scholars such as Jacques Hymens to conclude that "Britain might have been motivated to make an implicit recognition-for-ships trade with Japan."[84] The signing of the treaty opened the door for deeper relationships across the board.

[80]Evans and Peattie (1997), p. 53,59.

[81]See Nish (2004), p. 11. Economic factors were increasingly significant as an additional motivation for driving security cooperation between London and Tokyo. As Christina Davies notes, "[d]uring the period from 1868 until the formation of the two countries' alliance in 1902, security interests motivated Britain's attention to Japan, while both economic and security interests led Japan to favor an alliance with Britain over other security arrangements." See Davis (2008), p. 156.

[82]Nish (2004), p. 8.

[83]See Kobayashi (1922), p. 85.

[84]Hymans (2014),p. 65.

The fiscal implications of large-scale defense imports also required a sea-change in Tokyo's orientation towards the global financial system, centered on London. In order to expand government borrowing to fund defense procurement, Japan had to move onto the gold standard, requiring the acquisition of substantial sterling reserves.[85] The importance of the City was consequently of particular salience to Japan's defense-industrial expansion, and by extension, to the integration of British firms into the Japanese defense industrial nexus. Equally important was the issue of energy access. Japan's domestic resources of coal were poorly suited to naval use, being too high in sulfur. Britain, in contrast, offered vast quantities of cheap, high-quality Welsh coal. As a result, Japan at the turn of the century engaged in substantial imports of British coal, amounting to roughly a quarter of naval consumption.[86]

Overall, the defense economic ties of British firms bolstered Anglo-Japanese security cooperation; this cooperation in turn served to advance Britain's strategic interests. Initially it served to offset Russia in the region. In particular, it sought to both guarantee the territorial integrity of China, as well as the persistence of the "open door" policy.

3.6 *Shifting strategic dynamics and procurement contraction*

As a consequence of Britain's procurement response, the challenge posed by Franco-Russian naval power ebbed from the late 1890s. At the same time, British defense priorities were being pulled in another direction: the insurgent challenge posed by Boer rebels in South Africa. This resulted in a shift in the composition of state procurement demand away from naval forces, and towards the land-based requirements of empire.[87]

[85]Hunter and Sugiyama (2000), pp. 35-46.
[86]Evans and Peattie (1997), pp. 66-67.
[87]Rowe, Bearce, and McDonald (2002), p. 553.

Nonetheless, state procurement expenditure remained elevated.[88] The technological and capital demands of defense production had evolved iteratively with capital ship design since 1888. Defense producers consequently experienced a moderate increase in market pressure from the end of the naval procurement boom, which translated into a real, but limited pressure on firms. As a result of the reduction in procurement spending, and limited technological innovation, Britain experienced a moderate wave of vertical and horizontal integration, improving the structural position of firms in its the domestic defense industrial network. As R.P.T. Davenport-Hines noted,

> [t]his uncertainty of demand under monopsonist conditions, coupled with the high cost of equipment, led to the evolution of compensatory mechanisms, which would make it absurd to portray the private armourers wholly as dupes or victims.[89]

Vertical and horizontal integration served as a strategy for offsetting demand vulnerabilities by removing relationships from the realm of strategic interaction with markets, and incorporating them into internal organizational hierarchies.[90] By expanding their sphere of control within the defense industrial supply network, producer firms sought to re-balance the asymmetry of their dependence on the British government buyer. Through horizontal integration, producers could seek to increase their domestic dominance within a particular production niche by absorbing or coordinating with competing producers. Vertical integration, by contrast, represented the expansion of producers down through the supply chain, often reflected in the integration of firms with distinct yet linked technological competencies, or efforts by firms to build new competencies into those linked domains. While distinct, these two dynamics had similar effects on the nature of market interactions between customers and producers.

[88] Mallet (1913).

[89] Davenport-Hines (1986), p. 151.

[90] As Trebilcock observes, "[m]onopsony in any market will, classically, tend to promote oligopolistic arrangements among suppliers: H.M.G. was a potent monopsonist in the defense market, and armament entrepreneurs reacted accordingly." Trebilcock (1977), p. 23.

Horizontal integration reduced the competition between component producers, tending to increase their market power relative to customers within a given technological niche. Similarly, vertical integration bound those components together organizationally, leading to a reduction in the total number of independent producers across the defense industrial network.

Thus, as Roger Lloyd-Jones and Merv Lewis have contended, firms sought through coordination and combination to develop "countervailing powers" to offset the monopsonistic structure of the naval industrial market.[91] Lloyd-Jones and Lewis support the argument advanced in this chapter that the motivation for this coordination emanated from the uncertainty shaping companies circumstances. Without full knowledge as to the choices being made by the state or by other firms, armament contractors sought to cooperate and coordinate in order to impose predictability and limit chaotic interactions.[92] Armament orders followed a trend dictated by the beat of international political dynamics, rather than the commercial business cycle. As a result, armament firms faced recurring periods of feast and famine, with little insight to their timing.[93]

Yet vertical and horizontal integration was not merely motivated by the exogenous pressure of technological forces and the structural monoponist position of the state. Rather, it was fueled endogenously by the very processes of integration themselves. As firms extended their control laterally as well as forwards and backwards across the production process, they increased the relative vulnerability of non-integrated firms. Those firms now faced not only exposure to the mercurial demands of their government customer, but the prospect of being locked out of access to supply of crucial technology components by their erstwhile peers and competitors. Just such pressure appears to have motivated a number of cases of integration, most notably the efforts of Armstrong to acquire Whitworth, as well as Cammell Laird, Brown,

[91]Lloyd-Jones and Lewis (2011), p. 23.
[92]Lloyd-Jones and Lewis (2011), pp. 30-31; see also Johnston and Buxton (2013), p. 190.
[93]Trebilcock (1977), pp. 10-11.

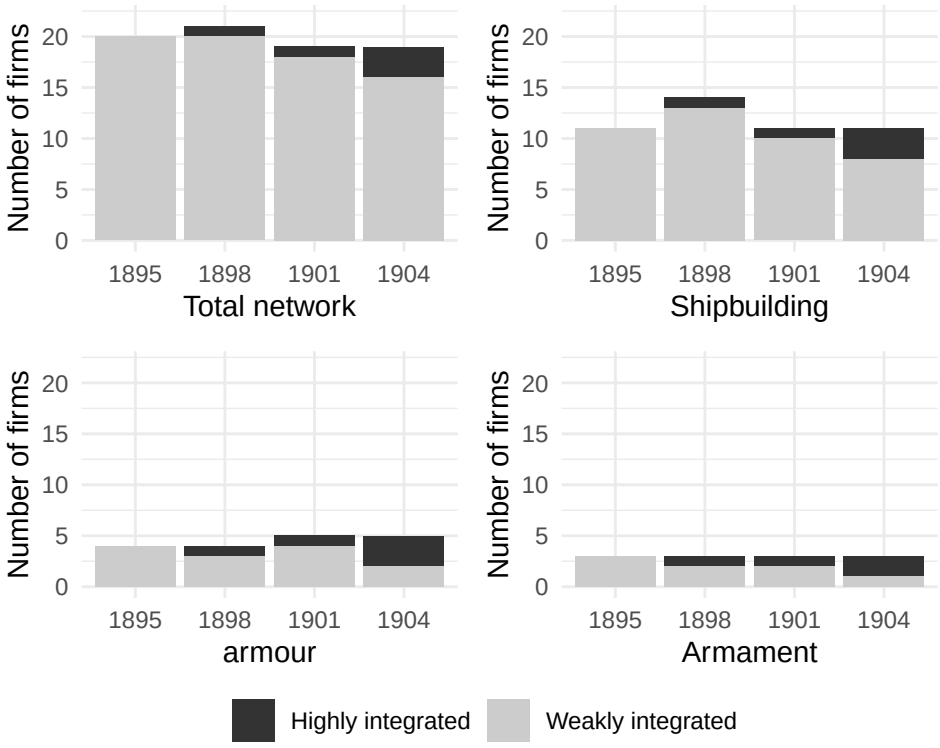

Figure 3.5: Number of UK naval producers with active capital ship contracts and their level of vertical integration, 1895-1904. *Source: Hill (2015). Note: For the purpose of these analysis, 'highly integrated' is defined as being active across two or more component sectors. For specific details on this dataset, see Chapter 3, footnote 9.*

and Fairfield's efforts to expand into ordnance production.[94] Integration thus held elements of a commercial security dilemma: the steps taken to secure firms against the perceived structural pressures facing them were in turn perceived as a threat by their peers. As J.D. Ellis, chairman of John Brown, warned shareholders equivocating over expansion, "[i]f they took no action they might find themselves without orders while their neighbors were full of work."[95]

The dynamics of vertical and horizontal integration can be assessed empirically through a close examination of the specific relational changes within the British defense industrial network during this period. The broad outline of the vertical integration process can be observed in Figure 3.5. The period between 1895 and 1904 was

[94]Warren (1989), pp. 60-61.
[95]Quoted in Peebles (1987), p. 47.

characterized by the rapid progress of vertical integration, with shipbuilding, armor, and ordnance manufacture increasingly united within single firms.[96] In most cases, the leading firms were those that had existing competencies in armor or armament production. In 1895, the armor producer William Beardmore and Co Ltd acquired the shipyard and engine works of Robert Napier & Sons Ltd. Two years later, seeking to expand out of its technological competencies in armor and armaments, Vickers Sons and Co Ltd purchased The Naval Construction & Armaments Co Ltd, gaining a shipbuilding and machinery production capability. As a result of these moves, the market for producers of heavy gun mountings shrunk by twenty-five percent, while Vickers emerged as the first fully vertically-integrated battleship producers, capable of supplying a completed vessel from its own resources. In 1899, John Brown & Co. Ltd. supplemented their armor production capacity through the acquisition of Clydebank Engineering and Shipbuilding Co. Ltd.[97] In 1903, the shipbuilders Laird, Son & Co merged with armor producer Johnson Cammell & Co. to produce another integrated defense firm. This process culminated with the founding of the Coventry Ordnance Works (COW) as a joint venture between Cammell Laird Co., the Fairfield Shipbuilding and Engineering Co., and John Brown and Co. Ltd. As a result, John Brown and Cammell Laird joined Vickers as fully vertically integrated producers of battleship systems.

This pattern of vertical integration was matched by a massive expansion of horizontal ties. In 1893, the Harvey United Steel Company of Great Britain, Ltd., was established to coordinate licensing and pricing arrangements for Harvey-patented steel armor. Vickers, John Brown, and Cammell, were stockholders, joined later by Beardmore, and in 1901, by Armstrong. Later, the Harvey armor syndicate acquired the global rights to the Krupp cemented armor. In coordination with Krupp, as well

[96]Peebles (1987), p. 46.
[97]Johnston and Buxton (2013), pp.65-67.

as French, Austrian, and American steel producers, armor production and licensing converged upon a single syndicate.[98] In 1897, Sir W.G. Armstrong Mitchell & Co. Ltd. made a bid to merge with fellow ordnance producer Sir Joseph Whitworth Co. Ltd., resulting in the formation of Sir W.G. Armstrong Whitworth Co. Ltd. Two years later, the Thames Iron Works Shipbuilding & Engineering Co. Ltd. acquired machinery producer John Penn & Sons Ltd. In 1902, Vickers acquired a fifty percent stake in fellow armor and ship-builder Beardmore, effectively seeking to control their entry into the armament sector.[99] Through subsequent years, there is significant archival evidence that Vickers and Armstrong attempted to coordinate the armaments markets to prevent further entry. Nonetheless, 1903 saw the merger of armor manufacturer Charles Cammell & Co. Ltd. with shipbuilder Laird Brothers Ltd.; as Cammell Laird, the company would partner with John Brown and Fairfield in 1905 to establish the Coventry Ordnance Works (COW) as a producer of naval gun mountings. In the process, Cammell Laird gained a fifty percent stake in Fairfield itself.[100] 1903 also saw the Tyne shipbuilding hub Swan, Hunter & Wigham Richardson Ltd acquire a sixty-three percent stake in machinery producer Wallsend Slipway and Engineering Co Ltd. Finally, in 1904, Scotts Shipbuilding & Engineering Co. Ltd. absorbed machinery manufacturer Greenock Foundry Co.

Overall, the pattern of both vertical and horizontal integration within the defense industrial network most favored private producers that occupied capital-intensive technological niches, specifically armor and armament production. While integration certainly reshaped the shipbuilding and marine machinery sector, its impact there was relatively more subdued. The result was that this joint strategy of vertical integration down the defense industrial network and horizontal integration across it was adopted as complementary by those private sector actors that possessed the cap-

[98]Misa (1995), p. 123.
[99]Trebilcock (1977), p.39.
[100]Peebles (1987), p.46.

ital, relationships, and network positions to do so. As the *Statist* financial magazine observed,

> The more recent method of securing community of interests by interchange of shares seems to be the more scientific, and in such a case as the one before us at present, when by means of the various concerns thus joined in common it is possible for the Company to completely build and equip a modern war-vessel from beginning to end, the Company is more likely to be prosperous and the shareholders are more likely to receive regular and substantial dividends than were the Company only in the position of securing a portion of an order, and being merely responsible for building of the vessel, say, on the one hand, or furnishing it merely on the other.[101]

This suggests that processes of vertical and horizontal integration dominated from the 1890s through to the mid 1900s. In both cases, integration primarily centered on those firms within the most capital-intensive segments of armor and ordnance. Indeed, by the mid-1900s, competitive pressures and the opportunities for economies of scale had resulted in these sectors being almost entirely populated by vertically and horizontally integrated firms.[102]

3.7 *Conclusion*

The foregoing analysis has highlighted the causes and consequences of Britain's evolving defense industrial capacity in the naval realm over the final decades of the 19th century and across the threshold of the 20th century. Facing the challenge of Franco-Russian naval modernization, the British government leveraged its central position

[101] The Statist (1906).

[102] Bastable (2004), pp. 212-213. This consolidation by capital-intensive firms illustrates Richard Caves and Michael Porter's argument regarding the co-evolution of industry capital intensiveness and market structure. See Caves and Porter (1977).

within its domestic defense industrial network to drive a program of procurement based on its assessment of the strategic implications of evolving, but still relatively nascent industrial technologies. As a consequence, the Admiralty advocated strongly for a quantitatively focused naval build-up, as opposed to industry imperatives for significant qualitative innovation.

This approach appears to have demonstrated the procurement capacity of the British government: by adapting its procurement agenda to the state of contemporary technologies, London avoided throwing resources into the development of technologies that could rapidly diffuse to its adversaries, while emphasizing its defense industrial efficiency (which remained a competitive advantage). Conversely, Britain failed to effectively leverage these developments to advance its gatekeeper capacity. The previous section provided an overview of the interplay between British strategic and defense industrial relations with several key powers during the late 19th and early 20th centuries. Taken together, these analyses suggest that while Britain's external defense industrial relations did on occasion reinforce its strategic interests, the causal relationship was not consistent either in its direction or its timing. It is not clear that the integration of UK firms into the global defense industrial economy served to consistently advance London's long term strategic interests.

CHAPTER 4

THE RISE OF THE PRODUCERS: BRITAIN, 1904-1913

> *. . . though numerically a very imposing force, [the Royal Navy] was in certain respects a drowsy, inefficient, moth-eaten organism.* — Arthur Marder[1]

The early 20th century brought a renewed challenge to Britain's naval power, motivating London to pursue a second round of naval industrial adjustment. From 1905 onward, British officials once again became increasingly concerned with the negative trends in the international balance of naval power, a consequence primarily of the rapid acceleration of German battleship construction.

Britain's procurement response to this challenge differed from its earlier reaction to Franco-Russian modernization. While military relevant technologies continued to diffuse — reflecting the limited breadth of those technologies and the closely linked nature of civilian and military industries — changes in the structure of the British defense industrial network empowered private producers to exercise greater influence over the character of Britain's naval procurement in the 1900s. Admiralty naval procurement requirements increasingly were reframed in terms of qualitative innovation, a reflection of growing reliance on the private sector for advanced engineering and technological capacities, which stemmed from the second wave of private-sector led industrialization to which naval technologies were still intimately tied.

The result was that Britain pursued a procurement response with an emphasis on qualitative innovation over the quantitative expansion of the Royal Navy. This led

[1] Fisher (1952), p. 147.

to distinctive shifts in capital ship designs, embodied in the battleship HMS *Dreadnought*, and the *Invincible* class of what became known as battle cruisers. These designs, which combined high speed with long range armament, challenged existing tactics, and rendered existing capital ships obsolete. However, in the context of what remained a fundamentally limited range of military-required technologies that were rapidly being absorbed by rising powers, these qualitative innovations were relatively easy for industrial peers to emulate, resulting in the rapid diffusion and erosion of Britain's technological advantage. The net result was to depreciate Britain's existing naval force structure advantage, substantially increasing the procurement costs of meeting its strategic requirements.

Britain's pursuit of qualitative innovation also did little to bolster its gatekeeper capacity. While Britain's introduction of HMS *Dreadnought* stimulated a short-term boost for foreign demand for British-built warships, the limited breadth of naval technological requirements meant that Britain's innovation in capital ship design was rapidly copied by other producers. The reality of rapid diffusion also continued to disincentivize Britain from developing regulatory institutions to align the direction of its warship exports with its wider strategic interests. As a result, while Britain retained a central position within the global defense industry, its ability to leverage that position for strategic advantage was highly circumscribed.

4.1 *The security challenge of German naval power*

By the early years of the 20th century the Royal Navy's maritime dominance was once again challenged. As industrialization spread to a wider range of countries, fueling their rapid economic growth, many of these powers sought to leverage their advancing productive capacities to develop independent naval power. The result was an expansion of the naval capacity not just of Britain's traditional rivals, France and

Russia, but also of the United States, Japan, and Germany. The latter, under the stewardship of Admiral Tirpitz, was to emerge as the primary challenger to Britain's maritime hegemony.

As Matthew S. Seligmann has argued, there was a growing awareness by Admiralty leaders, including Lord Selborne, Hugh Oakeley Arnold-Forster, and Director of Naval Construction Sir Philip Watts that the rapid German naval build-up represented an emerging challenge to Britain's naval power in the North Sea, and, if completed, could undermine Britain's ability to oppose a potential invasion by a superior German army.[2] In 1900 Germany passed its Second Navy Bill, significantly expanding the number of capital ships authorized for construction.[3] This sent a clear signal to British officials of Berlin's growing material challenge to the naval balance of power. This was reinforced the reports of successive Directors of Naval Intelligence from 1900 onward who noted the strategic implications of Germany's expanding fleet construction program.[4]

The naval challenge posed by Germany's naval build-up crossed a critical threshold in 1905, reflecting wider changes in the international balance of power (see Figure 4.1). The destruction of the Russian Imperial Navy in the Russo-Japanese War dissipated the risk to Britain's sea lines of communications posed by Saint Petersburg. At the same time, this threw into sharper relief the growth in German naval capacity and armaments production capacity.[5] In London, these shifts precipitated a new strategic challenge to Britain's naval interests.[6] However, the response to this challenge was conditioned by increasingly stringent financial considerations: following the massive

[2]Seligmann (2008), pp. 245-248. Note that Britain did not universally react to rising powers by seeking to offset their naval capabilities. The emergence of the United States as a major naval power at the turn of the 20th century saw London acquiesce to Washington's dominance of the Western Hemisphere - a region distant from the British Empire's core economic life-lines. See Lobell (2000), pp. 95-96.

[3]Lambelet (1974), pp. 2-6.

[4]Seligmann (2008), pp. 250-251.

[5]Seligmann (2010), pp. 44.

[6]Stoll (1992).

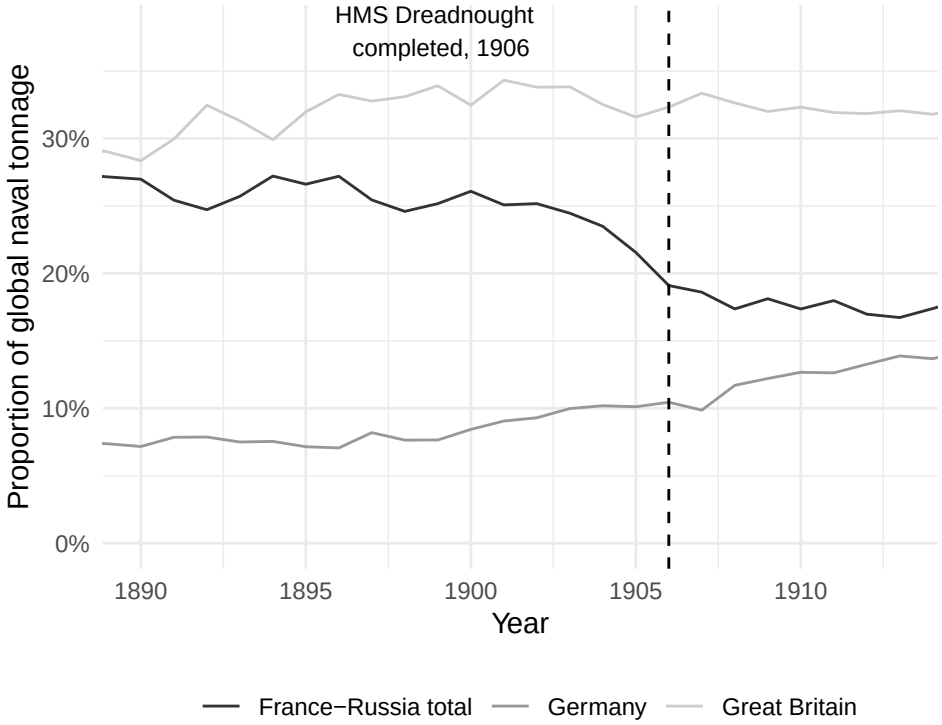

Figure 4.1: Britain's share of global naval tonnage relative to that of Germany, and the combined French and Russian navies, 1890-1914. *Source: Crisher and Souva (2014).*

expenditure of the Boer War, there was little appetite to throw new resources at the Royal Navy. British naval expenses had risen from £19 million in 1889 to £37 million in 1905.[7] As a consequence, the Liberal government pushed strongly for a retrenchment of naval expenditure, even amid the acceleration of Germany's naval build-up. How Britain ultimately sought to square these conflicting demands was determined by the interaction of state and private actors within the defense industrial network.

4.2 *Implications for procurement capacity*

The security challenge posed by Germany's naval build-up created both an expectation and an opportunity for a shift in the trajectory of British procurement de-

[7]Lambert (2015), p. 276.

mand. As Don Leggett pointedly observes, naval procurement choices are a product of "... networks of actors negotiating risk, speculation, anxiety, fragile credibility and competing interest groups."[8] The change in Britain's external strategic circumstances during the early 1900s served to activate the British defense industrial network by catalyzing state and producer interests, shaped by the character of military technology, and the structure of defense industrial relationships.

4.2.1 *Structural position and influence*

The domestic defense industrial context in which Britain's procurement demand was recast in 1905 differed significantly from that of the late 1880s. Unlike in 1888, producers benefited from a stronger structural position as a result of vertical and horizontal integration. This is illustrated in Figure 4.2. As was discussed in the previous chapter, from the late 1890s onward the key component technologies of the battleship had been subject to iterative improvement, requiring increasingly costly technical investments. In particular, armor and armament production necessitated significantly greater quantities of human and physical capital.[9] The rising costs of investments necessary to engage in producing the various components of battleships rendered firms increasingly vulnerable to volatility in the procurement decisions of the state.[10] A rapid drop in procurement could leave firms on the hook for these expensive investments. As a result, private producers became more integrated and substantial players within the defense industrial network. As fully integrated players such as Armstrong Whitworth and Vickers Maxim emerged, the Admiralty progressively deepened its relationships with them. Though unable to guarantee long term orders, the Admiralty was committed to reducing the salience of publicly owned production from a primary

[8] Leggett (2015), p. 5.
[9] Pugh (1986).
[10] Singleton (1993), pp. 229-230.

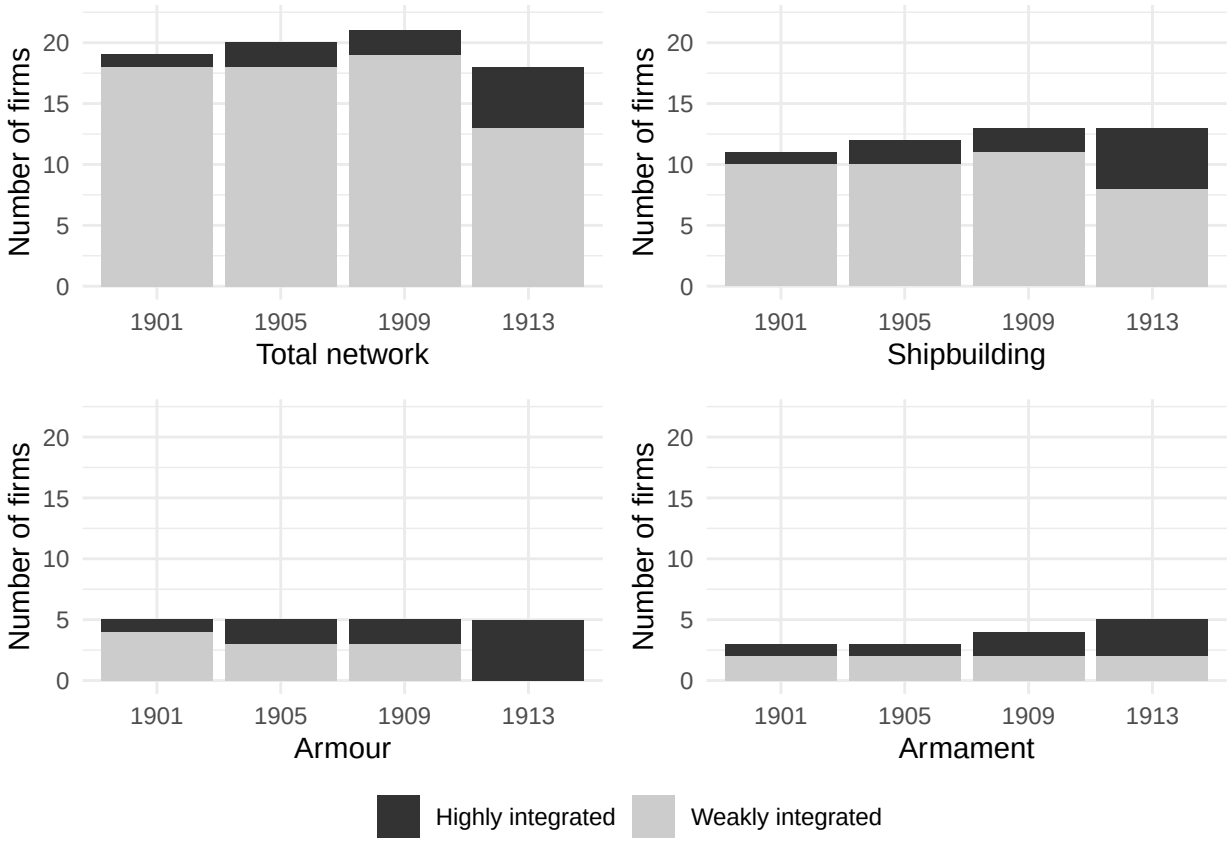

Figure 4.2: Number of UK naval producers with active capital ship contracts and their level of vertical integration, 1900-1913. *Source: Hill (2015). Note: For the purpose of these analysis, 'highly integrated' is defined as being active across two or more component sectors. For specific details on this dataset, see Chapter 3, footnote 9.*

role to a secondary one, pushing the private sector capability to the fore.[11] In addition, responsibilities were increasingly devolved to private contractors to complete the fitting out of vessels with Admiralty-ordered equipment, primarily ordnance, which had previously be conducted solely by the Royal Dockyards after transfer of the hull and machinery.[12] In part, this deepening relationship was a function of technological realities: progress in naval armaments was closely tied to broader developments in civilian industry, favoring private sector actors who retained strong connections with wider market-driven processes of technological development and diffusion.

This generated concern that Britain's state-owned naval industrial capacity was in-

[11]Peebles (1987), p. 59.
[12]Palmer (1903), p. 2, 7.

creasingly inadequate to the Admiralty's procurement demands. By 1901, Parliament became focused on the apparent dysfunction in naval procurement. As a result, the House of Commons authorized a Select Committee on the Arrears in Shipbuilding. While the nominal focus was on the delays in delivery of warships, its ambit extended more broadly to include "[w]hether the private sources of the United Kingdom are utilized to the fullest extent for the purposes of production for naval shipbuilding and armament, and if not, generally, how this end can be attained."[13]

The Forster Committee (as it became known) reported back in favor of a moderate increase in the latitude of the Admiralty to specify contracts with the private sector in a more flexible and novel fashion that would regularize the relationship between the two parties. Yet it also indicated a more radical streak of sentiment. In the dissent, Sir Francis Evans expressed concern that Admiralty relations with the private sector were fundamentally blocked by the limits of existing organizational structures. He advocated a shift to no-tender contracts, and a deeper mutual embedding of Admiralty and private sector producers. The aspiration was that

> the contractor would be acting all the time practically as agent for the Government, his purchases would be for their work, the acceptance or rejection of materials supplied would not affect the contractor adversely or otherwise, he would have every inducement to use only the best material... continuous work could then be promised to builders who carried out their work to the satisfaction of the Government, and the technical knowledge and skill of the shipbuilder would be constantly directed to the construction and designing of ships of war as part of their regular business.[14]

As increasingly central — and essential — stakeholders at the expense of the state-

[13]Forster et al. (1902), p. 2.
[14]Forster et al. (1902), p. 17

owned Royal Gun Factory and Royal Dockyards, the preferences of private producers were incorporated into procurement priorities. In light of the increasingly essential roles of private producers in supporting naval procurement, and hence Britain's naval power, managing relationships with those producers became a high priority of key naval figures such as First Sea Lord John Fisher. Lambert notes that the Admiralty was "anxious to establish a stable — and sustainable — working partnership between the navy and the private armaments firms. Fisher was certainly the officer best qualified to understand the dynamics of this relationship."[15] Fisher's early career had served to demonstrate the construction of these important ties within both the political and industrial spheres. In 1886 he was appointed Director of Naval Ordnance (DNO), responsible for armament supply at the Admiralty. During the late 1880s, Fisher engaged in a deeply political contest to secure the Admiralty's prerogative to place contracts with the private sector independent of the War Office, winning the right to procure 4 inch quick-firing guns directly from Armstrong in 1886.[16] In the course of these efforts, Fisher and his coterie developed substantial links with the private armaments industry. The result, Bastable observes, was that "[a]s this group of officers rose to positions of great authority, the relationship between the Admiralty and private industry matured and expanded."[17] Indeed, subsequent to his appointment as DNO, Fisher was offered (and declined) a senior position on the board of Sir W.G. Armstrong Mitchell Ltd.[18] Nonetheless, Fisher stayed the course, and was rewarded with rapid ascension to the top Admiralty post in 1904, a move that amplified the influence of private sector preferences. Following his ascension to First Sea Lord, Fisher brought in Philip Watts as Director of Naval Construction, with his extensive understanding of the capabilities and requirements of private producers (as the former head of Armstrong Whitworth's Elswick Naval Yard).

[15]Lambert (1999), p. 145.
[16]Johnston and Buxton (2013), p. 174.
[17]Bastable (2004), p. 191.
[18]A similar offer was apparently made in 1901. Fisher (1952), p. 99, 185.

Thus while the Admiralty remained the central core of naval procurement, it was increasingly embedded in what Leggett describes as "a network of naval, engineering and scientific collaborators."[19] The importance of this network — and the central position it provided to private actors — can be seen in the integration of senior scientific and engineering figures into government committees such as the Committee on Designs. This senior inter-organizational committee in effect defined Britain's naval procurement focus for the period from 1905 through to the First World War. The committee comprised not only senior members of Fisher's close circle, but also brought in leaders of industry, most notably Alexander Gracie, manager of Fairfield Shipbuilding and Engineering Co. Ltd., and important members of civil society, such as the renowned physicist Lord Kelvin. These figures were supplemented by a parade of other notable actors with commercial and research interests, exemplified by Charles Parson's attendance on January 17, 1905 to personally argue in favor of the use of turbines.[20]

The Admiralty's requirement to deepen its integration with private sector producers, and the specific bonds this promoted between those producers and rising Admiralty leaders such as Fisher, laid the foundation for the influence of those producers over the procurement choices made in reaction to the growing strategic pressures of 1904-1905. Structural dynamics thus ensured that private producers carried greater influence in the British defense industrial network than they had previously. As a result, there was greater room for firms to shape the procurement agenda in line with their preferences, as opposed to the established views of the Admiralty.

[19]Leggett (2015), p. 237.
[20]Fisher (1960).

4.2.2 *The breadth of technological competencies and force structure preferences*

As in the 1880s, force structure preferences were shaped by the limited nature of naval industrial technological requirements, and hence their widespread adoption among newly industrializing powers from Europe, to North America, and Japan. The limited depth of these technological requirements, embodied in their generic character facilitated the permeability of knowledge between civilian and military industries. As Trebilcock notes, British armament firms benefited from the interchangeability of skills across the turn of the 20th century, while also becoming a vector for the diffusion of techniques into adjacent industries.[21] The gun manufacturing sector was a particularly clear example: capacity to reproduce accurate tolerances in the manufacture of gun barrels saw firms expand into areas of civilian production with similar technological requirements, such as bicycle and automotive manufacture.[22] Indeed, Trebilcock observes that "[t]he firms which most involved in the arms race were also those that were contributing some of the most important innovations of the era to the general engineering and shipbuilding industries."[23]

Given the widespread distribution of naval technological requirements, a divergence persisted in the interests of public buyers and private producers. Many British defense officials remained leery of engaging in substantial defense industrial innovation that threatened simply to diffuse internationally to the benefit of their rivals. Thus, Admiralty and British officials regarded technological innovation, and hence a procurement focus on qualitative change, as a challenge to British naval power. Admiralty officials judged that existing expensive investments in capital ships were subject to liquidation if innovation proceeded, and instead preferred the maintenance of current designs. As Oscar Parkes notes, these investments generated a conservatism among

[21] Trebilcock (1969).

[22] See Irving (1975). In a similar vein, the development of the early American firearm industry played a crucial role in promoting the adoption of interchangeable parts in wider civilian manufacturing. See Smith (1985).

[23] Trebilcock (1969), p. 484.

Admiralty and political leaders:

> [s]o long as foreign designs showed no great improvements upon our own, traditional policy required that no changes should be introduced which could hasten developments militating against our numerical superiority. 'To follow and overtake rather than to initiate' was the golden rule of Whitehall.[24]

Conversely, private producers continued to see significant advantage in pursuing qualitative innovation. State-sponsored innovation would support their wider industrial recapitalization and modernization efforts. And private producers would benefit not only from increasing resources for the research and development of new technologies, but also from the prospects of adapting new techniques and technologies for military purposes. Armstrong-Whitworth — which was closely connected to Fisher — was already pursuing designs for all-large gun battleships that anticipated elements of *Dreadnought* during the early 1900s.[25] Similarly from the late 1890s, British technologists such as Charles Parsons sought to actively promote the potential of their newly-developed turbine engine technology to the Admiralty as a means of securing a stable source of orders from which to pursue wider commercial opportunities.[26] As a consequence, the prospects for naval recapitalization in reaction to the shock of Germany's rapidly maturing capabilities encouraged producers to promote a qualitative-focused procurement response.

4.2.3 *Qualitative and quantitative change*

The improved structural position of private firms within the British defense industrial network thus provided them with the negotiating heft and relationships to promote

[24]Parkes (1956), p. 421.
[25]J. Brooks (2007), pp. 161-162.
[26]See Smith (2007). See also Leggett (2011).

their naval procurement interests to senior British officers, and to have their input solicited. It is notable that in many respects Fisher's own vision for capital ship design intersected clearly with that propagated by private producers. In a letter dated August 21 1904, the chairman of Armstrong Whitworth, Sir Andrew Noble, responded to Fisher's request for preliminary battleship designs by advocating a possibility featuring a uniform armament and turbine propulsion, a move that pre-figured the design of HMS *Dreadnought*.[27]

The ability of private producers to shape Britain's naval procurement agenda was manifested in the decisions made by the Committee on Designs in 1905. In the history of the Admiralty, there existed no real precedent for bringing together such a grouping of experts to intensively debate and evaluate alternate designs for a ship.[28] The Committee on Designs deliberated on how the emerging consensus between private sector producers and Fisher's core group of Admiralty figures in favor of all main gun armament and turbine power should be incorporated into a production program that nonetheless functioned within the parameters of economy laid down by both the Admiralty and broader political forces. The result was HMS *Dreadnought*. Combining ten 12-inch guns in five gun mountings, *Dreadnought* possessed an unparalleled broadside capacity. This was accompanied - and enabled - by a shift to the marine turbine, which unlocked both a substantial increase in speed, and a reduction in hull space allocated to machinery, facilitating the redistribution of the armament.[29] At the same time, *Dreadnought* was able to combine these features with an existing emphasis on armor protection.

The result of the committee's deliberation was an effort to exploit the leading-edge of existing technological competencies to advance Britain's naval force structure. HMS *Dreadnought* promised to increase vastly Britain's absolute capacity to project force,

[27]Fisher (1960), pp. 31-32.
[28]Leggett (2015), p. 266.
[29]McBride (1992), pp. 275-277; McBride (2000), p. 93.

altering the operational character of naval warfare into one conducted at a distance by embracing new long-range sensing, targeting, and coordination technologies. As a result, its design precipitated radical shifts regarding the operational deployment of battleships within the ambit of the broader naval strategic paradigm, emphasizing long-distance firepower and speed over close quarters engagement. This was made possible by the substantial reorganization in the key component technologies, notably the introduction of an all-heavy (twelve inch or larger) armament and steam turbines.

This qualitative push must be seen as a victory for private sector producers. The introduction of turbine technology was in many ways as great a risk for private producers as it was for the state. As Peebles acknowledges, efforts by experienced shipbuilders on the Clyde to incorporate turbine production were met initially with varying levels of success.[30] In all cases, the shift required substantial capital investments. Part of the willingness of firms to engage in these investments was the appreciation that the relatively generic nature of military technology meant that asset specificity was weak; turbine production was hardly restricted to military vessels, and with its demonstration on capital ships, its wider civilian adoption was assured. As a result, Britain's major shipbuilders all sought out licenses for turbine technology, whether from Parsons, or, later, from the emerging Anglo-American alternative of Curtis-Brown (in which, as the name suggests, John Brown occupied a leadership role).[31] Similarly, Fisher mobilized the Admiralty's wide contractual freedom endorsed several years earlier by the Forster Committee to engage in no-bid contracting for all three of the initial *Invincible* class so that they were assigned to "carefully selected" specific contractors, namely John Brown, Fairfield, and Armstrong.[32] As Peebles notes, it is no coincidence that these firms were selected: the managing director of Fairfield, Alexander Gracie, had already been brought into a tightened institutional bond with the

[30]Peebles (1987), Chapter 5.
[31]Boyce (1996).
[32]Peebles (1987), p. 60.

Admiralty through his role on the Committee on Design which had assisted in the finalization of the *Dreadnought* design.[33] Thus private sector advocacy for advances in capital ship design through their increasingly embedded relations with the British state were ultimately realized in procurement contracts.

However, while beneficial to the private sector, these substantial innovations nonetheless failed to provide Britain with a lasting naval advantage. The introduction of *Dreadnought* was both a shock to naval-industrial planners worldwide, and a source of inspiration.[34] Charles Fairbanks Jr. observes that there is little evidence to suggest that Fisher believed other countries were able or willing to emulate the development of *Dreadnought*.[35] Yet in reality, the still-limited range of core component technologies underlying the design, combined with their relatively low levels of technological differentiation, meant a close connection remained between military innovations and civilian technological capacity, allowing for the rapid aping of the *Dreadnought* concept by other great powers. These efforts met their highest pitch across the North Sea, in Germany. German design decisions during this period largely demonstrated an attempt to converge on the key developments pioneered by Britain. Andrea and Mauro Gilli contend that

> In the span of just three to five years, Imperial Germany succeeded in copying the most advanced battleship of its time — the Dreadnought — the product of experience and know-how accumulated by Britain over the previous five decades.[36]

While Germany's first wave of post-*Dreadnought* construction (the *Nassau* class) represented a half-way house between the two generations of warships, the introduction of the *Helgoland* class in 1910 embodied an effort to match British designs across

[33]Peebles (1987), p. 60.
[34]Sumida (1989), pp. 111-115.
[35]Fairbanks (1991), p. 252.
[36]Gilli and Gilli (2019), p. 173.

their key characteristics. For example, in response to rumors that British battleships would shift to a 13.5 inch main gun battery, the design of the *Helgoland* class was upgraded from a 11 inch to 12 inch main battery.[37] Similarly, the subsequent *Kaiser* class was distinguished by its introduction of turbine propulsion, a feature of British vessels since *Dreadnought* in 1906.

As a result, the benefits of qualitative innovation for British naval power were fleeting, and came with a staggering acceleration in cost escalation - a classic example of weak procurement capacity. Matthew Johnson observes that

> The revolution in warship design heralded by the advent of the Dreadnought, laid down in 1905, and the new Invincible class of fast, well-armed battle cruisers, meant that the Edwardian naval race would be one of unprecedented financial expense.[38]

Britain was able to bear this financial burden due to its relative superiority in fiscal extractive capacity.[39] In contrast, Berlin faced increasing difficulties sustaining both its naval ambitions and the development of its army in the face of continental challenges, against a background of sharpening tensions over taxation and its impact on social stability.[40] But the fact that Britain placed itself in the situation where it had to lean on its fiscal capacity in lieu of defense industrial advantages represented a failure of procurement capacity. Rapid emulation had the effect of eroding the significance of Britain's pre-existing quantitative advantage in capital ships.[41] Ultimately, the distinct qualitative edge of *Dreadnought* battleships led Admiralty officials to re-construe the "two-power" standard of Britain's naval requirements to discount the value of pre-*Dreadnought* ships, implying a sharp diminution of Britain's relative naval strength

[37]Staff (2012a).
[38]Johnson (2011), p. 140.
[39]Lamborn (1983), pp. 135-141.
[40]Herwig (1991); Lambelet (1974), pp. 24-27.
[41]Sumida (1989), pp. 111-115.

as a direct consequence of its pursuit of excessive qualitative innovation.[42]

4.3 *Implications for gatekeeper capacity*

The trajectory of British gatekeeper capacity paralleled that of procurement capacity between 1900 and 1913. Quantitative analysis of the structure of Britain's naval industrial relationships, as well as a qualitative exploration of its ties with two key great powers, Italy, and Japan, indicates that London drew few consistent strategic advantages from its defense industrial relationships. This is despite the fact that London and British defense industrial producers were extremely prominent within the global battleship production network. As in the previous chapter, the reason that Britain was unable to leverage this position for strategic effect lay in the persistent narrow base of technological competencies necessary for naval production, and their increasingly widespread availability to other industrializing states. This rendered diffusion of new qualitative naval innovations a relatively straight forward proposition. And as a consequence, there was little motivation for the British government to pursue the regulative authority to consistently shape the flows of naval material and investment across its borders.

4.3.1 *Structural position and the international distribution of technological and industrial capacity*

Overall, the external competitiveness of the British domestic defense industrial network continued to guarantee a strong structural position for British producers within the global defense industrial network. As Figure 4.3 shows, Britain's share of the total number of global naval industrial producers remained stable throughout the

[42]Lambert (2015), pp. 306-307.

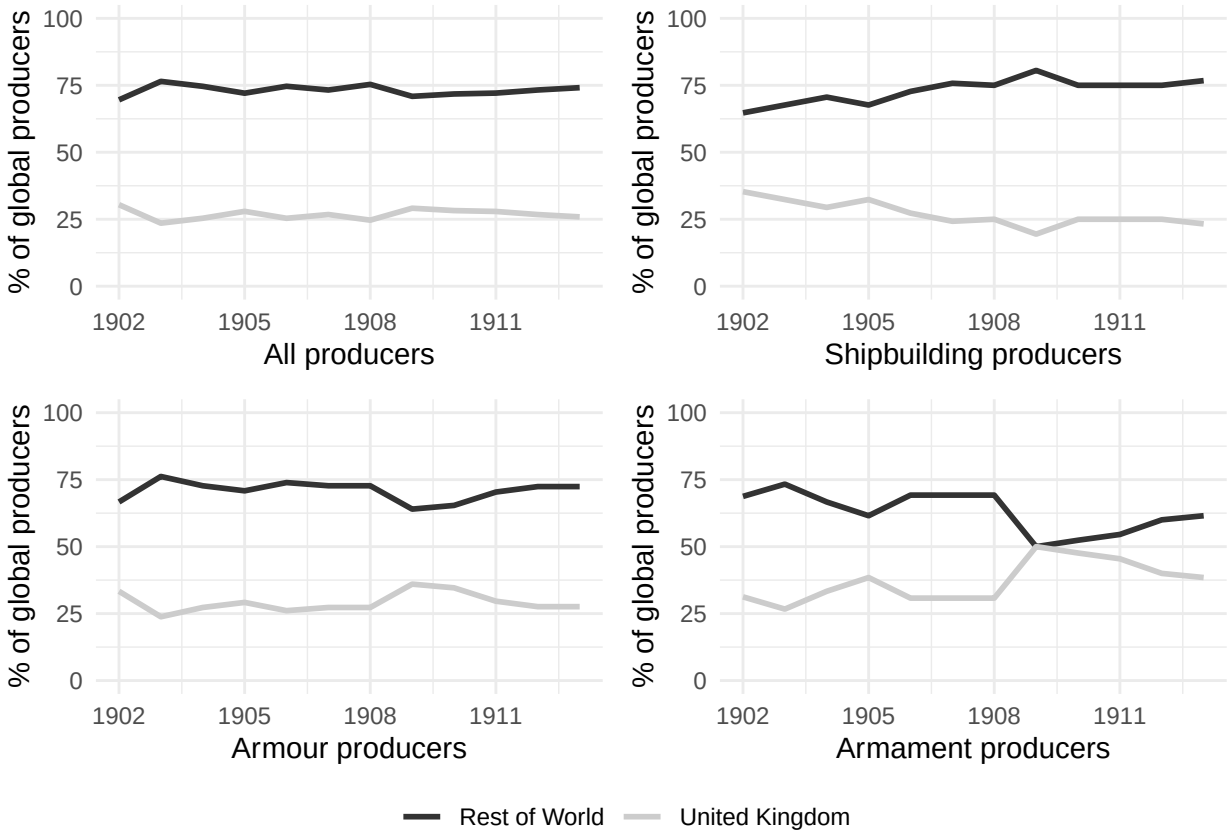

Figure 4.3: Britain's share of global producer base by technological segment, 1900-1913. *Source: (Hill 2015). Note that this analysis aggregates the number of producers on the basis of their active involvement in any naval contracts; due to data limitations it does not weight the number of producers by the value or total number of contracts.*

first decade and a half of the 20th century. While its share of shipbuilders declined through the period, this was largely offset by the rise in the number of British armament producers involved in the global defense industrial network. Overall, the introduction of HMS *Dreadnought* in 1905 does not appear to have had any substantive effect on these structural dynamics. As has been noted above, the widespread distribution of technological and industrial capacity meant that the salutary example of the post-*Dreadnought* Royal Navy was relatively easily emulated, denying Britain any lasting export advantage.

Despite its persistent centrality within the defense industrial network, the British gov-

ernment had little control over the value or direction of British overseas investment.[43] As Marchisio observes:

> [b]efore 1914 governments tolerated free trade of armaments and also free flows of information and technical expertise while participating in naval arms races. Even Great Britain, which, as the major naval power before 1914 might have had an interest in limiting the sale of naval armaments and warships, did not regulate these activities.[44]

As I contended in the previous chapter, the absence of significant changes in the capacity of the British defense industrial network to regulate arms flows reflects the persistently narrow basis of naval technological requirements, and subsequently their rapid adoption by other countries. Consequently, we observe sustained weakness in Britain's capacity to harness its industrial relations to advance its international gatekeeper capacity. This in turn undercut the motive or capacity of the British state to harness Britain's structural position for strategic effect.

4.4 *Britain's gatekeeper capacity consequences*

Despite the persistent centrality of British firms within the global defense industrial network, it remained the case that the British government only sporadically sought to leverage defense industrial relationships to advance its strategic goals. This weak level of coordination can be identified quantitatively, through a comparison of the structural pattern of the British defense industrial network's global relationships relative to the strategic security ties of the British state. Complementing this analysis, Britain's limited capacity to unify its strategic and defense industrial efforts can also be assessed qualitatively through an examination of the trajectory of Britain's strate-

[43] Atkin (1970), p. 324.
[44] Marchisio (2012), p. 10.

gic and defense industrial ties with two critical states: Italy and Japan.

4.4.1 *Evaluating the alignment of Britain's security and defense industrial networks*

In order to systematically assess the extent to which Britain's defense industrial relationships aligned with its strategic interests, I deploy the same social network analysis methodology as was used in Chapter 3. To recap briefly, I draw upon the Alliance Treaty Obligations and Provisions (ATOP) data-set produced by Leeds et al. to derive the network of security commitments between countries from 1904 through 1913, and utilize cluster detection algorithms to partition the network according to the greatest commonality in security relationships. I then utilize the global battleship production dataset I have coded to derive the network of naval industrial relationships among countries (defined by sales and licensing relationships), performing a similar clustering analysis.

The resulting clusters are presented in Figure 4.4. As the visualization demonstrates, there was an increased structural mismatch between Britain's global strategic commitments, and the pattern of its naval industrial exports across this period. Britain's pattern of security commitments manifested its geo-strategic position as what Christopher Layne has termed an "offshore balancer": a maritime state standing apart from contending continental power blocs (in this case centered on Germany-Austria-Hungary and France-Russia) which seeks to offset the emergence of a disparity between them.[45] In the 1900s, the source of this disparity was the strengthening of German military power fueled by its rapid industrial growth. Conversely, the pattern of defense industrial relationships defies strategic alignment. It is so interwoven that effectively only one cluster exists: the entire global defense industrial network in this period was an integrated whole, cutting across strategic interests and alignments.

[45] Layne (2014), p. 101.

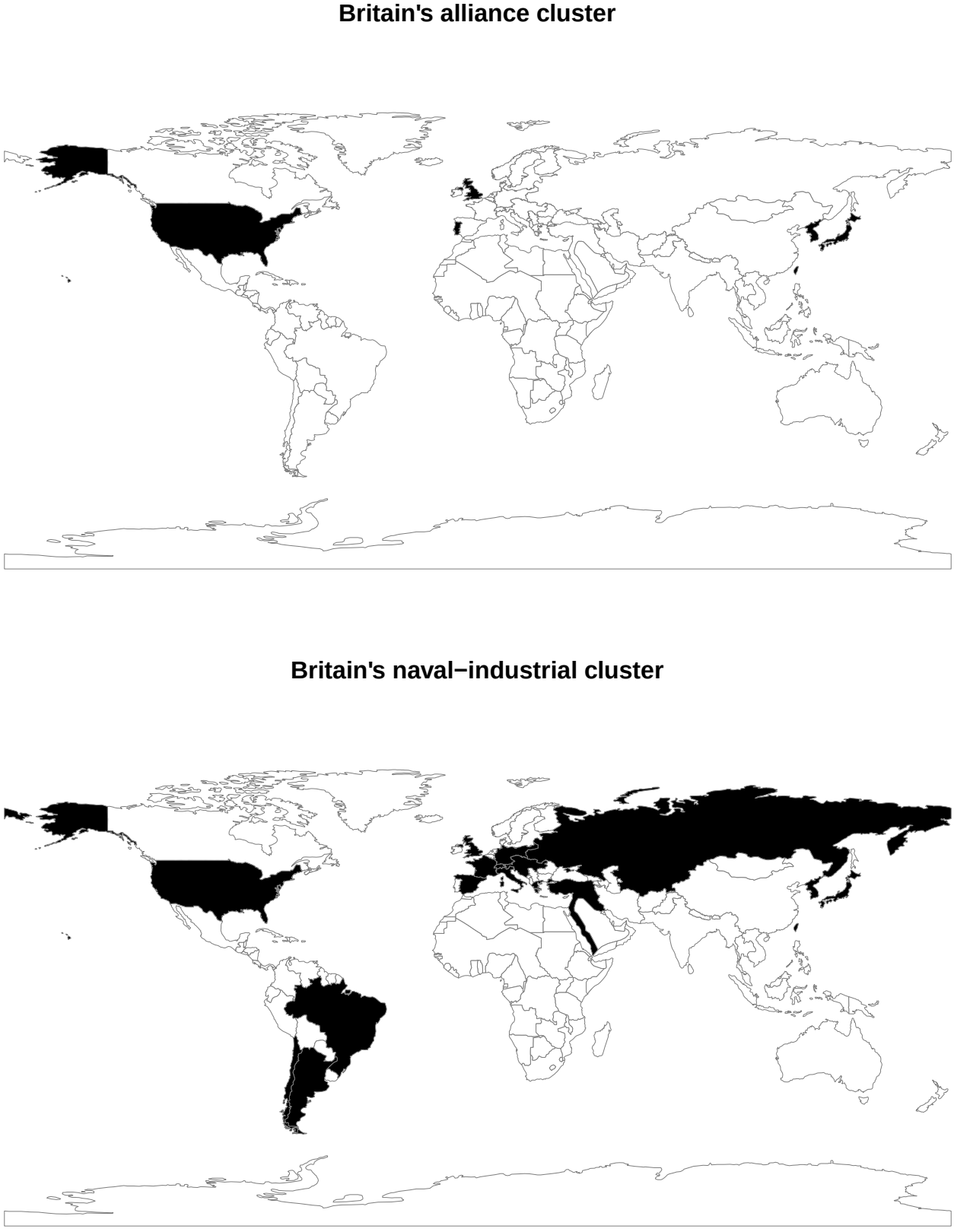

Figure 4.4: Britain's position in international naval-industrial versus military alliance blocs, 1904-1913. *Note: For clarity, figure only shows cluster affiliation with Britain. Source: (Leeds et al. 2002; Hill 2015.)*

This quantitative analysis indicates the absence of any correlation between the pattern of Britain's strategic commitments and its defense industrial relationships. It thus indicates the limited efficacy of Britain's gatekeeper capabilities during this period. However, it provides little insight into why Britain was unable to harness those capabilities to its strategic interests. To understand that, I turn to qualitative case-study analysis.

4.5 *Case studies in gatekeeper capacity*

As in Chapter Three, the following case studies focus on Japanese and Italian defense industrial and strategic relations with Britain. The focus here is on the drivers of these relationships in the decade before World War One. The analysis shows that the apparent correlation of Britain's strategic and defense industrial ties with both powers on the eve of the First World War was as much the product of fortune as it was of foresight. While Britain's engagement with Japan exhibited a conscious consideration of the interplay of defense industrial and strategic equities, in the case of Italy, the activities of British naval industrial producers did not exhibit signs of coordination, and took a trajectory that seemed at odds with Italy's emergence as a strategic rival to Britain in the Mediterranean.

4.5.1 *Italian-UK relations*

Through the first decade of the 20th century, British defense industrial ties with Italy deepened, further supporting Rome's naval ambitions. At the same time, however, the correlation of Britain and Italy's national interests became more uncertain, as strategic alignments in the Mediterranean continued to shift.

Building on the defense industrial engagement between British firms and Italy sur-

veyed in the previous chapter, the early 20th century saw a second major wave of British investments in Italian naval industrial capability. Armstrong engaged in a joint investment in shipbuilder Ansaldo with Italian financiers from 1903 to 1908. And it also saw a closer relationship emerge between Italian armor manufacturers and Britain. 1904 heralded the outbreak of an armor scandal, in which it was revealed that Terni had exploited its position as primary supplier of armor to the Italian Navy to charge higher prices than international competitors. Terni justified itself on the basis of domestic production, and higher quality than foreign product.[46] However, investigations revealed that the quality was far lower than Krupp process steel; in fact, use of Krupp processes would have reduced the cost and increased the quality of the output. The scandal delayed Italian naval procurement, casting a cloud over the navy and its practices. As a consequence of this scandal, Terni was forced into international linkages, primarily with British firms. First, Terni sought to adopt the Krupp system, becoming a shareholder in the Harvey United Steel Company as well as the Steel Maker's Nickel Syndicate, both British dominated transnational cartels. Then in 1905, Terni entered into an agreement with Vickers to create a joint venture, Vickers-Terni, which would create ordnance to compete with Armstrong-Pozzuoli.[47] In sum, as the 1900s wore on, connections between Italian and British armament industries became increasingly "numerous and deep, more so than among the armaments industries of other countries."[48]

However, even as British defense industrial firms deepened their engagement with Italy, this period saw London's geo-strategic interests in the growth of Italian naval power become less certain. Britain faced increasing strategic pressure in the Mediterranean from 1904 onward. As the emergence of the Austro-Hungarian navy as a blue water force threatened to undermine Royal Navy dominance of the lifeline to India

[46]Henderson (2014).
[47]Segreto (1985).
[48]Marchisio (2012), p. 11.

between Gibraltar and Suez, Anglo-German naval competition forced a reduction in strength of the British Mediterranean Fleet.[49] From London's perspective this threw the geo-strategic position of Italy into uncomfortable relief, as Rome remained closely aligned strategically to both of these parties.

Indeed, the strategic orientation of Italy became progressively less certain through the 1900s, complicating Britain's naval position within the region. Counting in Britain's favor, the Triple Alliance continued to be riven by competitive dynamics between Italy and Austria-Hungary. From 1910-1914, Italy and Austria-Hungary became embroiled in a new naval arms race, reflecting the maturation of *Dreadnought* indigenization efforts in both states.[50] Italy laid down *Dreadnought*-type warships from 1909, with the *Dante Alighieri*-class, soon joined by the *Cavour*-class in 1910. In 1911, two further *Dreadnought*s were added to the program, the *Duilio*-class. By 1912, the Italian navy had six *Dreadnought*s under order.[51] Yet the persistence of the Triple Alliance, internally contested as it was, created lingering doubt as to what would happen during a European war.[52] As Italy acquired a substantial modern naval capability, much of its supported through technology transferred by British firms, the strategic direction to which it would be oriented remained in question. This was underscored in the years leading up to World War I, as Italy's alignment with Austria-Hungary and Germany strengthened following the Libyan War of 1911.[53] As a consequence, Rome became signatory to an additional naval convention in 1913 that specified joint operations and a combined command within the Triple Alliance.

Ultimately, though, Italy chose to break from the Triple Alliance rather than assume its strategic obligations to Germany and Austria-Hungary at the outset of the First World War. In 1915, Italy extended its pivot to enter the war on the side of the Triple

[49]Henderson (2014).
[50]Marchisio (2012), p. 238.
[51]Halpern (1971), p. 191.
[52]Halpern (1971), p. 41.
[53]Henderson (2014).

Entente. As a result, Rome's naval modernization ultimately redounded to Britain's advantage. However, this decision can hardly be attributed to a coherent effort by London to harness its defense economic links to influence Italy's strategic trajectory in the 1900s. Nor can it be credited to the strength of underlying defense industrial structural pressures on Italy's alignment. Italian political opinion on whether to remain neutral or intervene on the side of the entente vacillated throughout 1914 and early 1915.[54] Economic forces lacked sufficient agreement for defense industrial interests to tip this balance. Indeed, Richard Bosworth contends that the "greater mass of evidence about the Italian business classes in 1914-15 shows them following behind political opinion rather than directing it."[55] As a result, eventual Italian intervention reflected opportunistic timing by Rome, and luck for Britain.[56] With its erstwhile Austro-Hungarian and German partners facing distractions to the north, Rome perceived a chance to expand its own interests in the Balkans and Mediterranean, with British and French acquiescence. It is quite plausible that if war had not broken out, Britain would have faced a further degradation of its strategic position in the Mediterranean in the face of an Italian fleet whose primary armaments and machinery technologies and the raw materials from which they were constructed were a product of British industrial interests. Consequently, it is difficult to reconcile the trajectory of defense industrial relations between Britain and Italy and the naval strategic considerations dominating London in the decades leading up to the First World War.

[54]C. J. Lowe (1969).

[55]Bosworth (1983), p. 126.

[56]Italian opportunism had been demonstrated clearly from the Algeciras Conference in 1906 onward. See Jones (2009).

4.5.2 *Japan-UK relations*

In contrast to the Italian case, Britain's relations with Japan highlighted the potential for strategic and defense industrial ties to be consciously interwoven to positive effect. Off the back of deepening defense industrial relations during the late 19th century, London and Tokyo identified a convergence of strategic interests in the early years of the 20th century. Britain, facing increasing strategic pressure from the resurgent naval capabilities of European powers, sought to reduce its strategic obligations in Asia. Japan, facing pressure from Russia, Germany, and France as their colonial interests in East Asia deepened, sought a partner that could serve as a strategic deterrent to European opportunism. The result was the Anglo-Japanese Alliance, signed on 20 January 1902.

The alliance served to reinforce defense industrial linkages. Following the signing of the alliance, the Admiralty made the decision that British firms could treat Japan as a "most favored nation", a non-binding formality that nonetheless encouraged those firms to sell to Tokyo any cutting-edge technology that had already been deployed to the British fleet.[57] Britain leveraged its defense industrial capacities not merely to strengthen Japan directly through sales, but also to deny access to potential adversaries at key junctures. Notably, on the eve of the Russo-Japanese War, the British government stepped in to purchase two Chilean-ordered (but British-built) battleships that were in the process of being offered by Santiago to Russia. As the British Ambassador to Tokyo noted, this rare flexing of Britain's limited gatekeeper capacity was done in order to "obviate a disturbance of naval power to the disadvantage of our Japanese allies."[58] British assistance did not end there. Through the position of British firms within the global battleship production network, London was able to identify and communicate to Japan possible opportunities to acquire Argentinian-

[57] Ferris (2004), p. 258.
[58] Quoted in Grant (2007), p. 142.

ordered cruisers that were put up for purchase in Italy.[59] The British government then formally purchased them on behalf of the Japanese government, crewed them with British officers, and sailed them to Japan, where they arrived shortly after the outbreak of the Russo-Japanese War.[60] Against the backdrop to the preparations for the war, the financial relationship between Britain and Japan also came to fore. Tokyo raised over 70 million pounds in government debt in London between 1902-1910, largely in response to the fiscal demands of military procurement; this was by far the most significant source of Japanese government borrowing.[61]

The Russo-Japanese War presented Tokyo with a resounding military victory. At its conclusion, the vast bulk of the combined Russian Pacific and Baltic fleets either garnished the bed of the Sea of Japan, or was paraded in Japanese ports as prizes. As the war was entering its final stages, Britain and Japan sought to renegotiate their alliance. With Imperial Russia's influence in East Asia in terminal decline, the alliance was extended to incorporate British interests in India. In turn, Britain also recognized the legitimacy of the Japanese position in Korea.[62] The alliance was increasingly framed by developments in Europe, with London looking to delegate the burdens of its strategic position in Asia to Japan as it pivoted to face German naval build-up.[63]. As a result, as Peter Lowe acknowledged, "[t]he naval factor was one of the most cogent reasons of the continuation of the alliance."[64]

The renegotiation of the Anglo-Japanese alliance was subject to heated domestic debate in Japan. Indeed, following the Russo-Japanese War there was increasing interest, particularly among senior members of the Imperial Japanese Army and affiliated officials (notably Katsura Taro, Yamagata Aritomo, and Goto Shinpei), in

[59]Inaba (2004), p. 69.
[60]Nish (1985), p. 272.
[61]Hunter (2004), p. 178.
[62]Lowe (1981), p. 80.
[63]P. Lowe (1969), p. 17
[64]P. Lowe (1969), p. 25.

abandoning the alliance with Britain in favor of one with Russia, giving Japan a free hand to seize British assets in Northeast Asia while Russia threatened India.[65] These designs were offset, however, by the Imperial Japanese Navy's continued appreciation of the naval industrial, technological, and strategic importance of ties with Britain. The Anglo-Japanese Alliance was recognized as facilitating Japanese access to British naval technology; by the same token, that technology requirement motivated Japan to retain a strategic alignment with Britain.[66]

While Japan continued to acquire vessels built in Britain, the focus from the 1900s onward was on developing domestic defense industrial capacity.[67] Substantial progress had been made in this area, as Japan increasingly became comfortable with the technical requirements of the pre-*Dreadnought* design. As a result of the maturation of this design, there was a shift from foreign imports to domestic manufacture of battleships from the early 1900s onwards. The emergence of *Dreadnought* in 1906 impacted on this process, though only temporarily. The shift in dominant design served to retard processes of indigenization, extending and deepening defense industrial ties between Japan and Britain. While Tokyo had successfully incorporated ammunition manufacture and shipbuilding, advanced steel manufacturing and turbine production remained as key bottlenecks that required ongoing British support.[68]

It was to fill this gulf that Tokyo encouraged a tight relationship with Vickers Maxim Ltd. Indeed, John Ferris contends with little hyperbole that "the IJN's ties with Vickers were a conduit for the greatest transfer of naval technology in history."[69] This centered in particular on the establishment of the Japan Steel Works (JSW) through a joint venture between the Hokkaido Coal and Colonization Co. (later to fall under the control of the Mitsui *zaibatsu*), Vickers, as well as Armstrong-Whitworth. Sponsored

[65]Dickenson (2004), p. 105.
[66]Evans and Peattie (1997), pp. 185-186; O'Brien (2004), p. 6.
[67]Kobayashi (1922), pp. 121-122.
[68]Evans and Peattie (1997), pp. 62-63; Matsumoto (1999).
[69]Ferris (2004), p. 259.

by the IJN, which was the prime locus of the drive to develop the domestic capacity to produce advanced naval ordnance and armor, this venture involved the sale of British machine tools, skills and technology transfer. In addition, Armstrong and Vickers sent a number of senior engineers to Japan to train workers at JSW, with eleven technicians being stationed at various times between 1911 and the outbreak of the First World War.

JSW demonstrated the effectiveness with which the Japanese state and private sector responded to the display of British defense industrial dominance manifest in the shift from pre-*Dreadnought* to *Dreadnought* designs. This emphasized the continued relevance of British firms amid the drive for indigenization. However, this dependence was clearly in decline. The eponymous lead ship of the *Kongo* class of battle-cruisers was built in 1912 entirely by Vickers in Britain. Subsequently, *Hiei* was constructed at the Imperial Naval Arsenal at Yokosuka using imported materials from Vickers. The final vessels, *Haruna* and *Kirishima* were built privately in Japan almost exclusively with local materials (though with substantial ongoing technical support).[70] The Japanese state's engagement with British firms in this regard demonstrated its own evolving sense of gatekeeper capacity. By deliberately forcing a partnership with both of Britain's great arms producers, Japanese leaders were able to exploit the competitive tensions between them in the search for export market share. This allowed Tokyo to maintain consistent influence over the direction of ventures such as JSW, particularly once Vice-Admiral Yamanouchi Masuji, the retired head of the state-owned Kuri armament works and the foremost Japanese expert on naval ordnance, took over chairmanship of the board of directors in the years leading up to the First World War.[71]

Other important joint ventures included the Japanese Gunpowder Co., established

[70]Evans and Peattie (1997), p. 161.
[71]Hunter and Sugiyama (2000), pp. 164-165.

between Armstrong Whitworth, the Chilworth Gunpowder Co., and Nobel Explosives in 1905. Yet JSW remained the crucial exemplar of this phase of defense industrial ties. As Admiral Kondo Motoki, Constructor of the IJN noted, British firms had "given us the free run of their shipyards and workshops to our workmen, enabled them to learn much in their trade which they could not have done otherwise."[72] Ultimately, this marked a crucial phase in the diffusion of battleship technology, as direct imports were then leveraged into technological transfers. This is not to say that Japan became fully independent of Britain's defense industrial support. At least through the First World War, Japanese dependence on Britain for war manufacturing remained part of the security of the strategic relationship. As John Ferris noted, "a British blockade would probably have halted Japanese naval construction, already crippled by the inability to purchase metals and munitions grade steel abroad."[73] But the trajectory of Japan's industry was such that, within a matter of a decade, it was set to transition from a defense industrial client of Britain's *Dreadnought* technology to an independent producer in its own right.

The strategic benefits from the deep defense-industrial relationship that grew alongside the alliance did not merely accrue to British firms and Japan. The British government saw substantial advantages in the continuation of the alliance and the parallel defense industrial ties. While Japan remained a willing customer of Britain's technology, Britain was able to substantially reduce its strategic commitments in Asia, re-positioning five battleships from the China station to Europe to confront a rising Germany. At the same time, it allowed London to avoid entanglements vis-à-vis the emerging challenge of Japanese-US tensions. Further renegotiation of the alliance in 1911 explicitly limited British commitments in case of war between Japan and the United States;[74] as a consequence, the revision incorporated recognition of the arbi-

[72]Quoted in Ferris (2004), p. 258.
[73]Ferris (2004), p. 251.
[74]Davis (2008).

tration treaty signed by London and Washington.[75] At the heart of the matter, the alliance held a new strategic value for Britain, in that it helped discourage Japan from seeking a larger naval capacity, and channeled Tokyo's behavior away from threatening Britain's strategic position in East Asia. This latter position is acknowledged by scholars, with Keith Neilson arguing that by 1911 "[t]he Anglo-Japanese Alliance had become a leash rather than a life-line."[76] Yet the significance of the interplay of strategic and defense industrial imperatives in this is under-appreciated: while Japanese economic development would have provided her with the capacity to generate military power to challenge British interests regardless of the Anglo-Japanese Alliance, the presence of that alliance, bolstered by extensive defense-industrial linkages, served to redirect the risk of Japanese strategic competition away from Britain.

Overall, the defense economic ties of British firms bolstered Anglo-Japanese security cooperation; this cooperation in turn served to advance Britain's strategic interests. Initially it served to offset Russia in East Asia. In particular, it sought both to guarantee the territorial integrity of China, as well as the persistence of the "open door" policy. With the decline of Russian naval power post 1905, the alliance changed in character. In particular, Britain's focus was on shifting naval resources to Europe to offset the rise of Germany.[77] By 1911 and the second revision of the alliance, Japan's rising power became the defining characteristic, rather than the challenge offered by Russia. London had helped Tokyo ascend to a status of naval power undreamed of a generation prior. In turn, Japanese naval capacity assisted Britain in securing its strategic interests as its attentions were drawn to the demands of war in Europe.

[75]Dickenson (2004), p. 110; Lowe (1981), pp. 84-85; P. Lowe (1969), pp. 45-50.
[76]Neilson (2004), p. 59.
[77]Lowe (1981), pp. 72-73.

4.6 *Shifting strategic dynamics and procurement contraction*

From 1910 onward, the intensity of Anglo-German naval competition moderated. The primary cause was Germany's inability to match Britain's investment in a sustained agenda of qualitative naval modernization. This stemmed in part from Berlin's institutional inability to match Britain's fiscal mobilization, due to an outmoded and politically constraining tax system.[78] It also, however, reflected Germany's challenging geo-strategic circumstances: while engaged in naval competition with Britain, Berlin also faced continental rivals rearming on two fronts: Russia to the East, and France to the West. As a consequence, from 1910 onward, competing land-focused force structure requirements acted to constrict Germany's capacity to match the scale of Britain's defense industrial modernization.

As a consequence of the decline in the intensity of the Anglo-German naval arms race after 1910, Britain appeared set for another round of procurement retrenchment. This likely had the effect of encouraging British producers to explore renewed hedging strategies against the potential for declining future orders. The prospects of tighter procurement conditions in turn motivated further vertical and horizontal consolidation of the British naval industrial network (see Figure 4.5). This was particularly clear in the shipbuilding and armor sectors, where a small number of highly-integrated producers dominated into the 1910s.

However, despite preemptive consolidation by British producers, the apparent end of the early 20th century Germany naval challenge was illusory. With the sudden escalation of continental tensions, Britain was drawn into defending its security commitments in Europe, which culminated in its declaration of war on August 4, 1914. As a consequence, London found itself doubling down on naval investment; thus in retrospect, the naval shock of 1904-1905 marked the opening salvo of a sustained military expansion that would not cease until 1918.

[78] D'Lugo and Rogowski (1993).

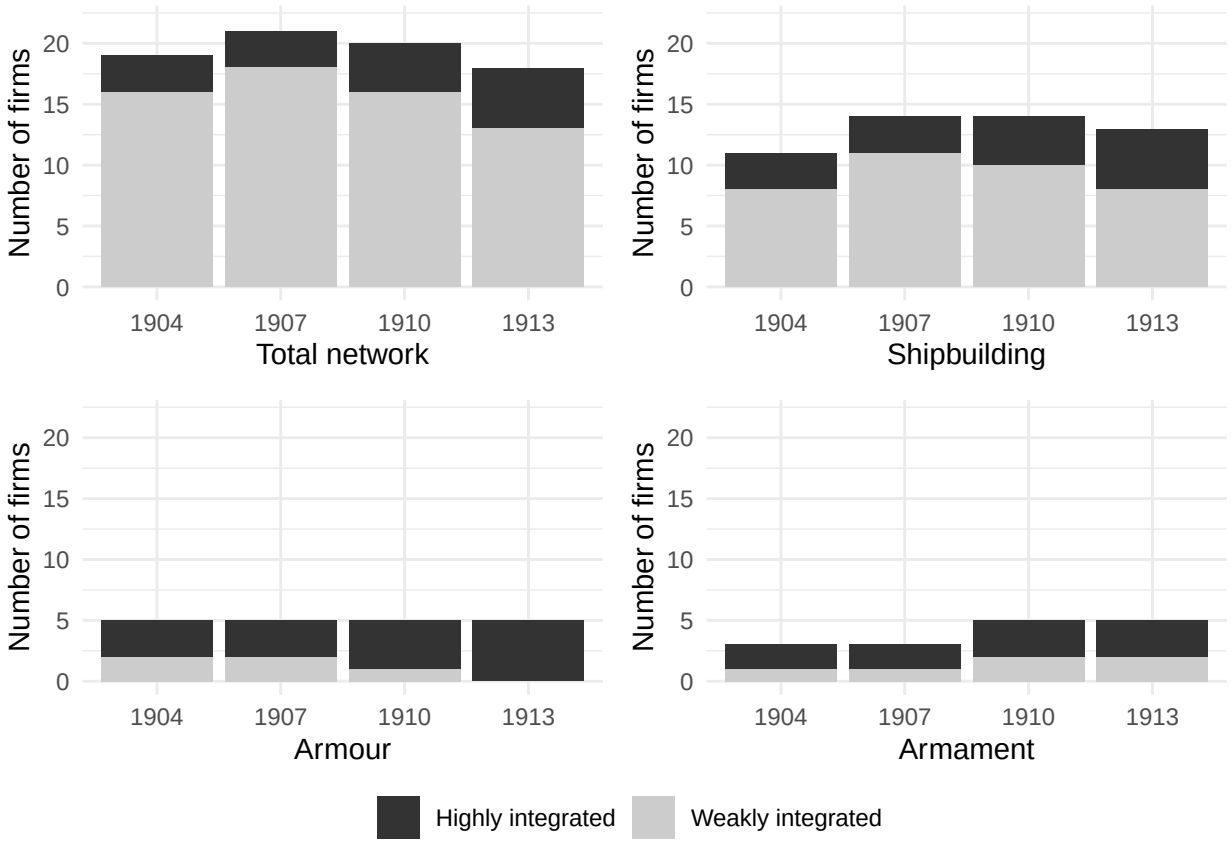

Figure 4.5: Number of UK naval producers with active capital ship contracts and their level of vertical integration, 1904-1913. *Source: Hill (2015). Note: For the purpose of these analysis, 'highly integrated' is defined as being active across two or more component sectors. For specific details on this dataset, see Chapter 3, footnote 9.*

4.7 *Conclusion*

The challenge posed to Britain's interests by the rise of German naval power in the early 20th century had an effect similar to that of the 1880s: it sparked a significant procurement response that had global ramifications. Unlike the late 19th century case, however, the British procurement response was largely qualitative, centered on the development of the *Dreadnought* battleship. This development reflected the interests of private naval producers, empowered by their increasing structural centrality with Britain's defense industrial network. In light of the persistent narrowness and shallowness of naval technological requirements, however, this qualitative innovation had negative consequences for Britain's procurement capacity. Foreign rivals were able to rapidly emulate the system architecture and underlying component technologies of the so-called *Dreadnought* revolution, rendering Britain's qualitative advantage short-lived, and undermining the strategic value of its wider quantitative advantage in pre-*Dreadnought* capital ships.

This shock also had a limited impact on Britain's gatekeeper capacity. While the impact of *Dreadnought* on capital ship design did serve to sustain Britain's centrality within the global naval industrial network in the short term, widespread distribution of industrial and technological capacity undercut London's capacity and willingness to act against the diffusion of this qualitative innovation internationally. Britain remained poorly equipped to harmonize its defense industrial relationships with its strategic interests, and even less able to leverage the former in the service of the latter.

CHAPTER 5

US TECHNOLOGICAL LEADERSHIP, 1979-1997

> *[T]he very nature of the problem has forced the military agencies to develop what is called the "systems approach." They recognize that they are no longer dealing with a series of weapons more or less independent of each other, or at least easily adjusted to each other, as might have been true some decades ago when the Navy was seeking to improve its battleships and at the same time to improve the guns to be mounted on their decks. All this has been changed by modern techniques of communication, by the speed and power of modern weapons, and — most important — by the fact that scientific development is no longer a short-term job for the engineer alone, but a long-term job for a team of scientists and engineers combined.*— Don Price[1]

In this chapter, my analytic focus shifts to the experience of the United States at the dawn of the information age - and the twilight of the Cold War. In the late 1970s, Washington experienced a challenge to its strategic position similar to that which London faced nearly a century earlier. As a result of the increase in Soviet military power from the mid-1970s onward, a brief period of detente between the Moscow and Washington collapsed into renewed strategic competition, and escalating procurement demands on the US defense industrial network.[2]

How did Washington respond to those demands? A strategic perspective focused on external competition would anticipate that the maturation of Soviet nuclear and

[1]Price (1954), pp. 68-69.
[2]Nuit (2009); Wallensteen (1985).

conventional forces would have prompted a shift in the focus of US defense procurement towards developing offsetting capabilities in those same domains. Indeed, this narrative is the prism that has been applied to analyzing US weapons technology developments during this period, described by some analysts as the "Second Offset Strategy."[3]

I argue that this is only part of the story. The US procurement response was in fact shaped by a wider set of variables, including the distribution of technology and industrial capacity, and the structural position of the state versus private producers within the US defense industrial network. Specifically, the increasing breadth of required military technological competencies, to include emerging microelectronics and information technology industries in which the Soviet Union was notably lagging, encouraged US defense officials towards a qualitative-focused procurement response. This technological advantage generated the expectation on the part of US officials that military innovation would be difficult for its Soviet competitor to rapidly and efficiently emulate, thus providing an enduring military advantage. This imperative dovetailed with that of private producers, who saw renewed innovation as a means to maintain research and development capabilities and existing production lines. The advantageous structural position of the US government within its defense industrial network, defined by a large number of prime contractors, reinforced the convergence of interests between defense officials and defense contractors.

This procurement impact also had consequences for US gatekeeper capacity. Qualitative improvements in US armaments raised the military benchmark worldwide. However, limited international access to the burgeoning technological foundations of US military innovation rendered emulation challenging. As a consequence, the US carefully developed and leveraged institutional controls over military technology sharing to shape patterns of diffusion in line with Washington's strategic interests. This

[3]Fitzgerald (2014).

involved empowering select regional partners (as explored in case studies focused on Japan and the United Kingdom), but also increasing institutionalized dependency within those partners on the US defense industrial network. These dependencies in turn encouraged those parties to prioritize the maintenance of security and defense industrial ties with the US as a key national objective, dovetailing with wider US strategic interests.

With the collapse of the Soviet Union — an event in part precipitated by the stresses of competing against US military technological advantages — US security concerns were significantly assuaged. But this had negative consequences for the US defense industrial network. As procurement demand rapidly subsided, US advanced technology industries nonetheless continued to rapidly advance the technological cutting edge, rendering the sustainability of cutting-edge military research, development, and systems integration competencies challenging. In response, the US government sought to promote consolidation that rationalized the scale of the US defense industrial network, while retaining its core systems and technology integration capabilities across all major technological domains. The downside of this approach — experienced subsequently in the 2000s — was that the influence of consolidated defense industrial producers was significantly bolstered at the expense of the US government.

5.1 *Security challenges and the Soviet military build-up*

The Cold War as a whole represented a period of sustained strategic competition between the United States and the Soviet Union. However, the intensity of that competition — and hence the salience of the strategic challenge posed by the Soviet Union to the United States — varied substantially. From the late 1940s, the United States and the Soviet Union engaged in competition for proxies and partners across the

developing world against the backdrop of post-war reconstruction and decolonization.[4] This competition escalated at key junctures when the proxy contests threatened to transition into open conflict between the superpowers, first with the Korean War, and subsequently in the Cuban Missile Crisis and the Vietnam War.

By the late 1960s, economic, social and political pressures within the United States, coupled with the maturation of Soviet power and a desire to reduce the cost of US external commitments, led the Nixon Administration to embrace a strategy of detente that marked a lull in strategic tensions between the two superpowers.[5] This approach was largely sustained under the subsequent Ford and Carter Administrations, both of which saw strategic retrenchment, at least implicitly, as a means to shift the burden of the United States' global presence to its partners, while reducing its international strategic commitments. The result was an ongoing reduction in US military investment through the 1970s. Yet detente was an unstable strategic construct that from the mid-1970s was progressively undermined by changes in the material balance of military power.[6] While the improvements in the Soviet Union's military capabilities were part of the initial impulse towards detente, US analysts and officials became increasingly concerned when the Soviet Union sustained investment in its military capabilities despite nascent efforts at arms control.[7]

The divergence between the Soviet Union's sustained military investment and Washington's reduced expenditure in armaments manifested itself as a key strategic challenge by the late 1970s (see Figure 5.1). Archival evidence and academic analysis show that the US strategic community became increasingly focused on emerging Soviet quantitative advantages (and moderating qualitative disadvantages) in the pro-

[4]See Latham (2010).

[5]Burr and Rosenberg (2010). On US assessments of maturing Soviet capabilities, see Central Intelligence Agency (2001c).

[6]Poole (2015), p. viii.

[7]Hanley (2014); Becker (1981), pp. 40-42.

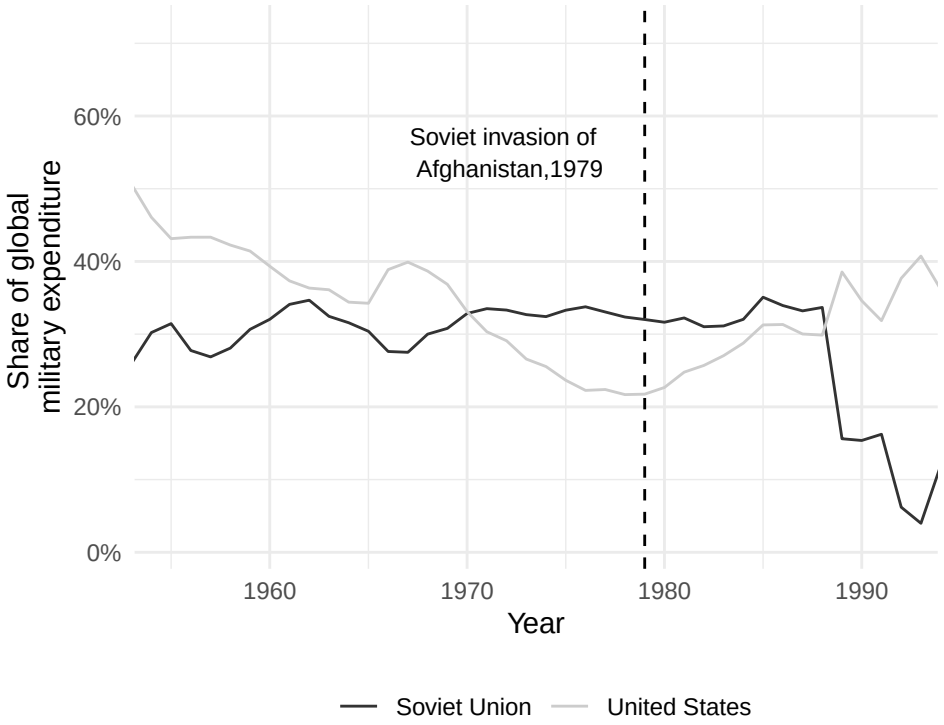

Figure 5.1: Soviet versus US shares of military expenditure, 1955-1992. Source: National Material Capabilities Dataset v5.0. For article of record, see Singer (1987). *Note that the specific estimates of Soviet military expenditure are subject to significant debate due to the lack of direct price comparisons between procurement in a socialist economy and a capitalist system. However, the trends identified in the NMC dataset accord with wider qualitative assessments of Soviet resource allocation to its military. See for example Becker (1981).*

duction of nuclear and conventional weapons.[8] The US intelligence community had tracked the ramping up of Soviet conventional and nuclear capabilities after Soviet General Secretary Leonid Brezhnev's assumption of power in 1964. Indeed, these were seen as threatening to swamp the military capabilities of the United States and its North Atlantic Treaty Organization (NATO) capabilities in Eurasia with forces that, while still somewhat technologically inferior, were increasingly numerous.[9] In a now declassified April 1981 assessment, the Central Intelligence Agency (CIA) judged that over the previous fifteen years the Soviet military had "[m]ore than tripled the size of their battlefield nuclear forces, reducing the credibility of NATO's nuclear weapons as a counterweight to the Warsaw Pact's larger conventional forces."[10] The same assessment also judged that Soviet Union had also increased its non-nuclear capabilities, challenging US and NATO technical advantages in land, aviation, and naval systems while simultaneously increasing the size of the forces deployed forward in Europe and around the world.[11]

Against the backdrop of this shift in capabilities, the specific trigger for the United States' strategic response was the Soviet Union's sudden intervention in Afghanistan in 1979. This direct challenge to US strategic interests provided the immediate driver for a substantial military build-up, started under the Carter Administration, but popularly attributed to the Reagan Administration.[12] This build-up had dramatic consequences. Indeed, as Amin Saikal observes, it not only "snuffed out detente", but laid the groundwork for a renewed strategic pushback against the Soviet Union.[13]

[8]Central Intelligence Agency (2001b).
[9]Fox (2011), p. 42.
[10]Central Intelligence Agency (1981), p. iii.
[11]Central Intelligence Agency (1981), p. iii.
[12]Adams (1986), pp. 7-8.
[13]Saikal (2009), p. 129.

5.2 *Implications for procurement capacity*

What determined the focus of the US procurement response to the strategic challenge from waxing Soviet military power? I contend that Washington's reaction primarily reflected the opportunities offered by its relatively advantageous access to the expanding breadth of military-required technologies, in the form of microelectronics and information technologies. Access to these technologies incentivized US officials to emphasize qualitative innovation over purely quantitative expansion of US military force structure. This in turn drove a convergence between the force structure priorities of the US defense bureaucracy and the desire for continuity in research and development and procurement demand on the part of private sector defense interests. This convergence was bracketed by the strong structural position of the US defense bureaucracy vis-à-vis private producers within the domestic US defense industrial network.

5.2.1 *The breadth of technological competencies and force structure imperatives*

The renewed military challenge posed by the Soviet Union impacted on both private producer and state procurement imperatives. The crucial mediating factor was the expanding breadth of military technological requirements, and their relatively narrow international distribution, concentrated primarily in the hands of the United States and its key strategic partners. Both firms and defense officials recognized that military technology was increasingly reliant on innovations generated within the private microelectronics and information technology industries. Furthermore, these industries were identified in intelligence assessments as a major weak point within the Soviet economy.[14] For defense officials, the conclusion was that this defense industrial advantage

[14]In a now-declassified 1980 National Intelligence Estimate, the US intelligence community identified micro-economics and computers as technological sectors in which the Soviet Union not only lagged the United States, but was anticipated to further lose ground in coming years. See Central Intelligence Agency (1980), p. 6.

rendered qualitative innovation an increasingly attractive procurement response, because the barriers to Soviet emulation held out the prospects of the US securing sustained military advantage. Conversely, for private producers, innovation offered a path both to subsidizing further dual-use research into these sectors, and sustaining their more military-focused specialized systems integration capabilities. The result was convergent interests in renewed military technological innovation in response to the Soviet military challenge.

How did US advantages in emerging technologies shape weapons procurement priorities in Washington? US officials and intelligence analysts recognized that the concentration of micro-electronics and information technologies in the hands of the US and its allies could allow for the development of military applications that would pose emulation challenges for the Soviet Union.[15] Andrew Marshall, a RAND analyst and soon-to-be head of the Department of Defense's influential Office of Net Assessments, noted in 1972 that while the Soviet Union had invested vast resources in upgrading the qualitative sophistication of its armed forces since the Second World War, it had done so from a low base.[16] Subsequent US National Intelligence Estimates conducted from the late 1970s through the early 1980s noted that while the Soviet Union had made substantial technological progress in some areas, it was likely still losing ground with respect to particularly novel technologies that involved the integration of a wide range of sub-component technologies, epitomized by micro-electronics.[17] This illustrates the particular challenge of emulation under conditions of high technology, an issue recently explored by Andrea and Mauro Gilli.[18] In particular, advances in technologies epitomized by the information revolution increased the breadth of technologies that a producer has to master in order to develop a weapon system.

[15]Becker (1981).
[16]Marshall (1972).
[17]Central Intelligence Agency (1980), pp. 5-6.
[18]Gilli and Gilli (2019).

This assessment of the challenge of emulation influenced US officials' support for a qualitative military build-up through the late 1970s and into the 1980s, dubbed the "second offset strategy." Like its predecessor in the 1950s, this strategy sought to set enduring US advantages in qualitative innovation against Soviet massed forces. This time, however, the focus was on leveraging the United States' edge in developing and integrating precision-guidance, long-range sensing, and network communications technologies derived from the micro-electronics revolution.[19] This concept traced its proximate heritage through the 1975 Long Range Research and Development Planning Program, later developed into the Defense Advanced Research Projects Agency's *Assault Breaker* program in 1978, and shepherded by Secretary of Defense Harold Brown, and Under Secretary William Perry in the Carter Administration.[20] In these technology development programs, Brown, Perry, Marshall and other senior US officials saw the opportunity to develop a new competitive strategy of "cost imposition", in which the United States sought to leverage its particular advantages in integrating a diverse range of technologies as a barrier to emulation to force Moscow to engage in an increasingly costly process of counter-innovation.[21]

Similarly, private producers also saw advantage in promoting qualitative innovation. However, their focus was not on relative military advantage, but rather the opportunity to subsidize their research and development capacity. Despite the growing leadership of the private sector in the development of micro-electronics, the US federal government continued to underwrite seventy percent of research and development spending through the 1980s, three-quarters of which was military related.[22] This funding facilitated more than just advances in military technology. US government research and development resources also allowed private producers to commercialize

[19]See Tomes (2009), p. 158; Atta et al. (2003), S-2.
[20]Atta et al. (2003), S-2.
[21]Ekman (2014).
[22]Markusen et al. (1991), p. 33

the benefits of specific advances in component technologies in the civilian economy, allowing military innovation to spill-over to their wider productive capacities.[23]

Amid innovation and the expanding breadth of military-required technologies, military systems integration took on increasing significance. Those producers that had developed and maintained capacity to absorb developments across the breadth of emerging technologies, and to integrate them with specific military requirements in to weapons systems, were much more invested in the military market than individual dual-use component manufacturers to whom they increasingly subcontracted specific elements of projects. This gave system integrators an additional interest in sustaining US government investment in qualitative military innovation that would utilize their specialist capabilities to deliver force structure recapitalization. In this, producers were responding to the "follow-on imperative", originally identified by James Kurth: sustaining the long-term capacity for the systems integration of technologies into weapons systems required ongoing procurement to maintain supply, rather than to address specific strategic demands.[24] Kurth has argued that the follow-on imperative drives continuity from existing product lines to future procurement:

> the disruption of the production line will be least and the efficiency of the product would seem highest if the new contract is structurally similar to the old, in the same functional category or production sector, i.e., is a follow-on contract.[25]

The salience of the follow-on imperative for firms reflected the fact that integrating an increasing range of diverse emerging micro-electronics and information technologies with legacy defense industrial technologies (in the shipbuilding, aviation, and other sectors) required specialized systems integration capacities, and investments in phys-

[23]Weiss (2014), pp. 39-40.
[24]Kurth (1972).
[25]Kurth (1972), p. 308.

ical and human capital. The maintenance of this capacity also required on-going and substantial flows of capital.[26] Of particular significance, those investments in military systems integration were now so specialized that the ability to re-tool these capacities for civilian production were limited. Thus, for defense producers as much as for the state, quantitative innovation was seen as necessary, though for very different reasons.

5.2.2 *Structural position and influence*

The convergence of these imperatives was reinforced by the structural dominance of the Department of Defense within the US defense industrial network. US government efforts to bolster the number of private defense producers from the Second World War onward saw a growth in the American defense industrial network that facilitated the central structural position of the US government, and which drove convergent efforts to define the United States' procurement agenda in response to the late Cold War challenge to Washington's strategic position in the world.

The fundamental shift in the scale of private participation in the US defense industrial network occurred at the point of transition between the Second World War and the Cold War, with the US government's strategic recognition of the importance of qualitative defense technological dominance, and the essential role of the private sector in fulfilling these requirements. During the Second World War, the state actively sought to support the transfer of specialized defense industrial knowledge and capacity to the private industry, in order to better leverage the latter's capacity for mass production.[27] This represented a significant readjustment from traditional US government reliance on public arsenals and shipyards to a persistent engagement with private contractors, a move with substantial long-term consequences.[28] In the wake

[26]Kaldor (1986), pp. 584-585.

[27]Regarding this and the expansion of non-governmental responsibility for innovation more broadly, see Lassman (2008), especially Chapter Two.

[28]In part this reflected the growing centrality of aerospace, which from its inception had been

of Second World War, the US government continued to actively foster a large pool of private contractors, expanding from a focus on production into research and development.[29] The result was the emergence of what Harvey Sapolsky termed "the contract state", which placed responsibility for development of weapon systems via the contract system on to private producers.[30]

Notably, while the defense industrial network expanded across this period, accompanied by the emergence of increasingly sophisticated systems engineering capabilities among private sector producers, it nonetheless remained only weakly integrated across major weapons system domains. As Ann Markusen and her co-authors argue, this facilitated the centralization of procurement coordination within the United States government.[31] This process was in turn linked to the increasing breadth of technologies required to produce advanced weapon systems. The expansion of military technology requirements necessitated firms to invest significant resources in specialized knowledge capabilities, while facing growing uncertainty regarding the cost and success of increasingly complex weapons development efforts.[32] This combination of cost and uncertainty necessitated new contract mechanisms (such as cost-plus contracts) to shield private producers from the full range of development risks, innovations which came at the cost of greater dependence on the state as the sole customer of the resulting weapons.[33] At the same time, this dependence was reinforced by the emergence of systems integration as a key challenge in weapons procurement.[34] As weapon systems became more functionally interdependent, the locus of procurement planning moved upwards, from the coordination of sub-components to the coordination of interacting

dominated by private producers. For an analysis of the evolution of the aviation sector from the periphery to the core of the US defense industrial network during World War II, see Holley (1989), in particular Chapters 2 and 14.

[29]See Converse (2005). See also Weiss (2014).

[30]Sapolsky (2004).

[31]Markusen et al. (1991), pp. 214-217.

[32]Peck and Scherer (1962), pp. 41-43. Spinney (1980).

[33]Sapolsky (2004), p. 23.

[34]Gilli and Gilli (2019), p. 151. See also Gholz (2004).

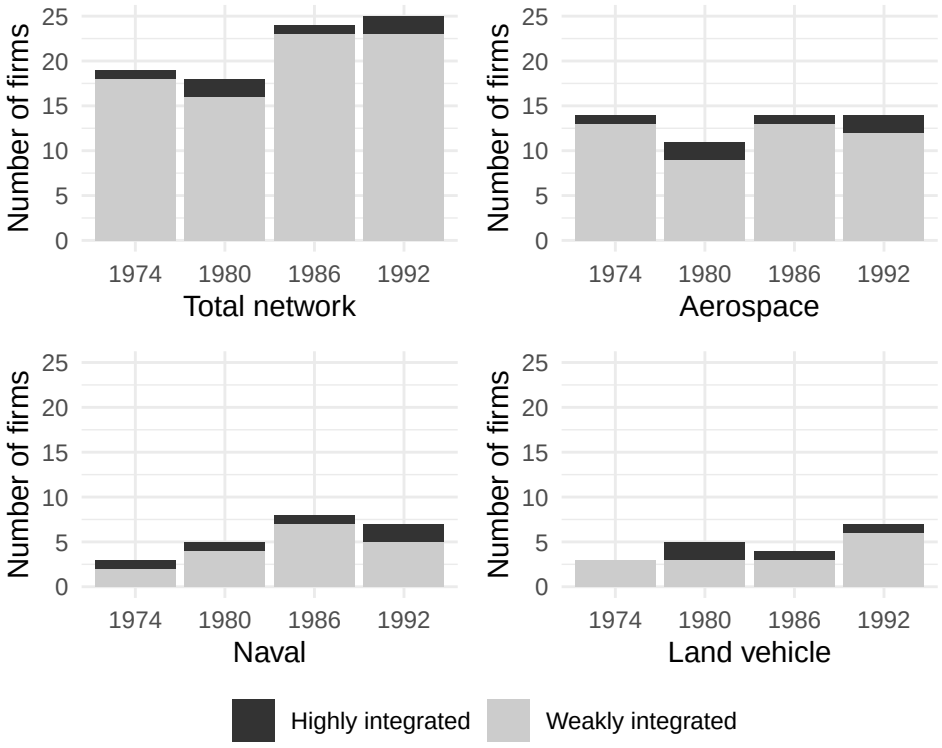

Figure 5.2: Number of US defense producers with active procurement contracts and their level of horizontal integration, 1974-1992 *Source: Hill (2016). Note: For the purpose of these analysis, 'highly integrated' is defined as serving procurement contracts across two or more weapon system domains. For specific details on this dataset, see Chapter 5 footnote 37.*

systems.

These dual pressures of broadening technological requirements and integration in turn supported the dominant position of the US defense bureaucracy within the defense industrial network. This period saw the creation of the Department of Defense, and specifically the Office of Secretary of Defense, as a key coordinating point in the gradual centralization of high-technology procurement efforts.[35] After 1958, the creation of the role of Director of Defense Research and Engineering within the Department of Defense further entrenched the centrality of the Department over procurement matters at the expense of the individual service branches. As a result, by the late 1970s weapons development and procurement had become a regularized, intimate process

[35]Converse (2005), p.31; Allison (1985), pp. 299-300.

coordinated by the Department of Defense, but conducted by private producers.[36] This reality was embodied and reproduced in the structure of the defense industrial network, and served to empower state procurement priorities. This can be seen in Figure 5.2, drawing on a US Procurement Dataset I have created of major US defense procurement projects from 1974 through 2010.[37]

5.2.3 *Qualitative Innovation and Strategic Advantage*

This ability to focus on qualitative innovation manifested the strength of US procurement capacity. The networked capabilities of the military platforms Washington deployed during the 1980s, and the communications and sensors that sustained them, resulted in a sharp improvement in relative US conventional military capacity as compared to the Soviet Union, which rued its inability to compete in an era of "military-technical revolution".

The swathe of weapon systems procured during the 1980s — defined by the development of precision guided munitions, and the supporting sensing, processing, and communications technologies that allowed them to be deployed in a robust and effective fashion on the battlefield — had their origin in a set of key innovations in advanced micro-electronics and information technologies.[38] When combined with wider changes in Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) technologies, they formed the material basis for

[36]For example, the Department of Defense's Independent Research and Development program supported the in-house research and development conducted by defense producers, and guided largely by their own priorities. See Reppy (1976).

[37]Hill (2016). In creating this dataset, I draw primarily on a 1993 Congressional Budgetary Office (CBO) collation of the total price and quantities of weapon systems procured by the US Government from Financial Year (FY) 1974 through 1994, drawn from original P-1 Department of Defense procurement budget documents. See Congressional Budgetary Office (1993). I have supplemented this with further public procurement data from P-1 documents for subsequent years FY 1995 through 2010. See Office of the Undersecretary of Defence (n.d.).

[38]Watts (2013b).

a deeper innovation in US doctrine during the Reagan Administration, the so-called "Air-Land Battle" operational concept.[39] It was also formally endorsed within NATO operational planning, forming the material substrate of the shift in NATO planning towards "Follow On Forces Attack."[40]

These technologies — and the weapons derived from them — were genuinely transformational, altering the operational balance in Europe and providing the United States and its allies with unparalleled capacity to see and strike opposing forces, and later giving rise to a heady narrative claiming a "Revolution in Military Affairs" (RMA).[41] They challenged the conceptualization of the relationships between key weapon systems, and hence the imperatives facing government buyers and private producers within the defense industrial network.[42] As a result, these technologies empowered actors within the defense industrial network to change the balance of weapons acquisition in favor of a generation of precision-guided conventional missiles and munitions.

Yet on another level, these technologies built on existing specialized military procurement competencies. The platform technologies into which they were integrated on represented iterative evolutions of established military systems. As a result, the armed services continued to draw on the US defense industrial network's established capacity to procure tanks, strike aircraft, and surface warships, though now with a new capacity to integrate novel sensing, targeting, and strike capabilities. In this sense, innovative technologies were integrated into existing production lines, responding to the needs of established defense industrial producers.

[39]Kurth (2013), pp. 73-74.

[40]Watts (2013b), pp. 6-8.

[41]For a discussion of the origins of the RMA narrative, see Kievit and Metz (1995).

[42]The industrial changes of coordination implied by this shift from a weapon system perspective to one centered on "systems of systems" echoed at a different level of analysis in the emergence of the concept of the weapon system itself: weapons were no longer seen "...an agglomerations of interchangeable parts assembled sequentially but rather as complex, fully integrated systems in which all constituent components were designed, built, maintained, and operated according to precise specifications and rigorous performance requirements." See (Lassman 2008), p. 70; (Gholz 2004).

It is very likely that the US generated substantial procurement capability advantages from its program of renewed qualitative military improvement inaugurated from the late 1970s onward. The key driver of this persistent advantage was the steep costs the Soviet Union faced in emulating US capability advances due to its lack of access to the technologies and industrial capabilities with respect of the emerging micro-electronics and information technology sectors. It seems likely that the perceived cost of matching the wide-ranging US program of qualitative military modernization was both a driver of the increased Soviet defense burden, and a motivation towards arms control that paved the way for a peaceful conclusion to the Cold War. The burden of matching the US procurement buildup of the 1980s was significant, and was particularly challenging for Moscow because of long-standing economic stagnation and institutional sclerosis.[43]

Scholars have acknowledged the role of the rising burden of military expenditure in the decline and dissolution of the Soviet Union.[44] Attention has focused on US strategic missile defense efforts as the primary driver of Soviet concerns regarding the qualitative inferiority of their weapon systems, and the costs of maintaining competitiveness with the United States. Certainly, de-classified CIA assessments indicate that Washington assessed that the Soviet Union faced significant military outlays to offset the Strategic Defense Initiative (SDI).[45] What was likely of even greater concern to Moscow was the comprehensive qualitative improvement in US conventional forces inaugurated by the RMA, which implied a requirement to raise the quality of Soviet conventional force structure and the skill levels of personnel that represented the larger proportion of Soviet defense expenditure. Observing the United States'

[43]Becker (1981); Harrison (2003); Central Intelligence Agency (2001a).

[44]Bluth (2010).

[45]As the CIA noted in 1987, "[F]or anything beyond a quite limited response, the Soviets' public claims that they could counter SDI quickly and cheaply probably understate the severity of the trade-offs they would have to make in responding to SDI". See Central Intelligence Agency (1987), p. v.

development of these technologies from the 1970s onward with some trepidation, Soviet analysts had arrived at the conclusion that innovation in new technologies had opened up the prospect of a "military technical revolution" (an equivalent term for what in Western circles was termed the RMA), in which precision-guided weapons assumed accuracy that allowed for destructive levels equivalent to low-yield nuclear weapons.[46] By 1987, Soviet Defense Minister Yazov used the venue of Warsaw Pact consultations to emphasize the emerging conventional military technical weaknesses of the Soviet Union and its satellites relative to the United States and its NATO partners.[47] At its heart, limitations on its access to advanced technological capabilities — now leveraged by the United States to drive qualitative innovation — was challenging Moscow's ability to maintain strategic parity. As Arthur Alexander contended in a contemporary report for the RAND Corporation commissioned by the US government,

> The advances in electronics, computerization, information, and miniturization since the 1970s have left Soviet military industry in a vulnerable position. The speed of change, the complexities of design, the integration of many different technologies and inputs from diverse sources, and the high precision and reliability needed in production strike at weak points of the Soviet economy, which are now affecting weapons acquisition.[48]

This understanding of the cost burden of qualitative military competition with the United States was likely also a driver of efforts to pursue arms control during the 1980s. Soviet scientists recognized that the qualitative shift in US defense procurement risked embroiling the Soviet Union in a costly and potentially destabilizing arms race, leading them to advocate strongly for arms control measures.[49]

[46] Watts (2013b), pp. 5-6.
[47] Bluth (2010), pp. 303-304.
[48] Alexander (1990), p. vii.
[49] Evangelista (1995), pp. 16-17.

5.3 *Implications for gatekeeper capacity*

The defense industrial implications of the strategic challenge posed by the relative expansion of Soviet military power was not limited solely to the US domestic defense industrial network. The effects of this challenge — and the US response to it — impacted on the second face of US defense industrial capacity: the United States' ability to leverage access to its defense industrial capabilities to support its wider strategic interests from the 1970s through to the end of the Cold War. In what follows, I provide systematic evidence of the correlation between US strategic and defense industrial relationships worldwide. I then explore the co-constitution of Washington's strategic and defense industrial relationships with Britain and Japan over this period. These results suggest two observations. First, Washington was able to consistently exploit its global defense industrial position to regulate and shape international flows of defense technologies in line with its strategic interests and relationships. Second, by embedding its foreign partners in defense industrial ties, the United States was over the long term able to shape their strategic orientation, binding them more closely in institutionalized security relationships.

5.3.1 *Structural position and the international distribution of technological and industrial capacity*

It was not only the Soviet Union that paid close attention to the military advantages generated by US qualitative innovations embodied in the RMA. The deployment of military systems-of-systems of unprecedented accuracy (and also complexity) created strong global demand for emulation.

However, as the Soviet Union also experienced to its chagrin, acquiring these technologies through domestic development and production came with a substantial price tag. The technical capacity to develop integrated C4ISR networks, and combining them

with precision guidance systems, was not easily emulated in the absence of broad technological capacities across a front that included not merely mature industrial technologies such as steel metallurgy, aviation, and petrochemicals, but also emerging technologies such as micro-electronics and information systems, from microchip design and fabrication, through to software development, satellite manufacturing, and space launch capabilities. While key US partners possessed cutting edge capabilities in several areas, few could hope to develop a comprehensive suite of advantages in all these critical new technological domains. Facing the significant costs of emulation, US allies, from Britain to Saudi Arabia, became intensely interested in acquiring access to the technologies that promised significant improvements in the precision and coordination of conventional military capability.[50] Beyond the circle of close US partners within the developed world, emulation was even more challenging. As a consequence of the breadth of technological requirements, Michael Brzoska and Peter Lock argue that the qualitative military-technical advantages of the Global North (and of the United States in particular) generated an increasingly insuperable barrier to convergence in the military capabilities of developed and developing countries.[51] As a result, the expanding frontiers of military technology appeared set to perpetuate and potentially extend a strong hierarchical pattern within the structure of global arms trading.[52] And in the context of the high technological barriers to emulation, the US government had the incentive to develop effective regulative capacities to manage external demand for US weapons.

[50]Gillespie (2006), pp. 133-134.
[51]Brzoska and Lock (1988).
[52]Neuman (1984).

5.3.2 *The United States' gatekeeper capacity consequences*

The United States not only benefited from its structural position within the global defense industrial network and its advantageous position in cutting edge technologies. It also sought to develop institutions governing foreign procurement to propagate its structural advantages further. A particular US focus was on propagating Rationalization, Standardization, and Interoperability (RSI) initiatives with its alliance partners. These initiatives attempted to define common standards across an array of key logistics inputs, from ammunition and transportation, to petrol, oil and lubricants and communications frequencies. Importantly, many of these standards (for example, communications and encryption protocols) were closed standards, details of which were strictly regulated and controlled to maintain security. Common but closed standards not only served to bolster the efficiency of joint operations; they also increased in value based on the number of other partners that utilized them. This represented a network effect.[53] Because these standards were closed, they tended to encourage the emergence of a few dominant standard setters. This is precisely the process that the US harnessed through its engagement in RSI with NATO and its International Standardization Agreements with other key partners.[54] They thus served to subtly bolster Washington's role as the preferred security partner to its defense industrial clients.

RSI within NATO was particularly successful in light of the United States' hegemonic arms provision position during the immediate post-war period. Active RSI efforts temporarily slowed through the 1960s and 1970s amid failed attempts at trans-Atlantic

[53] As noted in Chapter 2, the value of the technology associated with the standard is extrinsic to the standard itself, but is amplified by the range of partners that adopt it. See Zervos and Swann (2009), pp. 30-32.

[54] These include: the American, British, Canadian, and Australian Armies (ABCA); the Five Eyes Air Force Interoperability Council (AFIC); and the Australia, Canada, New Zealand, United Kingdom, and United States Naval C4 Organization (AUSCANNZUKUS). See Office of the Secretary of Defense (2020b).

cooperation, embodied by the XM-1 tank and ROLAND missile.[55] Nonetheless, these efforts gained renewed impetus from the late 1970s. Fearing the consequence of the United States being locked out of cartelized allied markets, Secretary of Defense James Schlesinger advanced the "two-way street" policy initiative, seeking to re-energize interoperability and mutual defense industrial cooperation through an emphasis on co-production programs.[56] The first major example was the F-16 co-production arrangement with a consortium of Denmark, Belgium, and the Netherlands. For its part, the Reagan Administration pursued further efforts to promote RSI, alongside supporting the expansion of the defense industrial base, and greater defense industrial integration with allies.[57] This was combined with a significant mobilization of private sector enthusiasm for defense globalization.[58] As Eugene Gholz contends, defense prime contractors played an important role as systems integrators in maintaining and extending technical standards that underpin interoperability, while coordinating with various contractors and subcontractors.[59] The advent of the Nunn Amendment to the 1986 Department of Defense Authorization Act crafted a common fund for supporting joint US-NATO co-development efforts, facilitating both access to the European market for US prime contractors, and favorable European engagement in defense industrial innovation.[60] The initiative sparked a flurry of cooperative agreements during the late 1980s, ranging from short range missiles to a proposed NATO frigate. Complementing this, was a sustained push to extend RSI efforts beyond NATO, to incorporate major US non-NATO allies such as Japan and Australia.[61]

[55]Taylor (1982), pp. 97-99.
[56]Kapstein (1991), pp. 664-665.
[57]Meagher (1991), p. 112; Vawter (1986), pp. 10-12.
[58]Bitzinger (1994), p. 182; S. G. Brooks (2007), loc 2661.
[59]Gholz (2004).
[60]Kapstein (1991), p. 669.
[61]Meagher (1991), p. 112.

5.3.3 *Evaluating the alignment of the US's security and defense industrial networks*

As with the previous two chapters, I begin my evaluation of the linkages between defense industrial and strategic dynamics by conducting a systematic assessment of the correlation in patterns of defense industrial and strategic relationships. Admittedly, such an analysis is not capable of providing clear insight into causality. I thus limit this initial inquiry to addressing one simple question: to what extent were Washington's transnational defense-industrial relations aligned with its security relationships across this period?

Structural analysis of the US defense industrial network and its relationship to US security commitments reveals a strong match, suggesting that strategic ties and arms trading were linked. As in the previous two chapters, I have used alliance commitments as a rough metric of strategic interests. Data for formal alliance commitments can be found in the Alliance Treaty Obligations and Provisions (ATOP) dataset produced by Leeds et al.[62] In order to assess US gatekeeper capacity, I draw on systematic data on US engagement in the global arms industry, in the form of time series data on the volume of global arms transfers contained within the Stockholm International Peace Research Institute (SIPRI) Arms Transfer Database. This dataset uses Trend Identifier Values (TIVs, estimates of the production costs of shipments) to track the overall quantity of armaments moving within the global defense industrial network.[63] I focus on the total quantity traded, and draw upon the total TIV values.

Data on the distribution of these two types of relationships - alliance and defense industrial ties — allows for the use of clustering, a social network technique discussed in previous chapters that partitions the network of states into groups based on the density of mutual ties. Such clusters should indicate emergent communities of shared

[62]Leeds et al. (2002).

[63]Note that these do not reflect the actual value of arms shipments, since SIPRI uses estimated costs of production rather than contract values. Furthermore, SIPRI data only captures transfers in weapons and primary components such as engines, weapons, radars. It does not capture second-tier and below sub-component flows. See Stockholm International Peace Research Institute (2015).

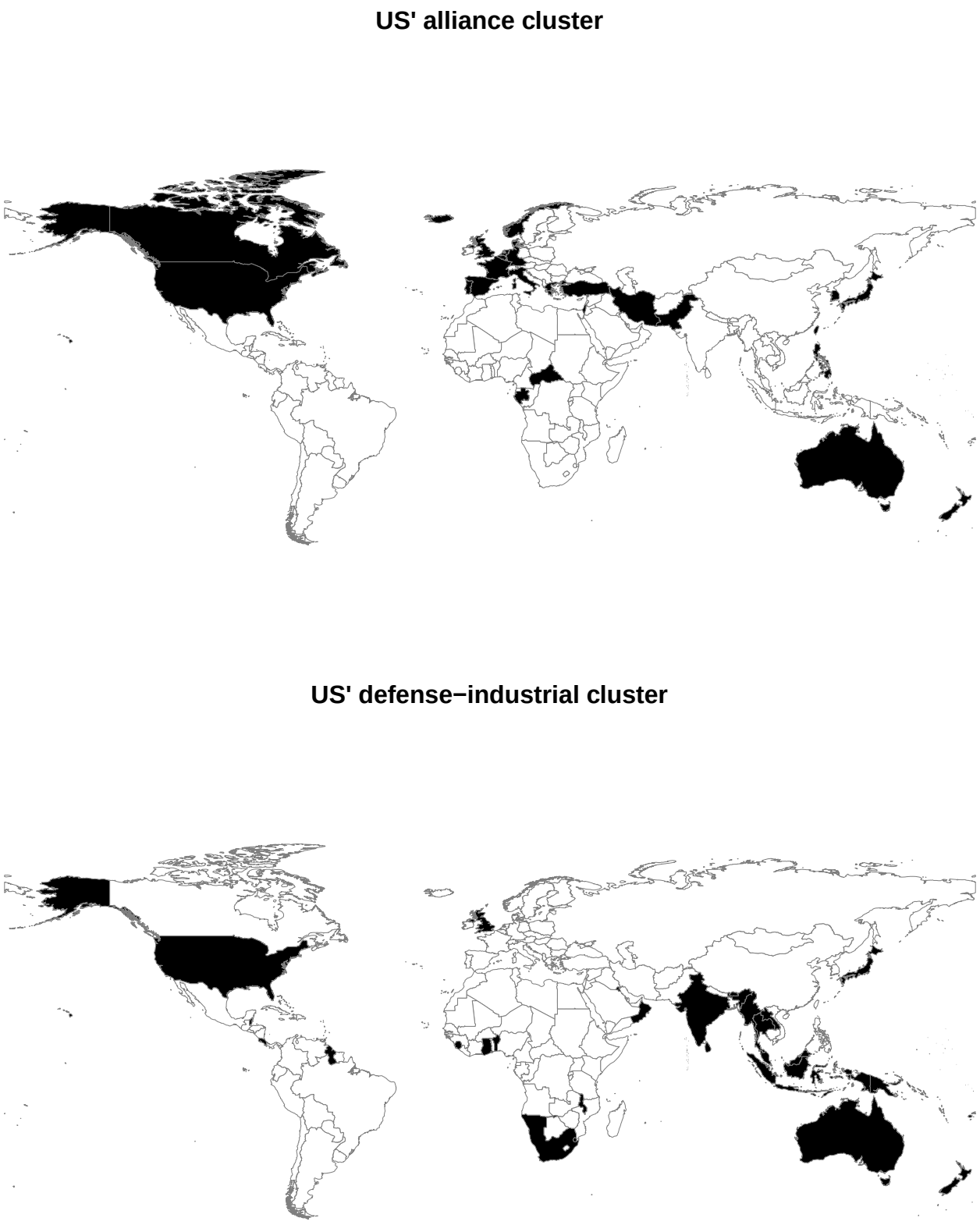

Figure 5.3: US position in international defense industrial versus military alliance blocs, 1979-1991.*Source: (Stockholm International Peace Research Institute 2015; Leeds et al. 2002.) Note: For clarity, figure only shows cluster affiliation with the US*

interests — strategic on the one hand, and defense industrial on the other. We would anticipate that these communities should prove tightly aligned. In the analysis that follows, I take the sum of interactions over the periods 1979-1991 to compare the clustering patterns for both defense industrial and alliance commitments.

Figure 5.3 suggests that alliance patterns and defense industrial relations do indeed share commonalities, but they are not isomorphic. In both cases, there is a clear cluster affiliated with the US-aligned grouping of capitalist democracies. Conversely, the cluster of defense industrial partners incorporating the United States, Japan and the United Kingdom, among others, is a subset of the broader Western strategic alliance. Overall, this structural clustering analysis suggests that US defense industrial and strategic relationships were significantly correlated at the global level. This in turn provides some circumstantial evidence in support of the contention that US gatekeeper capacity functioned to channel US defense industrial trade towards strategic partners of the Unite States, rather than its adversaries.[64]

5.4 *Case studies in gatekeeper capacity*

As in previous chapters, investigation of the causal relationship between defense industrial ties and strategic interests requires a pivot to qualitative case study analysis. The case studies of the United States' relationship with the United Kingdom and Japan underscores a similar logic at play: in both cases, a search for either strategic or defense industrial autonomy, in the context of US gatekeeper capacity and military capability, encouraged a doubling down on the wider bilateral relationship. The result was that defense industrial ties functioned as an important element in further institutionalizing US strategic partnerships from the late Cold War onward.

[64] I note here the contrast with the British experience prior to the First World War, covered in Chapters 3 and 4.

5.4.1 *UK-US relations*

The United Kingdom ended the Second World War with the second largest defense industry in the capitalist world. As a member of the 'Big Three' triad of wartime allies, Britain was perceived by Whitehall decision-makers as a global strategic player, a role which they anticipated continuing into the post-war era. Indeed, during the 1950s and early 1960s, London paid heavily to retain the military trappings of a great power, sustained by a diverse domestic defense industrial network.

Yet Britain did not pursue the procurement of a cutting-edge force structure merely to sustain its identity. For Whitehall leaders, maintaining an advanced military was also a crucial means of bolstering strategic relations with the United States, upon which London's security ultimately rested. Britain perceived a connection between its force structure decisions and its broader interest in ongoing security support from Washington. By demonstrating loyalty and usefulness on the global stage, Britain sought to reinforce the bonds of alliance that ultimately underpinned its security in the face of an increasingly activist Soviet presence in Europe.[65] However, as the breadth and depth of military technology requirements continued to advance through the late Cold War, Britain's ability to afford an advanced military structure increasingly required it to deepen defense industrial ties abroad, particularly with the United States. For its part, Washington explicitly harnessed its gatekeeper capacity to largely reinforce London's orientation, supporting Britain's defense industrial efforts to maintain maximal capability, consequently reinforcing US strategic interests in Europe.[66]

By the late 1970s, Britain's efforts to retain a diversified domestic defense industrial base was facing the dual challenges of fiscal overstretch stemming from its efforts to maintain a top tier global military and increasingly sclerotic industrial productivity.[67] This was most obvious in the shipbuilding sector, which had seen the virtual collapse

[65]Freedman (1999), pp. 32-36.
[66]Ball (2002), p. 81.
[67]Peden (2007), p. 315.

of civilian competitiveness and consequently an accelerating over-capacity problem as too many firms attempted to rely on limited Admiralty contracts.[68] However, it was equally apparent that British competitiveness in aviation was also declining, at a time when too many companies appeared to chase too few resources. The problem ultimately centered on rising unit production costs, driven by the increasing burden of development — a product of the increasing diversity of military technological requirements which necessitated investment in maintaining extensive technical competencies to facilitate systems integration. As development costs continued to escalate for many systems, London faced hard limits of affordability. The result was a wave of consolidation, culminating in the passing of the Aircraft and Shipbuilding Industries Act in 1977 which saw the vast majority of Britain's shipbuilders and aeronautics firms consolidated into two nationalized groups: British Shipbuilders and British Aerospace. However, while supply side consolidation served to rationalize Britain's defense industrial capacity, it did not serve to reduce the salience of cost pressures. Facing increasing costs, Britain was forced to lean ever more heavily on an increasingly asymmetric trans-Atlantic special relationship in order to sustain the material substrate of its global influence.[69]

This contributed to a growing sense of political dependence on Washington.[70] To dilute this, Britain attempted to increase its defense industrial ties with Europe.[71] Increasing participation in joint development/production contracts in Europe allowed

[68]Faltas (1986), pp. 203-206.

[69]Indeed, the Plowden Committee had observed in the late 1960s that the US-UK defense industrial relationship could hardly be termed a partnership. "The United States, unlike Britain, has no over-riding need for a partnership in aircraft development and production. Partnerships occur between those for whom they satisfy needs which are held in common. United States governments have not been disposed to rely on other countries for the development of any of their major military aircraft or guided weapons. The technical resources of the American industry can meet all the country's main needs and the domestic demand alone for an aircraft or weapon is normally large enough to make production economic." Plowden et al. (1965), p. 44.

[70]Priest (2006), pp. 140-141.

[71]See Baylis (1985). As Kapstein notes "collaboration... emerged as the principal European response to the dual problem of rising weapons costs and ensuring the maintenance of some national defense capabilities in the face of US competition and technical superiority." Kapstein (1991), p. 663.

London to offset to a degree deepening ties with the United States, while gaining access to a wider range of cutting edge weapon systems.[72] In aerospace, Europe, and particularly France, appeared to offer the best prospects for engaging in shared efforts to spread the rising costs of weapon systems.[73] Ultimately, however, disappointing results — a consequence of the politically fragmented and unstable nature of Continental defense industrial coordination — undermined the nascent pivot to Europe. In particular, the defection of France from key co-development arrangements (most notably the Anglo-French Variable Geometry fighter) contributed to growing British skepticism of the universal value of cooperation with its European partners. The problem, as London grasped it, was essentially one of the governance of a nascent transnational defense industrial network. Efficient co-development required mutual specialization, but this also required tolerating asset specificities in both institutions and technologies that could increase the risk of mutual defection.[74] Solving these issues required a dominant authority to govern exchange and provide a focal point for technological coordination; in its absence, British and European defense industrial projects proceeded on the basis of significant duplication.[75] This was epitomized by the Panavia Tornado (and subsequently, the Eurofighter Typhoon), which featured multiple production lines and duplication of key technology competencies. The result was the trans-nationalization of the defense industrial network between Britain and Europe, but with few significant efficiency gains.[76]

Amid the challenges posed by deeper defense industrial cooperation with Europe, advances in military technological requirements centered on the information revolution further encouraged Britain to seek efficiencies at the cost of deeper defense

[72]Office of Technology Assessment (1990), p. 56.
[73]Plowden et al. (1965), pp. 46-48.
[74]DeVore (2011), pp. 634-636.
[75]This echoes Hartley's argument regarding the limits of defense industrial specialization even in the face of mutual security commitments. See Hartley (2006).
[76]DeVore (2011), pp. 657-658.

industrial reliance on the United States. The emergence of electronically integrated C4ISR systems-of-systems in the United States posed dueling imperatives for Britain: maintaining the technological cutting edge in order to sustain interoperability with US forces, and procuring the technology to do so domestically. These innovations increased London's appreciation of America's enduring structural advantages as a defense industrial partner, bolstering the attractiveness of cooperation with the United States. While Britain recognized it was the junior partner in these engagements, this paradoxically generated a degree of trust from the US side: Washington was less likely to be wary of British defection from cooperation, since it could easily bear the burden of filling any gaps in defense procurement unilaterally if needed. As a result, Britain's defense industrial course during the late Cold War came to increasingly rely on developing and exploiting opportunities for exchange, particularly with the United States, in order to fill in key technological gaps.[77]

This trade-off was most evident in the evolution of the United Kingdom's seaborne nuclear deterrent. The missile technology was entirely sourced from the US Navy, and was structured in a fashion that heightened the strategic trade-offs in London's respective strategic orientations towards Europe and United States. This asymmetry only deepened following the deployment of the Polaris missile system, Britain's mainstay through 1970s and 80s, for which the United Kingdom was entirely reliant on the United States for technical expertise.[78] This defense industrial dependence — particularly as it pertained to the British nuclear deterrence — also became an important lever by which Washington sought to curb London's ongoing efforts to reduce its global military commitments.[79] Of course, interdependence had its advantages, most

[77] James (2000), p. 114. In the process of deeper defense industrial integration with the United States, Britain also gained access to key emerging technologies with significant strategic effects, including precision guided munitions that were to provide a key advantage during the Falklands War with Argentina. See Gillespie (2006), pp. 132-133. See also Uttley (2001).

[78] Priest (2005).

[79] Robb (2011).

clearly in the rationalization of research and development costs. Following the Polaris agreement, the proportion of the UK budget devoted to facilitating its nuclear deterrence fell from 10% to 5%.[80] The UK special relationship allowed it to gain access to the Trident II Submarine Launched Ballistic Missile for only a fraction contribution to its development cost ($116 million, or 5% of total development costs).[81]

The Thatcher era built on these foundations to substantially re-orientate the structure and international orientation of the UK defense industry. Large scale privatization led to the withdrawal of the British government from an ownership role within the defense industrial network.[82] This was paralleled by a radical shift away from a British-centric defense industry to one that was globally oriented. From favoring autonomy through self-reliance, Britain shifted to the pursuit of independence through diversified interdependence. In this respect, Britain's approach compared favorably to that of France, whose quest for autonomy saddled it with a substantial fiscal liability.[83] This process also saw Britain increase its engagement with transnational sub-contracting. By 1990, even those systems that were still built as British national products nonetheless contained on average 25% foreign components.[84]

With the end of the Cold War, Britain faced the same challenge as its Continental partners: how to deal with the sudden absolute and relative decline of European defense spending, and the dearth of new joint project opportunities on the continent. Like other domestic defense industrial networks around the world, Britain responded by pivoting towards greater ties with its American counterpart. This was hardly pre-ordained. US defense consolidation was perceived as a threat, motivating defensive consolidation from UK defense companies, most notably the merger of British

[80]Peden (2007), pp. 327-328.
[81]Marsh and Baylis (2006), p. 178.
[82]James (2000), p. 106.
[83]Taylor (1990), pp. 61-62.
[84]Taylor (1990), p. 65.

Aerospace and Marconi to form BAE Systems.[85] But deeper engagement with the United States was incentivized by the established structural complementarities between the two systems, bolstered by the integrating strategic institutions forged during a half century of defense coordination. It also reflected the depth of engagement already pursued by British firms. The reality was that the most significant defense market for the types of complex military products produced by the British defense industry remained the United States, though the ability of British firms to directly export was still limited.[86] As a result, the British government offered encouragement to UK firms to pursue foreign direct investment, with many gaining stakes in smaller US producers. The effect was to more closely bind their fates — and by extension, the fate of Britain's independent defense industrial capability — to even closer strategic alignment with Washington.

5.4.2 *Japan-US relations*

Defense industrial ties were an integral element of the wider strategic relationship between the United States and Japan during the Cold War.[87] Setting a pattern that would characterize the trajectory of Japanese defense industrial affairs during this period, the United States exerted a crucial role in rebuilding Japan as an East Asian defense production hub after the Second World War. This process was shaped fundamentally by Japan's unique postwar circumstances, particularly its "Peace Constitution" that constrained its development of military power, and subsequently in the fiscal limits it imposed on defense spending, and the restrictions on military exports. These circumstances led Tokyo to adopt a procurement orientation centered on defense industrial autonomy, or *kokusanka*, which embodied an assessment "that

[85] Reppy (2000a), p. 7; James (2000), p. 102.

[86] This future had been identified presciently by the Plowden Committee. See Plowden et al. (1965), p. 45.

[87] Chinworth (1998).

national security is enhanced as much by the ability to design and to produce as by the actual deployment of sophisticated equipment."[88] Paradoxically, Japan's efforts to leverage US military industrial assistance to advance this goal ultimately drove closer strategic ties and dependence on Washington's military capabilities to compensate for Japan's inability to afford a large scale force structure.[89]

Following the economic devastation and political shock imposed by the conclusion of the Second World War, Japan began its journey to rebuild its defense industrial capacity. This process was shaped by the interplay of two major forces. On the one hand, political reconstruction of Japan had been premised on significant constraints on Tokyo's future ability to emerge as an independent military power in the Western Pacific. Article Nine of Japan's 1947 Constitution banned Tokyo from developing "war potential", though this was interpreted to allow for the creation of self-defense forces.[90] However, the structure of these forces was strongly tethered to a limited, localized defense mission focused on Japan's territorial integrity and the security of its immediate maritime area.[91] The second major factor shaping Japan's pursuit of defense industrial capacity was the dominant presence of the United States as both a security provider and as an armaments supplier. In the initial post-war period, Japanese firms sought first to undertake licensed production of weapons from US producers in order to gain access to technology and production experience, then to transition to domestic production.[92] To achieve consensus with government actors, *kokusanka* was framed as an important element in facilitating the development of broader Japanese capabilities with respect to technology. It thus became a key element of the country's wider techno-nationalist agenda.[93]

[88]Samuels (1991), p. 48.
[89]Green (1995), Chapters 1-2.
[90]Samuels (1991), pp. 51-54.
[91]Chai (1997), p. 399.
[92]Chinworth (1998).
[93]Samuels (1996); Bitzinger (2015).

Military technology changes from the late 1970s interacted with these domestic and international conditions to channel Japan's pursuit of *kokusanka* towards deeper defense industrial and security integration with the United States and its Western allies. The emergence of the RMA signaled a qualitative shift in military technology, fueled by systems integration of a wider range of sensing, communicating, targeting and guidance component technologies that built upon wider micro-electronics and information technology advances. On the one hand, the salience of new component technologies played to Japan's advantage as it moved towards the leading edge of global technological and industrial capacity. At the same time, however, integration of these technologies relied increasingly on developing and sustaining a breadth of competencies in systems integration adapted towards more specialized military requirements.

This had implications for the imperatives facing key actors within the Japanese defense industrial network with respect to the desirability of pursuing domestic autonomy versus external reliance. As the breadth and depth of technological investments required for military-focused systems engineering increased, the prospects for spin-off from these activities into the civilian sector decreased, deepening the reliance of major Japanese defense producers on state procurement. At the same time political constraints imposed by Japan's peace constitution were reinforced by the emergence of informal — but politically powerful — constraints on Japanese military spending from the 1970s onward, effectively capped at 1% of Gross Domestic Product, constraining the scale of the domestic military procurement market. In response, Japanese defense firms prioritized producing discrete dual-use components and subsystems, as opposed to the development and maintenance of specialized military systems integration capacity.[94] The pursuit of defense industrial autonomy increasingly required specialization on the part of the limited Japanese defense industrial network, a development that

[94]Takahashi (2008), pp. 104-105; Lee (2003), p. 161.

was at odds with the producer focus on acquiring technologies that could be deployed on a greater scale within the civilian economy. Similarly, key public organizations, such as the Ministry of International Trade and Industry (MITI), now saw rising development costs for defense projects as detracting from, rather than complementary to, their core mission of supporting the development of the Japanese technology and industrial base.[95] Rather than engaging in the autonomous development of military projects, MITI instead advocated international cooperation and integration into transnational supply chains, exploiting dual-use possibilities and Japanese competencies at the sub-component level. In light of this, as Green argues, Japan's commitment towards autonomy was re-conceived in the mid-late 1970s, with an emphasis on R&D shifting to "... focus on strengthening Japan's technology 'trees' (specific subsystems that drew on commercial technologies) rather than focusing resources on technology 'forests' (new systems-level projects such as YS-11 or PXL)."[96]

This technological pressure away from autonomy was reinforced by the structural influence of the United States. The commercial opportunities offered by deeper integration into US defense industrial chains increasingly shaped producer priorities, and became visible in the political positioning surrounding the 1976 National Defense Program Outline. While initially inspired by Prime Minister Nakasone's desire to push forcefully for a much larger and autonomous Japanese Self Defense Force, it ultimately ended up as a more modest proposal to develop increased Japanese defense capability within the context of the US alliance.[97] This approach was driven not merely from above via the state, but from below through the interests of defense producers.

For firms and other actors, the rationality of autarky was undermined within Japan by the greater transnational opportunities perceived by Japanese defense produc-

[95]Lee (2003), pp. 159-160.
[96]Green (1995), p. 79.
[97]Corning (1989), p. 272.

ers within a US-centric defense industrial order, rather than against it. While they were unable to export full military systems, Japanese producers responded to these changes by increasingly engaging in international military production networks. Research sharing and development cooperation, as well as participation in US defense industrial projects, offered the prospect of ameliorating the growing burden of technological change. This was echoed by a broadening of the range of actors involved in the production of weapon systems away from traditional heavy industry players and towards microelectronic powerhouses such as Toshiba and Fujitsu.[98] At the same time, supporters of the US alliance within the Ministry of Foreign Affairs (MOFA) perceived defense industrial cooperation as a means of bolstering Japan's military capacity and contribution within the US alliance, thus gaining greater international latitude via its relations with Washington. By embedding themselves in ties with the United States, Japanese policymakers and defense producers saw themselves as gaining greater autonomy and influence over American policy within Asia.

Through the early 1980s, it became clear that the interaction of the political economic consequences of technological change within the Japanese defense industrial network with both domestic political constraints and wider external strategic conditions was facilitating a resurgence of US structural influence over choices made within the Japanese defense industrial network.[99] Ultimately, US gatekeeper capacity arising from the structural influence of American defense industrial choices resulted in the Japanese defense industrial network conceiving of its orientation as so deeply interdependent with Tokyo's concern for the maintenance of the US-Japan alliance that the pursuit of autonomy in the procurement realm was limited by the perceived negative spillover risks. In short, the resurgent salience of the alliance amid technological change underpinned inter-firm defense industrial ties; at the same time, those

[98]Green (1995), pp. 78-79.
[99]Green (1995), p. 4.

defense industrial ties created additional value for the alliance. Yet this symmetry of interdependence between procurement and security relations within Tokyo did not find an echo in the bilateral relationship with the United States itself. Rather, this relationship was characterized by persistent asymmetries, in which the salience of the US procurement and security sensitivities embedded into Tokyo's worldview was not matched by the salience of Japanese considerations in Washington's calculus.[100]

These dynamics were epitomized by Japan's efforts to develop future fighter aircraft, known as the FSX program. As Japan began to develop competencies that exceeded those of the United States in certain component technological areas, Washington saw advantage to be gained through greater access.[101] Indeed, in a contemporary observation of this dynamic, Michael Chinworth contended that "[i]t is not an exaggeration to assert that DoD is more committed to mutually beneficial cooperation with Japan than at any point in the post-war relationship."[102]

This clashed with Japanese expectations of continued unilateral technology transfer, and the development of autonomous capacity. There was some hope in Tokyo that Japanese expertise could be harnessed as a bargaining tool through which to access high-level US technological competencies. However, the structural asymmetries between the two parties guaranteed that Japan lacked the basis for effectively asserting its autonomy interests on par with those of Washington.

This became increasingly apparent as the United States grasped Tokyo's intention to utilize US technology as a basis to pursue a fully indigenous designed and built fighter aircraft.[103] Alerted by US firms who had been approached as consultants by Japanese prime contractors, the Pentagon began to mobilize sustained access pressure on Tokyo

[100]Green (1995), p. 87.
[101]Chinworth (1998).
[102]Chinworth (2000), p. 392.
[103]General Accounting Office (1982).

to increase the scope and weight of US involvement in the FSX project.[104] Advocacy of joint development was made both directly through the US Embassy, and indirectly through sympathetic institutions such as MOFA and elements of the Japan Defense Agency (JDA), who feared the impact of a *kokusanka*-related spat on the broader bilateral relationship. Indeed, intimations of the political consequences that would be attendant on full indigenization were clearly communicated by the Pentagon.[105] At the same time, the balance of interest within the US defense industrial network swung decisively in favor of US participation in the FSX program. General Dynamics argued that the agreement would provide valuable access to new technology, at the cost of distributing what was already a mature design.[106] This pressure on Japan, by both the US Government and American firms, served to encourage greater internationalization and cooperation with the Japanese aeronautical sector.[107]

Ultimately, the FSX program evolved into a compromise solution between Japanese heavy industrial system integrators and elements of the JDA longing for a fully autonomous Japanese defense industry, and a transnational coalition of US defense firms, Japanese sub-component manufacturers, American defense officials, and Japanese industrial planning bureaucrats. As a result, the FSX shifted from a notionally indigenous project to one that spliced Japanese technology onto an existing US fighter design, namely the F-16.[108] This approach was congruent with a broad techno-nationalist emphasis on achieving autonomy even at the cost of efficient production across the wider economy.[109] However, in the defense sector, the cost efficiency trade-off had a deeper, perverse strategic consequence. The pursuit of domestic autonomy cut against the grain of economies of scale, imposing relatively high unit costs that

[104]Green (1995), pp. 90-91.
[105]Green (1995), pp. 90-97; Alexander (1993), p. 31.
[106]Mastanduno (1991), p. 87.
[107]Lee (2003).
[108]Chinworth (2000), p. 386.
[109]Lee (2003), p. 145.

have driven a significant decrease in force structure size.[110] As a result of attempting to pursue domestic production integration for much of the FSX, the aircraft became the worst of both worlds, with the cost of the system ballooning to US $80 million per aircraft (in 2000 constant dollars), approximately twice the cost of the original F-16. The result was that Japan had less military capability for its fiscal investment than it would have under conditions of greater imports, and hence was forced to lean more heavily on the United States for strategic depth in capabilities. This outcome, however, was not problematic within the logic of the *kokusanka* trade-off, since it has served to facilitate the development and extensions of sub-system technological competencies that have benefited the wider civilian economy. Consequently, Tokyo's attempt to avoid defense industry dependence was conditioned by — and in turn, reinforced — overall strategic dependence on the United States.[111]

These dynamics were reinforced by the end of the Cold War. Japan, like other countries, saw the fall of the Soviet Union as an opportunity to take a peace dividend.[112] As a consequence, the Japanese defense industry faced heightened challenges regarding the affordability of indigenous procurement, and a greater incentive towards pursuing joint development and transnational integration.[113] The most obvious starting point for this cooperation was an extension of pervasive linkages into the US defense industrial network. By the 1990s, Japan saw itself as 5-10 years behind the United States in systems integration capacity, but at or near parity with respect to the complexity of component technologies.[114] This asymmetry encouraged the continued pursuit of defense industrial exchange and strategic integration between the two countries.

[110]Bitzinger (2015), pp. 466-467; Green (1995), p. 4.; Hughes (2011), p. 464.
[111]Green (1995), p. 5. The focus of the Japanese defense industry on sub-component excellence is congruent with Sakaguchi's broader argument that the US-Japan alliance has encouraged mutual specialization between Tokyo and Washington in the provision of strategic goods of value to both partners. See Sakaguchi (2004).
[112]Chinworth (2000).
[113]Green (1995), pp. 134-135.
[114]Green (1994), p. 3.

5.5 *Shifting strategic dynamics and the end of the Cold War*

From 1987 onward, US-Soviet tensions began to ebb. This was driven in large part by the ascension of Mikhail Gorbachev as General Secretary of the Communist Party of the Soviet Union, and his pursuit of domestic political opening and reform (a policy known as *glasnost*). At the same time, Gorbachev also pursued a reduction in international tensions with the United States. As was noted previously in this chapter, it is likely that the economic burden of responding to US military modernization was a factor linking Gorbachev's domestic and international policies.[115] In particular, through his economic policy of *perestroika*, Gorbachev sought to redirect resources from military to civilian production, a move that required reaching a *modus vivendi* with Washington.[116] However, while he was able to achieve historic arms control agreements with the Reagan Administration, Gorbachev was ultimately unable to contain the forces unleashed by his domestic reforms. The conclusion of the Cold War thus stemmed in large part from the internal ramifications of Soviet efforts to reform and adapt amid external military pressure.

The twilight phase of this decades-long struggle culminated in the withdrawal of the Soviet armed forces from Eastern Europe and the subsequent collapse of the Soviet regime, and marked a sudden end to the Soviet strategic challenge that characterized the Reagan era. As a result of the evaporation of Soviet power, the United States pursued a retrenchment in procurement expenditure that required a consolidation of the US defense industrial network, leading to a fundamental shift in the structure of the US defense industry.[117] The core issue the network faced was how to reconcile the maintenance of increasingly crucial — but specialized — private sector defense industrial systems integration capacity with reduced funding for development and

[115] Watts (2013b), p. 8.
[116] Alexander (1990), pp. v-vi.
[117] Shiman (2005), p. 283; Office of Technology Assessment (1991), p. vi. See also Russett, Hartley, and Murray (1994).

procurement. Effectively, the growth of the defense industry had outstripped the appropriate peacetime scale, leading to a deep mismatch between producer and customer requirements. The US government's chosen response to this mismatch was to undertake significant defense industrial reform.[118] Proposed under the watch of the Clinton Administration, the key element of this reform was state-sponsored but private-led industrial consolidation. These defense industrial reforms were articulated in the first instance by US Department of Defense officials. John Deutch, who served as Undersecretary of Defense for Science and Technology in the Clinton Administration, described the concerns motivating Pentagon thus:

> If assets were not reduced, smaller defense budgets would mean unit costs would rise, inevitably placing downward pressure on profit margins available to industry. If returns on capital declined, defense aerospace companies essential to a strong defense infrastructure would be in trouble, and this was not in the interest of the nation, DoD, or stockholders. The policy intent was to encourage the companies, through normal capital market mechanisms, to make rational business decisions that would result in fewer assets devoted to defense.[119]

Federal government pressure for industry consolidation escalated through the 1990s.[120] At a dinner for defense industrial executives — quickly labeled the "Last Supper" by political wags — US Secretary of Defense William Perry signaled that the US government did not envisage future procurement on a scale capable of sustaining the industry at its current size.[121]

Thus, while the proximate impetus for structural consolidation in the US defense industry lay with budgetary and procurement choices made by the US government,

[118] Markusen (2000), p. 28.
[119] Deutch (2001), pp. 138-139.
[120] Shiman (2005), p. 301.
[121] Sapolsky and Gholz (1999).

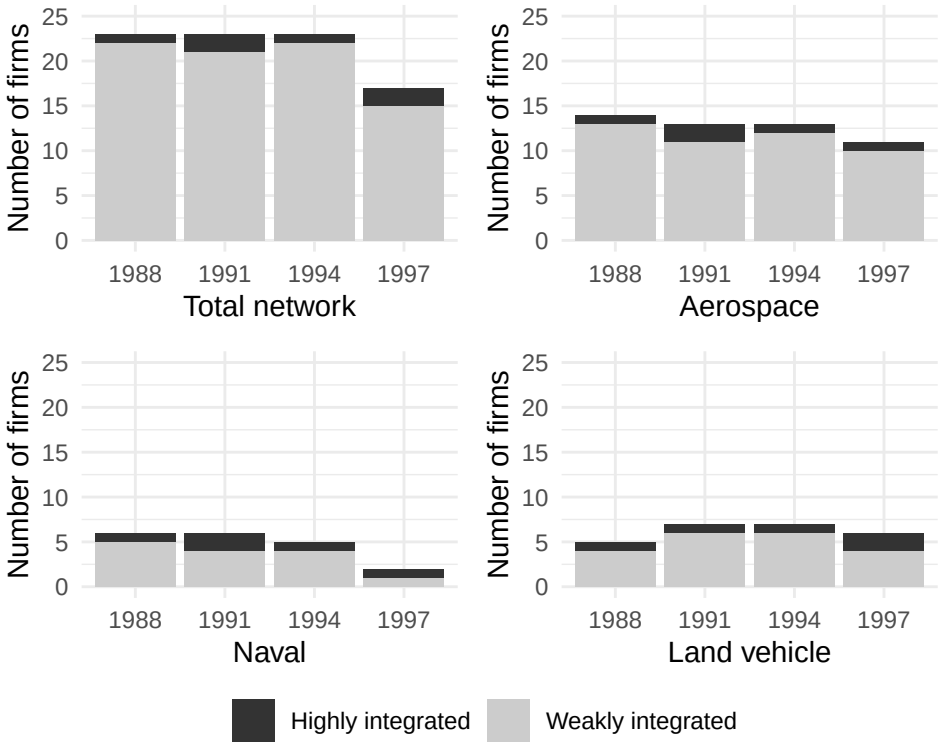

Figure 5.4: Number of US defense producers with active procurement contracts and their level of horizontal integration, 1988-1997 *Source: Hill (2016). Note: For the purpose of these analysis, 'highly integrated' is defined as serving procurement contracts across two or more weapon system domains. For specific details on this dataset, see Chapter 5 footnote 37.*

the realization of these structural changes and their particular focus was placed in the hands of established private producers. Facing the reality of a sharp decline in military expenditure, these producers pursued consolidation and horizontal integration as a means of survival. Between 1989 and 1996, employment in the US defense industry declined by 39%, from 1.33 million to 0.806 million.[122]

The effects on the structure of the US defense industrial network were two-fold. First, the US defense industrial network experienced a sudden, deep rationalization of the number of prime contractors. This dynamic is illustrated in Figure 5.4. While the number of prime contractors had increased from 1974 through till 1990, it dropped precipitously during the following years, reaching its nadir in the early 21st century.[123]

[122]Weidenbaum (1997), p. 5.

[123]This of course contradicted the expectations of policy-makers in the late 1980s, who anticipated the level of structural competition to persist: "[s]tatistics indicate that competition may have quanti-

Expanding procurement budgets had obscured the rising development cost pressures that had steadily picked up from the 1970s onward, and the collapse in defense spending brought them painfully to the fore.[124]

A second element of this process was a further rapid shift into horizontal integration across weapon system domains. After 1990, the number of firms focused solely on development and procurement within only a single weapon system domain declined significantly. While such firms remained a majority of all participants in the late 1990s, the number of firms engaged in two or more sectors had grown substantially. This serves to reconcile the broader changes across the defense industrial network with those occurring within specific sub-sectors: the number of producers overall fell sharply, largely through absorption of rivals and expansion into other weapon system domains. Overall, this improved the structural position of private producers vis-à-vis public buyers: firms now became less exposed to changes in single production lines or procurement decisions with respect to single technologies, and thus were less vulnerable to the monoposonist powers of the US armed services.

5.6 *Conclusion*

As this chapter has demonstrated, US defense industrial capacity in the late 20th century differed substantially from that of Great Britain almost a hundred years earlier. The US government's advantageous structural position vis-à-vis private producers provided it with an edge in influencing the course of procurement dynamics in reaction to the threat posed by Soviet military power, just as the Admiralty's privileged position had enabled it to assert its imperatives in the late 1880s. However, the distinctive feature of the American experience was the presence of a significant advantage

tatively reached the highest level achievable and can be expected to remain at that level." (Fuhrman 1988), p. 31.

[124]Flamm (2000), pp. 52-53.

in the distribution of access to key military-relevant micro-electronics and information technologies. This advantage — and its impact on the prospects of military technical diffusion — influenced the US government's orientation towards qualitative innovation.

It also shaped its engagement with defense industrial exports. The increasing breadth of key military technology requirements upon which qualitative innovation rested raised the prospect — and hence motivated the practice — of controlling the diffusion of military technologies, allowing the United States to selectively bolster the capabilities of key foreign partners such as Japan and the United Kingdom, and also to bind them into closer strategic partnerships that altered their assessment of their security interests, and hence a willingness to trade autonomy for military capability and security.

As we will see in Chapter 6, these dynamics did not fade with the end of the Cold War but were altered by the empowerment of US private producers as a consequence of the structural reorganization of the US defense industrial network that followed the post-crisis procurement drawdown.

CHAPTER 6

FIRMS SHAPE THE AGENDA: THE UNITED STATES, 2002-2010

> *The future challenge to the technology and industrial base is not just how to maintain the capability to produce the forces we have developed in the past, but also how to continue developing the weapons of the future* - Office of Technology Assessment, US Congress.[1]

In a post-Cold War environment characterized by apparently unparalleled US global military dominance, the September 11 2001 terrorist attacks presented a profound challenge to the United States' strategic interests. Washington's subsequent decision to respond by engaging in a worldwide counter-terrorism campaign metastasized into two extended wars in Afghanistan and Iraq, and entailed a substantial increase in defense procurement.

From the perspective of national security requirements alone, it would be expected that increased procurement would be orientated towards shifting force structure composition in line with the nature of the specific challenge to Washington's interests. This would suggest a focus on acquiring the light infantry forces and high-mobility aviation necessary to sustain a rapidly deployable expeditionary force structure, in the face of a trend towards low intensity 'brush-fire' conflicts. Yet this is not what occurred. While Washington did eventually utilize part of the procurement boon generated by the security challenge posed by al Qaeda to expand its force structure to better accommodate counter-insurgency operations, the majority of this expansion was channeled through — and reinforced — the continued procurement of qualitatively sophisticated assets adapted for interstate conflict.

[1] Office of Technology Assessment (1991), p. 11.

What explains this qualitative procurement response, adapted to state-level security challenges, when the proximate challenge to the United States emanated from transnational or sub-national actors? I argue that this reflects the structure of the US defense industrial network, in the context of broad and deep military technological requirements that entrenched US defense industrial advantages. The specific nature of the post-9/11 security challenge — an opponent with limited access to advanced technology, pursuing terrorism and insurgency — should have encouraged the US defense bureaucracy to respond through a quantitative expansion of US Army and US Marine Corp directed at supporting counter-terrorism and counter-insurgency operations. US defense producers however, with substantial investments in specialized military systems integration capacity, and with little ability to pivot to alternative civilian markets, were particularly subject to the "follow-on imperative", the need for renewed procurement of advanced military technologies.

Weighing in the balance of this disjunction between the nature of thesecurity challenge to US interests and the character of the procurement response was the weaker structural position of the federal government within the US defense industrial network. Following the post-Cold War consolidation of the network, the US defense bureaucracy faced fewer and more politically influential defense producers. These producers were better able to shape the procurement agenda in favor of a continued emphasis on qualitative defense transformation. The ultimate result was that while US defense procurement expanded to address a retooling towards counter-terrorism and counter-insurgency, it also served to cover a substantial qualitative recapitalization of US assets in other domains, including multi-role 5th Generation fighter aircraft such as the F-35, and preparation for a new class of nuclear-powered supercarriers. This procurement pivot was facilitated bureaucratically and politically by the fact that the breadth and depth of military technological requirements meant that this qualitative procurement focus did have positive, albeit secondary, security benefits,

by bolstering US international military power relative to rising and resurgent powers such as China and Russia.

The strategic challenge posed by transnational terrorism, and the subsequent US procurement reaction, had flow on implications for US gatekeeper capacity, some of which parallel the experience of the United States during the 1980s build-up. Despite initially leading to a reprogramming of defense production from exports to domestic sales, the US Government's push for qualitatively advanced military capabilities under conditions of burgeoning military technological requirements ultimately served to reinforce its dominant structural position within the global defense industrial network. Because advanced US systems remained challenging to emulate due to persistent US advantages across a wide front of advanced technology sectors, Washington had the incentive — and the institutional capability — to shape the diffusion of those technologies in a controlled fashion. As a consequence, the United States was able to leverage foreign buy-in on advanced weapon systems (such as the development of the F-35) to strengthen its security ties with key partners such as the United Kingdom and Japan. Those parties in turn continued to deepen their security alignment with the United States, redounding to the benefit of Washington's wider strategic interests.

6.1 *9/11 and the challenge to the US strategic environment*

The September 11 2001 attacks presented a direct and unexpected challenge to US national security, requiring a shift in strategic posture. Prior to the attacks, Washington's attention was firmly centered on maintaining US global military dominance, and leveraging it to proactively head off emerging state challenges.[2] Accompanying this was a commitment to upgrading US conventional forces in line with the late Cold War vision of achieving a Revolution in Military Affairs (RMA). This agenda —

[2]See Layne (2006), p. 12.

now identified as military transformation — would seek to harness ongoing advances in micro-electronics and information technology to deploy digital communications, advanced sensors, and precision guidance in the service of further improving US relative military capabilities. This imperative was itself shaped by the judgment that the United States had developed a uniquely successful weapons paradigm that, if reinforced, offered the prospect of sustained global military advantage.

As was noted in the previous chapter, the touchstone for this paradigm stretched back through the end of the Cold War. In late 1990, the United States faced an unexpected conventional military test in the Middle East, following the annexation of Kuwait by Iraq. In response to the sudden invasion, President George H. Bush ordered a full-scale deployment of forces to the region to coerce Iraqi President Saddam Hussein to the bargaining table. After an initial defensive effort, US and Allied forces went on the offensive. Operation Desert Storm was a rapid and decisive success, far exceeding the most optimistic assessments of military planners and external analysts.[3] US forces, armed with the fruits of the previous decades sustained investment in mobile, accurate, and increasingly interconnected weapon systems, were able to inflict lop-sided casualties on the Iraqi Army, and its elite Republican Guard.[4] In the glow of victory, many US commentators concluded that the conflict validated the RMA as a key enabler of US military power. In their view, novel weapon technologies marked a decisive break in the nature of war. Further enhancements in sensing, communicating, and targeting technologies promised an exponential increase in the lethality of a networked combat force. In the future, smaller, more agile US forces would be able to annihilate the older massed formations of adversaries from afar, exploiting technology to impose a fundamental asymmetry in the fog of war.[5]

This military technological advantage was to become increasingly central to US strate-

[3]Shimko (2010).
[4]Mahnken (2008), Chapter 5.
[5]Davis (2010).

gic planning from the late 1990s onward, as Washington became aware of the prospects of challenges to its unfettered global military access from rising regional powers, most notably the People's Republic of China (PRC).[6] Despite a flourishing bilateral economic relationship, US political and strategic assessments of China's intentions in Asia began to harden following the Tienanmen Square uprising in 1989. These were reinforced by the PRC's missile tests directed at intimidating the government on Taiwan in the lead up to the island's first democratic presidential election in 1996. These actions prompted Washington to deploy significant naval power into the Taiwan Strait, an event that likely underscored to Beijing its impotence in preventing US military power projection near its shores.[7] In the context of sustained rapid economic growth, the PRC increasingly had the resources to commence military modernization aimed at mitigating the challenge to its own strategic ambitions posed by regional US military dominance.[8] Subsequent events, including the US bombing of the PRC embassy in Sarajevo during the 1999 Kosovo War, stirred mutual distrust, and probably spurred further efforts at the military modernization of the People's Liberation Army (PLA).[9] As a result, the Bush Administration entered office in 2001 having publicly described the PRC as a "strategic competitor."[10] These concerns came to a head in April 2001, when a US EP-3 Aries surveillance aircraft collided with a PLA Air Force aircraft over the South China Sea near Hainan Island. While this crisis was averted through careful diplomacy, by mid-2001 the Bush Administration was preparing to double-down on defense procurement aimed squarely at a sustained contest with the PRC's rising military power.

It was in this context that Washington was confronted by an attack from an unexpected quarter: Al Qaeda, a transnational terrorist organization with limited re-

[6] See Jackson (2018).
[7] Heginbotham et al. (2015), p. 25.
[8] Ball (1993). See also Hartfiel and Job (2007).
[9] Carter and Bulkeley (2004).
[10] Gries (2005), pp. 401-402; Miller (2010), p. 50.

sources, harnessing commercial transport rather than advanced military technology to strike at civilian targets within the United States itself.[11] The attack shattered a long-standing assumption of conventional American strategic impunity: that the continental United States was not vulnerable to external attack short of global nuclear Armageddon.[12] And as a consequence it generated a rapid reorientation of US strategic priorities, with the announcement of a "global war on terror" focused on rooting out Al Qaeda and associated groups, and alleged state-backers. This shift in strategic focus carried with it the implication that the US military would undertake expeditionary operations to deny terrorist groups foreign sanctuary in countries such as Afghanistan, and eventually to destroy those groups as functional organizations capable of threatening the US homeland.[13] These new military demands in the face of the sudden emergence of a major new security threat thus served to galvanize procurement demands.

6.2 *Implications for procurement capacity*

Washington's procurement response to this security challenge was not, however, determined solely by the nature of the sub-state terrorist and insurgent opponents it now faced. The United States did ultimately prioritize the larger and more flexible infantry-centric ground force needed to effectively prosecute counter-insurgency and counter-terrorism operations, and increased procurement for rotary aviation and light ground forces through the 2000s accordingly. However, the procurement challenge of responding to sub-state and insurgent opponents following the September 11 attacks did not mean that investments were predominantly tailored to those impera-

[11]Subsequent public debate has dwelt on whether a partial intelligence picture existed of Al Qaeda's intentions and exploration of activities to strike at the United States. Nonetheless, these insights did not in themselves demonstrate that al Qaeda possessed the capability to directly threaten the continental United States. See Pillar (2006).

[12]Miller (2010), pp. 50-52.

[13]Record (2003).

tives. Throughout this period, the United States continued to prioritize the pursuit of high-technology defense transformation, including multiple classes of the new 5th generation of strike fighters (the F-22 and F-35), attack submarines, and initial proposals for modernization of the US nuclear triad, none of which can be argued as obvious responses to the pressing new security challenge that had ostensibly inspired the post-2001 wave of arms acquisition.

What then informed the focus of US defense procurement during this period? I argue that the US procurement response to the 9/11 attacks was conditioned by the increasingly consolidated structure of the American defense industrial network, against the backdrop of established US advantages in the broadening scope of military-relevant technologies. The improved structural position of producers empowered them to shape procurement priorities in favor of their underlying material interests in continued qualitative military transformation, despite the existence of established US advantages in conventional military power. The particular quantitative demands of counter-insurgency and counter-terrorism were ultimately addressed, but did not exert a dominant influence on the focus of the US procurement response.

6.2.1 *Structural position and influence*

The salient fact defining the US defense procurement network at the dawn of the 21st century was the increasing degree of defense industrial consolidation that had occurred in the wake of the Cold War (see Figure 6.1). This was to have significant implications for the structure of that network, ultimately impacting on US procurement capacity over the following decade.

The consensus among analysts is that post-Cold War US consolidation efforts failed to achieve their primary goal: the reduction of excessive production capacity relative

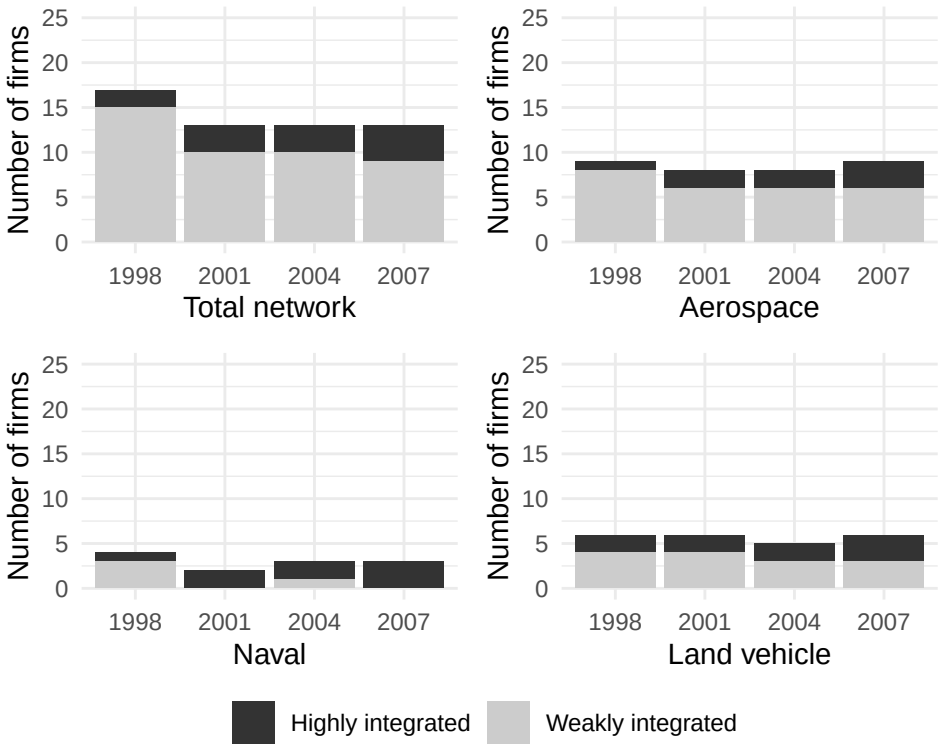

Figure 6.1: Number of US defense producers with active procurement contracts and their level of horizontal integration, 1998-2007 *Source: Hill (2016). Note: For the purpose of these analysis, 'highly integrated' is defined as serving procurement contracts across two or more weapon system domains. For specific details on this dataset, see Chapter 5 footnote 37.*

to declining demand.[14] Rather, costs were spread across weapons system domains. As the armed services and the Pentagon sought to reconcile procurement to appropriations, they cut back on the scale of production runs. As a result, per unit costs soared, prompting Congress to further curtail — and in many cases abandon — major weapons programs. This approach attracted further criticism, in particular due to the explicit financial incentives to consolidation offered by the Pentagon, which allowed firms to write off the costs of mergers against existing procurement contracts.[15]

The process of consolidation was initially only haphazardly directed by the Pentagon, to the detriment of its interests. The immediate impact was to increase barriers to entry, by empowering established positions of prime contractors.[16] Awareness of the long-term implications of these changes dawned only gradually on the Pentagon, eventually encouraging belated action by the US Government to head off the emergence of monopolists in key production sectors.[17] This was demonstrated most dramatically in the case of Federal action to block the proposed merger of Lockheed Martin and Northrop Grumman in 1997.[18] The speed of the reduction of military expenditure, and the initial disengagement of the federal government from the management of this process was not surprising given the history of US procurement. These dynamics echoed (though less dramatically) earlier American de-mobilization experiences from other major strategic build-ups, including the World Wars.[19]

Consolidation had implications for the political influence of producers. As a consequence of their more advantageous position within the defense industrial network, these firms held increasing influence as critical hubs of expertise and knowledge nec-

[14]Markusen (2000), p. 31; Gholz and Sapolsky (1999).
[15]Markusen (2000), p. 30.
[16]Weidenbaum (2003), p. 696.
[17]Flamm (2005), p. 9.
[18]Weidenbaum (2003), pp. 701-702.
[19]For example, the US Government sought to rapidly reduce its procurement liabilities and industrial involvement immediately after the Second World War, though this process was reversed as tensions with the Soviet Union escalated. See Lassman (2008), pp. 12-13.

essary to the construction of major weapon systems. This limited the leverage of the Pentagon to play alternative producers off against one another, and reduced its ability to ignore their preferences in key procurement decisions, since the loss of a single key producer could compromise the United States' ability to access domestically integrated weapons systems across multiple weapons system domains.[20] At the same time, consolidation also changed the political geography of weapons procurement. As Rebecca Thorpe has argued, over the late 20th century, Congressional support for military procurement grew particularly in areas with relatively non-diversified economies in which the defense industry was the dominant economic force.[21] As consolidation progressed, and prime contractors expanded their influence across multiple military capability domains, they were better positioned to coordinate the production of military systems-of-systems across a wider range of more politically sensitive districts. For example, the F-35 is structured with 1,900 suppliers in 45 US states, a fact that is specifically trumpeted on Lockheed Martin's promotional website, which cites both the purported economic benefits to each state, and the estimated share of the 254,000 total jobs supported by the program.[22] As a consequence, the structural consolidation of the US defense industrial network not only bolstered the position of US prime contractors in directly engaging with the Department of Defense; it also heightened their salience within Congressional defense procurement debates.[23]

6.2.2 *Technological distribution and force structure imperatives*

This improvement in the structural position of firms within the defense industrial network interacted with persistent US advantages in access to the breadth of military

[20]This was illustrated by the example presented in Chapter Two of US supercarrier production and systems integration at a single shipyard at Newport News.

[21]See Thorpe (2014), pp. 11-12.

[22]Lockheed Martin (2020).

[23]As Keith Hayward notes, "Corporate scale can also bring greater political clout for managing public and customer relations and influencing the procurement process". See Hayward (2001), p. 120.

relevant technologies to fuel a further drive for qualitative military transformation. While aligned to the interest of defense producers, there was strong enthusiasm for military transformation among government customers through the Cold War period and beyond the 9/11 attacks. As Eugene Gholz and Peter Dobrowski observed,

> During this period of high operational tempo, civilian and military leaders have remained committed to military innovation, and some argue that the national security challenges facing the United States today reinforce the logic of transformation.[24]

As noted previously, this commitment in part reflected an important, albeit secondary security motive in the post-9/11 era: an enduring focus on emerging great power challengers, particularly China. The global portfolio of interests that Washington sought to protect meant that even attacks such as those of September 11 2001 could not justify an abandonment of the Department of Defense's force structure requirements to address emerging state competitors. And many of the key procurement programs pursued under the rubric of qualitative military transformation had been long in the making. For example, the F-35 Joint Strike Fighter program was established in 1995, reflecting efforts to rationalize post-Cold War fighter aircraft procurement across the US armed services.[25]

Nonetheless, it remains puzzling that US defense officials sought to double down on military transformation as their procurement priority in response to the 9/11 attacks. Statist and structural realist perspectives — premised purely on external strategic dynamics — suggest the US government should have had little enthusiasm for accelerated innovation under these conditions. The nature of the security challenge to US interests revealed by the 9/11 attacks — effective though it was — was also qualitatively unsophisticated, relying on humans and dual-use technologies as expend-

[24]Dombrowski and Gholz (2006), p. 136.
[25]Bolkcom (2009).

able weapons, rather than leveraging advanced and bespoke military technologies. Combating this opponent lent itself to an operational response defined by counter-terrorism and counter-insurgency missions, whose force structure requirements were in turn labor, rather than capital, intensive.

Yet, the 2001 Quadrennial Defense Review published only weeks after the 9/11 attacks demonstrated the powerful anchoring of qualitative defense transformation in the minds of senior US decision-makers. The defense review, mandated by the US Congress and functioning as a core element of US strategic procurement guidance, remained premised on a shift from threat-based planning to capability based planning necessitated by the requirements of military transformation. As the report notes:

> Adopting this capabilities-based approach to planning requires that the nation maintain its military advantages in key areas while it develops new areas of military advantage and denies asymmetric advantages to adversaries. It entails adapting existing military capabilities to new circumstances, while experimenting with the development of new military capabilities. In short, it requires the transformation of US forces, capabilities, and institutions to extend America's asymmetric advantages well into the future.[26]

This narrative — that qualitative military transformation was necessary to resolve all manner of security challenges facing the United States — had emerged and been propagated in an environment where private defense contractors had a heightened degree of structural influence over the definition of military transformation.[27] This influence had been displayed from the early 1990s onward, as US officials came under increasing pressure to adopt best practices in corporate planning, culture, and processes from private suppliers within the defense industrial network. This "Revolution

[26]Office of the Secretary of Defense (2001a), p. iv.
[27]Dombrowski and Gholz (2006), pp. 19-20.

in Business Affairs" was seen as a key complement to the RMA: by removing the impediments of established "business as usual" mindsets within the Department of Defense, it was anticipated that military transformation could be rapidly advanced.[28] This increased structural influence and concentration of technical expertise also allowed firms to lead the way in defining the content of military transformation. Eugene Gholz and Peter Dombrowski note based on interviews with defense industrial insiders, that "...Boeing, for example, had a grasp of network-centric logic before most military organizations, not to mention a business plan to take advantage of the emerging opportunities in systems integration and space-based communications."[29]

Analysts of the US defense industry have long acknowledged the salience of corporate and bureaucratic interests. Producers, with established capacity and a strong structural position within the defense industrial network, have an interest in (and ability to shape) the procurement of weapon systems to meet their own technological and capacities.[30] Variations on this argument have been advanced by several authors, most notably James Kurth, who suggested that the mutual interests of large defense producers and established defense buyers align on maintaining existing capacity within the defense industrial base; consequently, their requirements for new innovations to occupy established production lines became a motive for the pursuit of new weapons systems — the so-called "follow-on imperative."[31]

As a consequence of their structural position and technological capacity, the interests of US defense producers in sustaining technological innovation were endorsed by US defense officials and key Congressional players over the late 1990s and into the 2000s. Thus, despite awareness of the need to adapt to the changing strategic demands imposed by the 9/11 attacks, US defense officials engaged in sustained advocacy of

[28]See Chinworth (2001). See also Office of the Secretary of Defense (2001b), pp. 3-6; Gongora and Riekhoff (2000).
[29]Dombrowski and Gholz (2006),p. 24.
[30]Dombrowski and Ross (2008), pp. 29-31.
[31]Kurth (1972).

broad qualitative military modernization.

6.2.3 *Qualitative and quantitative change in US procurement*

In the aftermath of the 9/11 attacks, the intersection of the increasing breadth and depth of military technology requirements and the advantageous structural position of defense producers empowered a procurement response focused not only on an adaptation towards counter-insurgency and counter-terrorism operations, but also on maintaining strong continuity with the pursuit of RMA technologies, under the aegis of "defense transformation". This had mixed implications for US procurement capacity.

As noted previously, the initial qualitative focus of Washington's defense build-up during the early 2000s reflected primarily the commercial imperatives of producers to secure demand to sustain their broad technological integration competencies. This conception of US procurement objectives had also been embraced by senior defense officials within the Bush administration, most notably Secretary of Defense Donald Rumsfeld, but extending as far as President Bush himself, who had made rebuilding US military power a campaign issue.[32] In this, administration figures were deeply influenced by voices from within the ranks of US defense industry. In both cases, procurement priorities were structured by the follow-on imperative. US production lines for the existing range of weapon systems — particularly tactical aircraft, nuclear submarines, and land vehicles — had been operating for several decades, and were now winding down. Firms thus required a new set of products to sustain and rebuild revenue streams. With weapons acquisition spending flush following the 9/11 attacks, procurement was rapidly orientated towards realizing these existing imperatives. This was explicitly stated by the first report of the Office of Force Transformation, estab-

[32]Dombrowski and Gholz (2006), pp.ix-x

lished by Rumsfeld in October 2001:

> [I]t has become increasingly clear that defense transformation is not simply a response to global terrorism. While the events of September 11th triggered a "system perturbation"— a systemic shock to the stability of the international system — profound change was already occurring in that system. Thus, the establishment of the Office of Force Transformation signified not just a reaction to terrorism, but rather Secretary Rumsfeld's overall commitment to the process of transformation within the Department.[33]

This qualitative procurement focus was not, however, the full story. As it progressed, Washington's procurement build-up became increasingly defined by a sharp escalation in quantitative demand for light armored ground vehicles and other equipment orientated towards expeditionary counter-insurgency operations. This shift in focus was itself a product of a realization of the limits of the RMA and of the military transformation agenda.[34] While qualitative innovation focused on integrating the breadth of military-relevant technologies produced a radical improvement in US military capabilities against conventional military forces, these technologies did not confer the same advantages to forces confronting a non-state adversary dispersed among civilian populations.[35] This transition took several years to manifest itself, under the searing operational demands of US efforts to combat insurgencies in Iraq and Afghanistan. As James Hasik has argued, US and allied forces only gradually grasped and adapted to the requirements of the threats they confronted in Iraq and Afghanistan.[36] US land vehicle acquisitions during the initial years of the Global War on Terror were not clearly tied to immediate tactical threats, in particular the proliferation of impro-

[33]Office of Force Transformation (2004), p.i.
[34]Dombrowski and Ross (2008), p. 22.
[35]Shimko (2010), pp. 200-212.
[36]Hasik (2013).

vised explosive devices.[37] It would take years for US procurement priorities to adjust to the requirements of bolstering counter-insurgency operations; even then, the bulk of spending would continue to be directed towards capital-intensive platforms orientated towards high-end international conflict.

The varying focus of US defense procurement during this period highlights the mixed implications for US procurement capacity of a supplier-centric defense industrial network combined with US advantages in access to advanced technological and industrial capacity. On the one hand, US procurement priorities were initially unresponsive to the proximate nature of security challenge posed by transnational terrorism. The qualitative force structure embodied in the push towards "military transformation" provided capabilities that were highly effective at dislodging alleged state-sponsors of terrorism such as the Taliban government in Afghanistan and Saddam Hussein's Ba'ath regime in Iraq, but were poorly adapted to targeting and destroying the terrorist organizations such as Al Qaeda that were seen as the proximate threat to the US homeland.

On the other hand, the qualitative improvements sought under defense transformation likely had ancillary implications for broader US security interests, albeit ones detached from the focus of the 9/11 attacks. Further evolution of the RMA concept towards network-centric warfare, and a more pervasive integration of sensors, weapons platforms, and command and control capabilities almost certainly lifted US conventional military capabilities.[38] This in turn imposed an increased burden on US rivals such as Russia and China, but also on so-called rogue states and in particular North Korea and Iran, to devote greater efforts to developing their own military capabilities. Given the inherent barriers to diffusion imposed by high levels of military technological complexity, these countries were forced to devote increasing resources

[37] Hasik (2016).
[38] Dombrowski and Ross (2008).

to match US capabilities, or to seek other offsetting capabilities, in particular, the pursuit of nuclear weapons.

6.3 *Implications for gatekeeper capacity*

The focus of Washington's procurement response to the post-9/11 shift in its strategic requirements had substantial implications for the global defense industrial network, and for the United States' influence within it. In the short term, US procurement demand re-orientated capacity from exports to domestic production, and thus temporarily eroded the United States' global market share and structural position. However, this effect reversed itself over time, as the effects of the security shock ameliorated and US procurement demand normalized. Under these circumstances, external demand rebounded, reflecting the implications of persistent US qualitative innovation under conditions of concentrated advantages across the breadth of military-required technologies, and the systems integration capacity to transform them into weapon systems. Washington's innovations had served to outmode existing weapon systems and thus drive a need for recapitalization by other states that could not easily be satisfied through emulation. Reinforcing this trend, US technological advantages also meant that existing partners held asset specific investments that motivated them to persist with sourcing weapons systems from the United States.

6.3.1 *Structural position and technological distribution*

The initial increase in US procurement demand from 2002 onward almost certainly had the effect of redirecting defense production from exports to fulfill domestic requirements. This stemmed from the interaction of the spike in procurement demand with the specialized nature of military systems integration of advanced technological

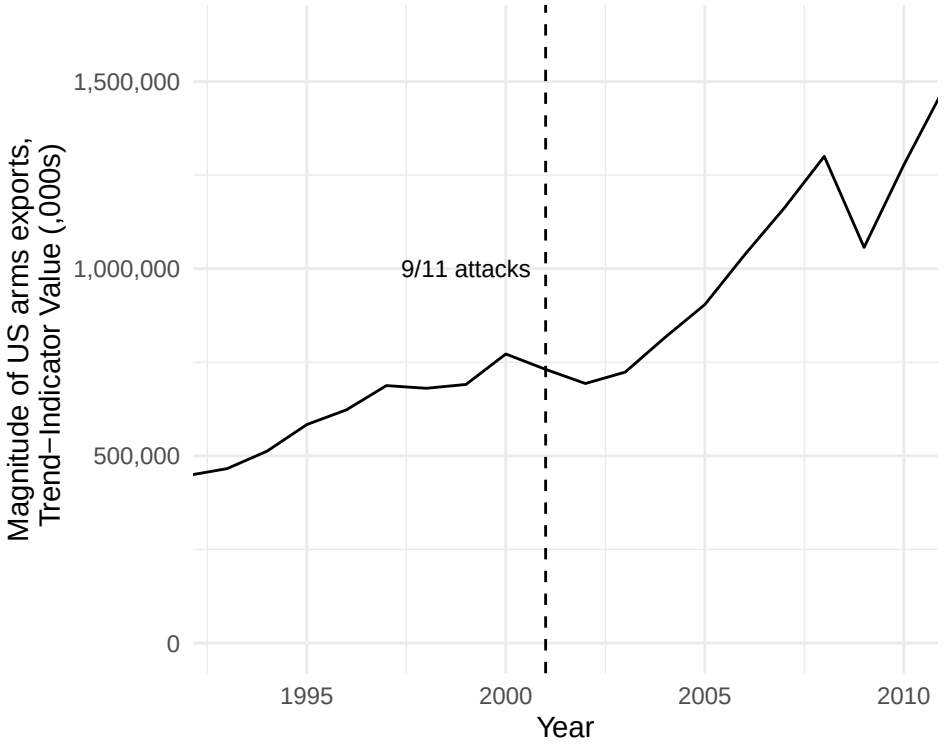

Figure 6.2: Magnitude of US arms exports, 1993-2010. *Source: Stockholm International Peace Research Institute (2015). Note that SIPRI data is presented as Trend-Indicator Values (TIVs), which represent a measure of military capability transferred, rather than a specific financial value. For more detail on the construction and use of TIVs, see Holtom, Bromley, and Simmel (2012).*

capacities. As the salience of systems integration had risen sharply over the preceding thirty years, and with it the deep technical knowledge and skill base required to engage with the breadth of necessary technologies, the ability of firms to surge capacity to development and procurement had become increasingly limited. In essence, the barriers imposed by the growing breadth of military technological requirements on international diffusion also resulted in barriers to domestic market entry by commercial producers: because of specialized capacity requirements, non-military producers faced significant challenges re-tooling to meet rising military procurement demand. The net result of this was that a sharp rise in domestic demand came at the immediate cost of decline in the United States' structural position within the global defense industrial network.

As Figure 6.2 demonstrates, this decline in the United States' structural position

persisted for only a couple of years during the initial ramping up of domestic procurement demand. Subsequently, US armament exports increased again, and further accelerated from the late 2000s. Amid the draw-down of US commitments in both Afghanistan and Iraq, and domestic economic pressures following the Global Financial Crisis of 2006-2007, slack capacity increased within US defense industrial network. This in turn facilitated a re-assertion of the United States' dominant position within the global defense industrial network.

This resurgence was also driven by rising external demand for US weapons. Demand was shaped by the consequences of the enduring US emphasis on qualitative military transformation following the 9/11 attacks. The restricted international distribution of the full range of military-relevant micro-electronics and information technologies, combined with the specialized nature of military systems integration requirements, continued to prove an enduring barrier to the diffusion of military technology to other countries. This is epitomized by the network-enable precision strike capabilities that had informed assessments of US military prowess following the Gulf War. As Barry Watts observes,

> ...American observers presumed this emerging form of warfare would proliferate rather quickly. Not widely foreseen in the mid-1990s was that nearly two decades later long-range precision strike would still be a virtual monopoly of the US military.[39]

At the same time, prior Allied procurement of US military technology had generated institutional and physical asset specific investments that inclined them towards further imports from the United States.[40] Historical reliance on US military imports, adoption of US-centric technical standards, doctrine, and training requirements made further procurement of US systems less disruptive than sourcing systems from alter-

[39]Watts (2013b), pp. 1-2.
[40]Suh (2007).

nate suppliers. At the same time, increasing complexity also increased reliance on US defense industrial suppliers for after-market servicing and technical support, generating relationships that facilitated further procurement in the future.

The result of the intersection of US defense industrial slack from the late 2000s onward with the barriers to diffusion imposed by the restricted international distribution of advanced military technologies drove a resurgence, not only in Washington's position within the global defense industrial network, but also in its gatekeeper capacity to leverage that position for strategic advantage.

6.3.2 *The United States' gatekeeper capacity consequences*

As the previous chapter highlighted, US officials have long been alive to the implications for US gatekeeper capacity of US advantages due to the breadth of military technological requirements and the sustained dominance of US defense producers within the global defense industrial network. Even prior to the 9/11 attacks, US administrations had taken action to increase both the strength and flexibility of the US defense export regime in order to leverage foreign demand for US weapon systems for strategic effect.

Washington's assessment of these advantages — and the importance of maintaining it — was summarized in 1999 by the final report of the Department of Defense's Strategic Study Group (SSG), focused on the challenge of defense globalization. The SSG report manifested a clear public recognition of the hard-edged market power advantage that leaders within the US defense industrial network saw as the consequence of propagating the diffusion of American defense technology. The authors' view was that the United States must "sell technologies to establish market leadership and cultivate dependencies."[41] Where the propagation of advanced US technology offered the

[41] Secretary of Defense Strategic Studies Group IV (1999), p. 6.

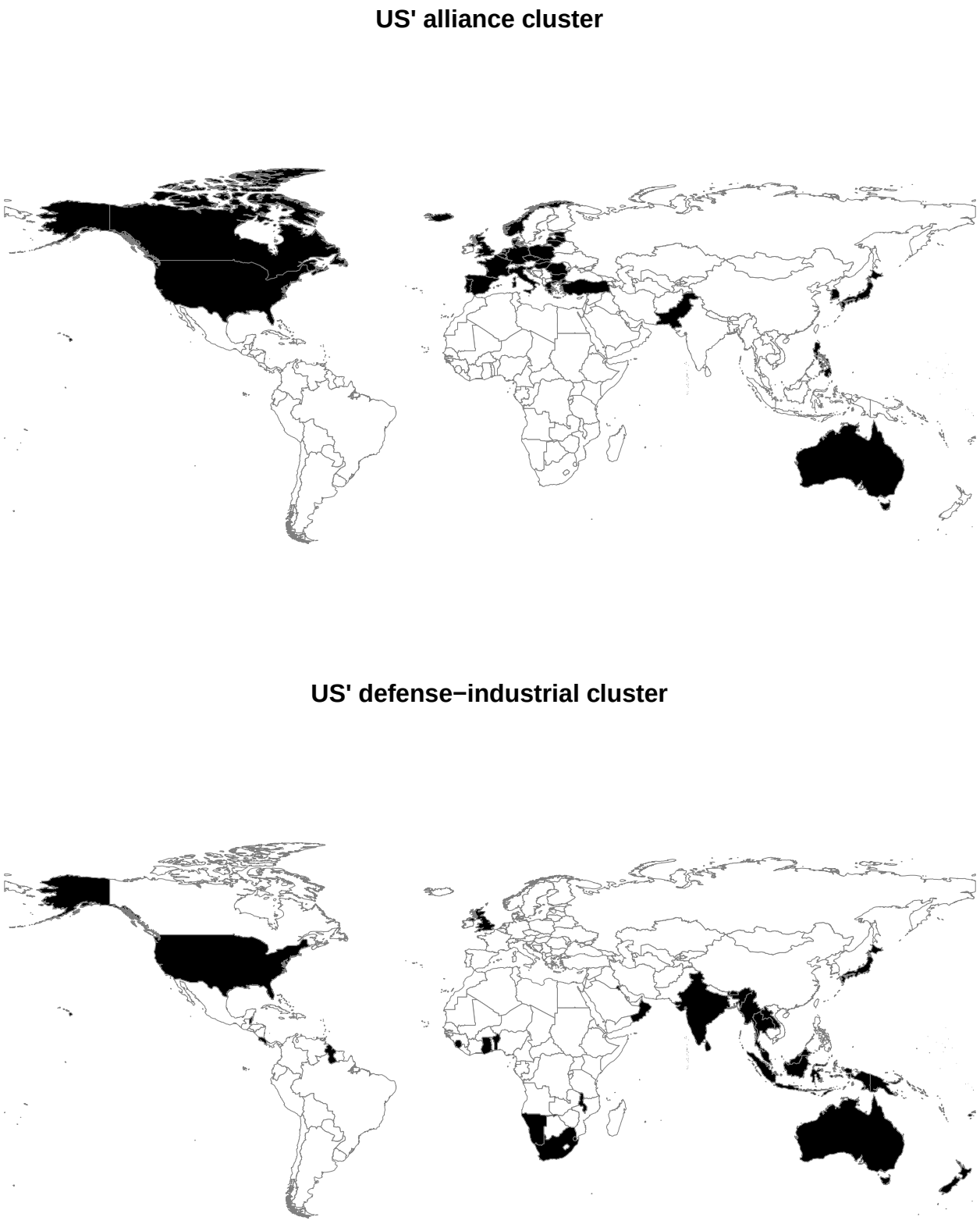

Figure 6.3: US position in international defense industrial versus military alliance blocs, 2001-2010.*Source: Stockholm International Peace Research Institute (2015); Leeds et al. (2002). Note: For clarity, figure only shows cluster affiliation with the US*

potential to bolster the power of other states, this was to be harnessed strategically as a tool to expand the capacity of new and friendly centers of power.

As a result, despite the brief retrenchment of US defense exports following the post-9/11 procurement build-up, Washington was well positioned to leverage its enduring defense industrial centrality and the consequences of high military technological complexity to shape patterns of weapons exports in line with its interests. These focused primarily on bolstering key US allies in Europe, the Middle East and Asia, where the United States was seeking to draw-down its own military commitments in order to enhance its global strategic flexibility. Consequently, US exports continued as an enduring source of US gatekeeper capacity, advancing its strategic interests.

6.3.3 *Evaluating the alignment of the US security and defense industrial networks*

Drawing on the established methodology of the preceding chapters, I begin my exploration of US gatekeeper capacity post 9/11 by examining the alignment between the global pattern of defense industrial ties, and US alliance relationships. This structural analysis is illustrated in Figure 6.3.[42]

It is immediately clear that there exists a partial correlation between the clustering of global defense industrial relationships, and US security commitments. In both cases, the United States is located in a large cluster along with its key global partners, Great Britain, Japan, and Australia. However, while the US alliance cluster includes also its European partners, these are absent from the defense-industrial cluster (while not shown for simplicity, they form their own distinctive cluster reflecting the increasing level of defense industrial integration on the continent). In addition, the defense

[42]Once again my analysis here focuses on identifying clusters of closely interlinked states within both alliance and defense industrial networks. This analysis draws on alliance data from Leeds et al. (2002). It also utilizes SIPRI data on arm trade flows. See Stockholm International Peace Research Institute (2015).

industrial network includes a number of less entrenched US security partners, most notably India and Southeast Asian states, as well as a range of Pacific countries. This is suggestive of the role of defense industrial ties as a form of soft strategic binding, focused on creating relationships and alignments in the absence of formal commitments or institutionalized cooperation.[43]

6.4 *Case studies in gatekeeper capacity*

The correlation between US defense industrial and security ties during this period is suggestive of the underlying structure of US gatekeeper capacity internationally. To substantiate this, I turn to a deeper exploration of two particular cases of key US defense industrial and security relationships, namely those of the US-UK and US-Japan.

6.4.1 *UK-US relations*

The post 9/11 period saw a continuation of the deepening — but asymmetric — defense industrial and strategic interdependence between Britain and the United States. This was shaped by the enduring legacy of post-Cold War shifts in the structure of the global defense industry, which exacerbated the pressures imposed on Britain by the growing breadth of military technology requirements, epitomized by micro-electronics and information technologies. The result was that the RMA deepened assessments that Britain would necessarily have to pursue closer cooperation with the United States if it were to retain the capacity to project global power.[44]

The US structural position with respect to the United Kingdom was shaped by the

[43]This aligns with the thesis of Yarhi-milo *et al.* that arms and alliances are somewhat substitutable as part of a 'bundle' of security assistance. See Yarhi-milo, Lanoszka, and Cooper (2016).

[44]Gompert, Kugler, and Libicki (1999), p. 21.

implications of the post-Cold War draw-down in military spending. As was noted above, reductions in defense budgets drove substantial consolidation in the structure of the US defense industrial network. The impact was proportionally more severe in Britain, as it was in a number of smaller economies. With a lower baseline level of military spending than the United States, these economies nonetheless faced the same high fixed research and development costs associated with developing new weapon systems, which required specialized systems integration capabilities and established competencies across a wide range of advanced technologies. Consequently, a reduction in resources available for military procurement carried sharper consequences for London than it did for Washington. This acted to further accelerate the dynamic (observed in Chapter 5) of a growing wedge in the costs associated with domestic military procurement between the United States and the United Kingdom.

This had implications for defense procurement, by sharpening the trade off between domestic procurement and force structure size post 9/11. As the Grey Review of Acquisition noted in 2009, the "UK's level of ambition around capability is significantly out-of-balance with resources available on any realistic short-, medium- or long-term basis."[45] While seeking to retain a sovereign capability for military procurement in select domains (particularly shipbuilding and land armaments), Britain was increasingly willing to trade domestic procurement capability against force structure size in domains that would enable its ability to sustain global power projection capabilities (regarded as its key contribution to the transatlantic relationship in an era of expeditionary operations under the War on Terror).[46] This choice manifested in particular in the F-35 Joint Strike Fighter. Following its participation in a European-focused international collaboration in the production of the 4th generation Eurofighter Typhoon jet fighter, the United Kingdom recognized that maintaining a qualitative advantage

[45]cited in K. Hartley (2016), p. 9.
[46]Hayward (2001), pp. 117-120.

required pursuit of a 5th generation fighter. However, with little Continental appetite for such a system, and no domestic capacity to indulge the fixed costs of development, the only opportunity for procurement of such aircraft was through close collaboration with the United States in development and production of the F-35.[47] In the process, Britain gained important contracts for the procurement of sub-systems of the aircraft across all models (including in the United States), providing a significant sustaining boost for British defense industrial production capacity. Nonetheless, the choice did imply a continued growth in dependence on US systems integration capacity.

This dynamic was also exemplified by the deepening of foreign direct investment linkages, with the notable result that the growth of UK subsidiaries and their component exports to the United States came to exceed those within their home market in Britain. British firms, alongside their European counterparts, responded to the relatively greater procurement opportunities available in the United States by seeking to enter that market to maintain profitability.[48] This transnational embrace was symbolized by the purchase of Tracor by GEC, and Rolls Royce's control of the Allison Engines Corp.[49] This likely allowed Britain to sustain a greater proportion of its defense industrial base during this period than would otherwise have been the case. However, it had the ultimate implication of altering the balance of priorities for these firms towards a focus on both the United States and Europe, embedding the British defense industry across both sides of the Atlantic. This itself served to bolster US gatekeeper capacity. As Britain simultaneously became more deeply embedded into both the European and North American defense industrial networks, it emerged as a key bridge between them, allowing Washington to have greater indirect influence over European developments.[50]

[47]Hartley (2012), p. 35. See also Pugh (2007), pp. 29-30; Di Domenico (2006), p. 23.
[48]Dombrowski and Ross (2008), p. 36.
[49]James (2000), pp. 117-118.
[50]Note that this role partially embodied London's long-term self-conception as an intermediary between the two sides of the Atlantic. O'Driscoll (1998), p. 130.; Marsh and Baylis (2006), pp. 197-

The embedding of both the British government and British defense producers in deeper ties with the United States has had strategic consequences for their international latitude. Greater dependence on the United States has served to empower Washington's ability to condition Britain's defense industrial exports. This was exemplified in the case of US concerns to avoid the export of military technology to the PRC, which have been internalized by London and the primary UK defense producer, BAE Systems: both have taken a harder, explicit line regarding such trade, in marked contrast to the stated priorities of some of their European political and commercial counterparts.[51]

More subtly, Britain's increased dependence on the United States also served as a vector for Washington to exert structural influence over how London prioritized its strategic interests. This was in part because the relationship has generated strategic advantages for Britain, even as it has deepened dependence. US structural influence led to the evolution of US-UK defense industrial ties away from a crude autonomy of alternatives between dependence and autonomy, towards a reconstruction of asymmetric interdependence as a pathway to subordinate power. John Bayliss captured this assessment tautly, contending that "Britain, it can be argued, has to a large extent become dependent on the United States in order to to preserve her independence of action in the international system."[52]

Britain's European links have also served as a bridge for the transmission of the UK's strategic imperatives — structurally-derived from relations with the United States — into the European policy domain. This is most obvious with respect to the focus of the European Defense Agency on prioritizing transatlantic interoperability of EU procured military equipment.[53]

198.

[51]Dover (2007), p.118.

[52]Baylis (1985), p. 374.

[53]Dover (2007), p. 119.

6.4.2 *Japan-US relations*

Similarly, the post-9/11 period saw a greater intertwining of Japan's defense industrial and strategic relationships with the United States. As with the United Kingdom and other powers following the end of the Cold War, Japan sought to retrench its defense spending amid enduring domestic constraints on military procurement. This generated cost pressures, exacerbated by the growing breadth and depth of military technology requirements, similar to those faced by London: a sharpened choice between strategic capability (in terms of force structure scale) and defense industrial autonomy (with respect to maintaining domestic production). Unlike Britain, however, Japan continued to double down on the pursuit of domestic defense industrial independence, even as it implied a sharp attrition of relative military capability. This occurred despite a deterioration in Tokyo's security environment, as Japan faced the emerging challenges posed by North Korea's nuclear weapons and ballistic missile program, as well as the longer-term shift in the regional strategic order driven by the PRC's military modernization.[54] Reconciling these dynamics, Japan pivoted towards a deepening of strategic ties with Washington.

Japan's emphasis on indigenization of defense industrial production reflected a continued prioritization of both the drive for strategic autonomy and the potential for domestic economic spin-off from domestic military production.[55] At one level, this was fulfilled: domestic production or co-production of systems served to generate and sustain indigenous producers of defense goods. And in some specific sectors those producers generated specialized capabilities, most notably in the manufacture of conventionally-powered submarines. However, these specializations proved increasingly difficult to sustain and successfully leverage for strategic and wider economic advantages. This was a direct consequence of the effects of the sheer scale of techno-

[54] Yoshihara and Holmes (2008); C. W. Hughes (2009).
[55] Chinworth (1998).

logical requirements that needed to be integrated into contemporary weapon systems, and the barriers this generated for the diffusion of technological progress from the military to the civilian domain, and vice versa. As Richard Bitzinger has observed, "[t]he challenge to Asian arms industries is meeting the growing demand for self-sufficiency in arms acquisition, that is, autarky in production, as well as the rapidly increasing technological requirements of next-generation weapons systems."[56]

Further, Japan's defense production has increasingly evolved into a limited, niche sideline for civilian manufacturers.[57] This is epitomized by Mitsubishi Heavy Industries, the largest private contractor, responsible for some 20% of total military contracts, which nonetheless remains primarily a side business for its parent conglomerate.[58] The increasing technological capabilities required to maintain military systems integration capabilities has likely limited the willingness of those firms to invest further resources in matching advances to military technology, a dynamic reflected in the exit of a number of defense producers from the sector.[59]

All these dynamics have been exacerbated by the stagnation in post-Cold War defense expenditure, as channeled through the particular characteristics of Japan's political orientation towards national defense. As was noted in Chapter 5, Japan's defense expenditure was already limited to approximately 1% of Gross Domestic Product during the late Cold War period.[60] This reflected domestic political commitment to Japan's peace constitution, and a strong reliance on the United States as Tokyo's security guarantor. The end of the Cold War, while not characterized by a dramatic cut in defense spending, nonetheless saw total real military expenditure effectively frozen through the 2000s. This was in part driven by the wider slowdown of Japan's economy. Notably, unlike the United States, Japan did not respond to the 9/11 terrorist

[56]Bitzinger (2015), p. 454.
[57]Takahashi (2008), p. 105; Friedman and Samuels (1993).
[58]Hughes (2011), p. 456.
[59]Hughes (2011), p. 473; Hayward (2001), p. 125.
[60]Sachwald (2014), p. 14.

attacks through increased defense expenditure.[61] As a result of limited fiscal investment in military capabilities through this period of broadening military technological requirements, Japan experienced increasing cost pressure to maintain its defense industrial capabilities.[62] For example, it is estimated that the cost of the FSX fighter aircraft was approximately three times that of its closest equivalent, the US F-16C.[63] These were further exacerbated by the self-imposed ban on defense exports, which has persisted until recently despite the lobbying of Japanese defense producers to remove it.[64] This ban served to limit the ability of Japanese defense producers to maintain scale through a reliance on international markets.[65]

The strategic consequence of this was a greater reliance on Washington in the face of emerging security challenges. Perceiving Pyongyang as being on a path to potentially targeting Japan with ballistic missiles armed with either conventional or nuclear weapons, Tokyo began prioritizing the acquisition of ballistic missile defense (BMD) capabilities from 2003 onward, a process formally inaugurated in the 2004 revised National Defense Program Guidelines.[66] Given the diverse component technologies needed to realize these systems — requiring robust integration between long range radar and early warning sensors with telemetry tracking, command and control systems and interceptor missiles — Japanese officials rapidly recognized that a purely indigenous procurement response would be extremely expensive, and likely subject to lengthy development timelines. As a consequence, Tokyo turned to Washington, seeking to utilize BMD as a focal point for renewed defense industrial integration.[67] The United States and Japan cooperated on the co-development of the SM (Standard Missile) - 3 Block IIA interceptor, which was integrated into Japan's domestically-

[61] C. W. Hughes (2009), pp. 89-90.
[62] Bitzinger (2010), p. 2; Kimura and Matsuoka (2001), pp. 30-31.
[63] Hughes (2011), p. 464.
[64] Kawasaki (2009), pp. 140-141.
[65] Takahashi (2008).
[66] G. Hughes and Tripodi (2009), pp.11-12.
[67] Takahashi (2008).

produced (but US licensed) Patriot Advanced Capability missile batteries, as well as *Aegis* radar equipped destroyers. This served to integrate Japanese technologies into a wider US-centric BMD architecture that included X-band radar sites based in Japan, as well as US-controlled space-based infrared sensors.[68] The result, once again, was the increased strategic dependence of Japan on the United States.

Similarly, the rise of the PRC as a great power and aspiring regional hegemon pushed Japan to pursue closer strategic and defense industrial ties with Washington.[69] China's military modernization through the 2000s, fueled by a dynamic and rapidly growing economy, began to erode Japan's historical qualitative advantage. Unable for domestic political reasons to match increases in Beijing's military largess, Tokyo once again pursued deeper integration into US advanced weapons procurement programs, most notably the F-35 Joint Strike Fighter. This provided Tokyo with access to a mature 5th generation fighter aircraft, allowing it to retain an edge over Beijing, which was still in the process of developing its own equivalent. Acquisition of its own production line for the F-35, and integration into the international supply chain for the fighter, provided a sop for the Japanese aerospace sector. However, it further underscored the dependence even of countries at the civilian technology frontier on US systems integration capabilities. What is more, as with BMD, access to American technology was not sufficient to grant Tokyo strategic autonomy. Rather, in the face of deepened strategic asymmetries with the PRC, Tokyo has sought to supplement its own capabilities with more explicit US security guarantees: for example, with respect of its control of disputed island territories in the East China Sea.

Japan did not of course restrict its defense industrial ties to Washington. The process of external technological and geopolitical change did fuel an increasing interest in defense cooperation with the only other international cluster of advanced military

[68] Hughes (2013), p.3.
[69] Calder (2006).

producers: Europe. At face value, greater cooperation with Europe did offer an opportunity to reduce dependence on the United States for technology. However, much of what Europe had to offer was restricted to the sub-component level. Like Japan, smaller European states and producers were also feeling the logic of pressures to integrate within US-led defense industrial chains. At best, the extension of the network served to substitute indirect for direct dependence. More fundamentally, increasing Japanese engagement with European producers was itself conditioned by the structural dominance of the United States within the globalization of defense production. Just as Japanese acquisitions were shaped directly by US technology, so too were those of America's European partners. In both case, these efforts served to create convergence towards common US-led standards and inputs across systems. This in turn increased the potential interoperability of Japanese and European defense systems, bolstering their attractiveness to each state. Thus the formation of Japan-US defense industrial linkages can be seen as following a process that in social network analysis is referred to as triadic closure: the relationships between the United States and Japan and the United States and European partners increased the value from the formation of Japan-European linkages.[70] Yet despite Japan's aspirations, its self-imposed limitations on extensive arms exportation have severely limited its capacity to engage with defense globalization, and hence to combat the escalating cost of the technologies associated with the RMA.[71]

This exploration of US-Japan defense industrial ties, and the relationship of American structural and regulative power to the mediation between actors within the Japanese defense industrial network, points to the strategic economic element in Washington's engagement with defense industrial globalization. By engaging with Japan strate-

[70]For a discussion of how processes of triadic closure structure network evolution, see Cranmer, Desmarais, and Kirkland (2012). These network pressures on the internationalization of the Japanese defense industry resemble a sector-specific form of what T.J. Pempel termed "structural gaiatsu". See Pempel (1999), p. 910.

[71]Hughes (2011), p. 466.

gically in response to technological change, the US defense industrial network was able to channel the possibilities of greater interdependence into an asymmetric advantage that bolstered US national power.[72] This runs in the face of assessments of the differences in orientation towards strategic trade between the two countries, which dominated analysis of the relationship during the late 1980s and early 1990s. For example, contrasting the strategic partnership of the Japanese developmental state and private industry with Washington's relationship to the US private sector, Stephen Krasner argued that

> American officials have rarely been sensitive to the benefits that might accrue by intervening on behalf of industries with declining costs; for such an enterprise a small initial advantage can guarantee market dominance as the industry matures.[73]

The defense industry tells the lie to this: the US defense industrial network has indeed been aware of the importance of intervening strategically to capture and defend the commanding heights of global military production.

6.5 *Shifting strategic dynamics and procurement contraction*

The procurement surge that drove Washington's post-9/11 defense procurement cycle drew to a close in the late 2000s. However, it did not end because of a clear resolution of the security challenge that had sparked the Global War on Terror. Rather, the US government's procurement boom was challenged by both the external failure of US

[72]This strategic approach was clearly identified in Washington by the mid 1980s. As the Libicki et al. study for the National Defense University noted, with respect to increasing reliance on Japanese electronic sub-components, "[t]he problem [of dependence] also admits an alternative point of view. The Japanese have created technological capabilities that our market can take advantage of. If the market alone mediates the terms on which we deal with Japanese industry, we get one pattern of consequences. If some strategic thinking can be brought to our industrial capabilities and their relationship with those of the Japanese (among others), outcomes more favorable to national and/or economic security are possible." Libicki, Nunn, and Taylor (1987), p. 76.

[73]Krasner (1986), p. 801.

strategy, and a negative shock to the fiscal foundations of US military spending.

By the late 2000s, Washington's Global War on Terror had met with mixed success in its stated goal of suppressing Islamic extremism worldwide. In a limited sense, the direct threat to the United States was ameliorated; Al Qaeda had been dispersed, and the prospect of large scale terrorist attacks against the US homeland curtailed through a massive expansion of security measures.[74] However, by defining the scope of the threat posed by Islamic extremists as encompassing the entire globe, the United States found itself increasingly embroiled in military commitments running the gamut from nation-building in Iraq and Afghanistan to counter-terrorism in the Southern Philippines.[75] What is more, these international gains proved fleeting. While Iraq was temporarily stabilized by the surge of US forces in 2007, in the years that followed disenfranchisement of the Sunni population would intersect with the collapse of social order in neighboring Syria to give rise to a new and even more challenging Islamic extremist threat, flying the black flags of the so-called Islamic State.[76]

At the same time, the US procurement surge was challenged from within. As Thomas Oatley has contended, Washington's military build-ups have tended to end due to a reduction in political support for fiscal outlays, particularly amid the pressures of the financial crises they may have been at least partially responsible for fueling.[77] From the late 2000s onward Washington's procurement spending came under intense pressure from the devastating impact of the Global Financial Crisis on the US economy. This crisis, which threw the United States into what was until then the worst economic downturn since the Great Depression of the 1930s, required massive fiscal expenditure, and severely depressed tax revenues. In the aftermath, the 2011 Budget Control Act imposed sequestration on defense spending, represented a rapid reduction

[74]Miller (2010), pp. 64-65.

[75]Pirnie and O'Connell (2008), pp. 17-19; Catharin E. Dalpino, "The Bush Administration in Southeast Asia: Two Regions? Two Policies?" in Dalpino (2003), pp. 103-116.

[76]Soufan (2017).

[77]Oatley (2015), particularly Chapter 2.

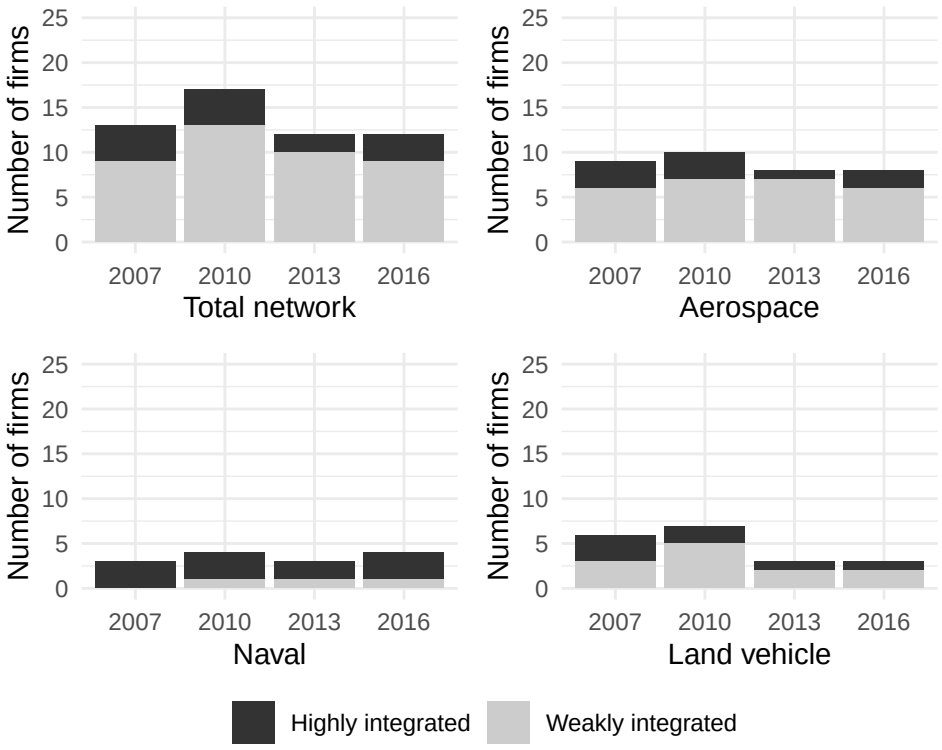

Figure 6.4: Number of US defense producers with active procurement contracts and their level of horizontal integration, 2007-2016 *Source: Hill (2016). Note: For the purpose of these analysis, 'highly integrated' is defined as serving procurement contracts across two or more weapon system domains. For specific details on this dataset, see Chapter 5 footnote 37.*

in fiscal allocation to procurement.[78]

As a result of this reduction in US defense expenditure, the size of the US defense industrial network peaked in 2009-10, before entering a period of renewed consolidation among defense producers.[79] This can be seen in Figure 6.4. This consolidation was not, however, as sharp as that which followed the end of the Cold War. This likely reflected the existing extent of consolidation, which limited the potential for further significant mergers Instead, the network appeared to shrink back to a size and level of integration similar to 2001, at the inception of the security shock.

6.6 *Conclusion*

The challenge to US strategic interests presented by the 9/11 attacks did drive a significant procurement shock in the United States, similar to that experienced during the late Cold War Reagan build-up, though the nature of the ostensible threat — transnational terrorism — was radically different. Significantly, Washington chose to respond to this challenge in a similar fashion, at least initially: it engaged in a procurement effort predicated on qualitative military transformation that extended US investments in high-tech, high complexity conventional weapons systems.

I have contended that this choice was a product of the intersection of persistent US military technological advantage with a notable shift in the structure of the post-Cold War US defense industrial network in favor of large, consolidated private producers. Empowered within the defense industrial network, these producers were able to influence and shape the procurement agenda in favor of their own core competencies in high technology conventional weapon systems. This procurement response was not ideally adapted to the immediate challenge that had sparked the build-up: namely,

[78] Crawford (2016), p. 2.
[79] Watts (2013a); Tama (2015), pp. 16-17.

confronting transnational terrorism and insurgency. However, it did have ancillary implications for wider US security interests: because of the complexity of military technology, barriers to diffusion imposed additional challenges on US state rivals to make similar expensive investments, or pursue offsetting capabilities.

The US procurement response also had implications for US gatekeeper capacity. While initially detracting from the United States' structural position within the global defense industrial network, the combination of qualitative innovation and relative US productive capacity served to encourage renewed demand for American weapon systems in the late 2000s, and consequently bolstered Washington's position within the global defense industrial network. This in turn increased Washington's ability to utilize defense industrial relationships to shape the strategic orientation of partner states.

CHAPTER 7

CONCLUSIONS

This dissertation has sought to address basic questions regarding the interplay of defense industrial capacity and national power. How (and how well) do states harness defense industrial relationships domestically and internationally to advance their strategic interests? And what are the key dynamics that affect this capacity over time?

In responding to these questions, I have conceptualized state defense industrial capacity as having two facets: procurement and gatekeeper capacity. Procurement capacity represents the ability of states to engage with domestic producers to acquire weapon systems that respond to their current strategic challenges. Conversely, gatekeeper capacity embodies the state's capacity to harness international defense industrial relationships to achieve its strategic objectives.

To explain the sources of defense industrial capacity, I have developed a theoretical framework that situates it at the intersection of two key variables: the breadth and depth of contemporary military technological requirements, and the structure of the defense industrial network (both domestically and internationally). The structure of the defense industrial network affects the relative salience of producers versus buyers of military systems, and hence the respective influence of one over the other. I have contended that changes in defense industrial capacity stem from shifts in these underlying variables, and are revealed in the context of defense industrial cycles driven by changes in a state's external security environment. In response to rapid changes in their security circumstances, states face an impetus to develop responses, premised on the procurement of military capability. I have argued that the focus

of that procurement response reflects state and producer imperatives, informed by military technological requirements and, in the case of the state, their assessment of the strategic environment. The balance of influence of these priorities is conditioned by the structure of the defense industrial network, and is manifested in terms of qualitative versus a quantitative focus for procurement.

The focus of this procurement response bleeds over into the international realm through its effect on the structural position of the state in question within the global defense industrial network. Procurement choices can shape military force structure choices of other states, and hence their demand for armament imports; however the effect is conditional on the breadth and depth of military technology requirements, which affects the prospects for technological diffusion and domestic emulation, and hence the extent to which the producer state is incentivized to develop institutions to manage and shape the diffusion of military technology. Depending on its effect on the intersection of structural positions within the global defense industrial network and the state of military technology, the propagation of the procurement response to the initial security challenge will thus have consequences for state gatekeeper capacity.

Empirical investigations substantiate the plausibility of the theoretical framework I have laid out: the structure of defense industrial networks and the breadth and depth of military technology requirements shaped how both Britain and the United States responded to shifts in their external strategic environment through the 19th to the 21st centuries. In the case of late 19th century Britain, the focus of Chapter 3, the naval challenge posed by growing French and Russian naval power in the late 1880s prompted a substantial increase in naval procurement. Channeled through the structurally-dominant position of the Admiralty within the British domestic defense industrial network, the focus of that procurement response reflected the strategic priorities of Royal Navy leaders. These priorities, in turn were shaped by the Admiralty's

understanding of the limited nature of contemporary naval technological requirements, which allowed for rapid diffusion and emulation of qualitative military innovations. As a consequence, the Admiralty promoted a quantitative naval build-up that played to Britain's strengths in large scale, efficient naval production, manifesting Britain's high level of procurement capacity. This procurement surge tipped over to shape international defense industrial dynamics, and Britain's gatekeeper capacity. Britain's expanded naval capacity contributed to heightened international defense industrial demand. However, the limited breadth of military technology requirements meant that other countries were able to emulate Britain's naval build-up, albeit at generally higher costs. What is more, without a technological advantage to secure, Britain lacked the incentive to develop regulatory institutions to direct the arms exports of British firms in line with its strategic interests. Consequently, Britain's gatekeeper capacity remained limited.

In Chapter 4, my examination of Britain's defense industrial situation in the lead up to the First World War showed a shift in both procurement and gatekeeper capacity. In responding to Germany's rapid naval buildup, Britain pursued qualitative naval innovation. This pivot towards a qualitative defense industrial response was a consequence of a structural shift within the defense industrial network, rather than a fundamental increase in the breadth and depth of military technological requirements. Vertically integrated British producers saw particular advantage in harnessing state procurement demand to advance inherently dual-use metallurgical, shipbuilding, and engine improvements in a single weapon system architecture. The result was the development of the *Dreadnought*-type battleship and battle-cruisers which, while rendering existing capital ship designs obsolete, were themselves easily emulated by foreign powers. As a consequence, Britain undercut its own existing advantages in capital ship numbers, forcing a commitment to re-capitalizing its fleet at great expense. This failure of procurement capacity was echoed in the international defense industrial sphere.

The limited nature of naval technological requirements embodied in the *Dreadnought* innovation allowed for its rapid diffusion, and continued to undermine Britain's incentive to develop regulatory institutions to shape global defense industrial flows in its favor.

Subsequent chapters moved the empirical focus to the case of the United States in the late 20th and early 21st centuries, periods marked by a substantial increase in the depth and diversity of military technological requirements. Chapter 5 focused on the US procurement response to the rapid increase in the Soviet Union's military capabilities from the late 1970s through to the end of the Cold War. Under conditions of increasingly broad military technological requirements embracing cutting edge sectors such as micro-electronics and information technologies, and with the US defense establishment enjoying a strong structural position at the center of a diverse network of defense industrial suppliers, Washington responded to the Soviet challenge through qualitative innovation in sensors, weapons, communications systems and command and control networks. This effort, which laid the foundation of what was subsequently referred to as the Revolution in Military Affairs (RMA), built on decades of increasingly sophisticated and wide-ranging systems integration capabilities and skills. The increasingly expansive and expensive technical knowledge requirements that underwrote military technological integration rendered emulation challenging, producing an enduring military advantage for Washington in its strategic competition with Moscow, and encapsulating effective procurement capacity in action.

The success of these technologies, and the challenges of diffusion, created international demand for US defense industrial exports. Having recognized the barriers to emulation posed by the growing breadth and depth of military technology requirements, Washington refined and utilized a system of export and technology controls

to manage the distribution of these technologies worldwide. This served not only to directly shape the global military balance in favor of US partners, it also functioned to deepen their defense industrial dependence on Washington. This positive strategic alignment of US defense industrial activity with Washington's security interests manifested its high levels of gatekeeper capacity.

Chapter 6 capped off this analysis by exploring the experience of the US defense industrial network in responding to the security challenges of the 2000s. Following the September 11 2001 terrorist attacks, the United States engaged in a further defense buildup. However, in contrast to the relatively low-technology, personnel-intensive requirements of the sustained counter-terrorism and counter-insurgency operations it was actually faced with, Washington pursued a renewed bout of qualitative military technological innovation. This choice stemmed from a shift in the structure of the US defense industry during the post-Cold War period, which saw significant consolidation among suppliers, and a consequent reduction in the influence of the US defense bureaucracy in favor of producer imperatives. This represented a decline in US procurement capacity relative to the Cold War period. However, renewed US qualitative innovation had more positive implications for US gatekeeper capacity. By reinforcing demand for difficult-to-emulate US military hardware, the post-9/11 military buildup supported US gatekeeper capacity to shape the international diffusion of military capability in line with its security partnerships, and its strategic interests.

7.1 *Insights from contemporary dynamics: US-PRC competition*

This dissertation has demonstrated the significance of defense industrial capacity as a concept by embedding it in the strategic context of great power competition across two centuries. By extension, my research has also established strong grounds for treating both the structure of defense industries and the breadth and depth of

military technological requirements as significant variables in explaining both state approaches towards security challenges, and the strategic outcomes that result.

A deeper understanding of defense industrial capacity is arguably even more crucial today, as we witness a resurgence in strategic competition between great powers, in which military procurement and arms exports are increasingly central.[1] Over the past decade, the People's Republic of China (PRC) has continued to pursue rapid qualitative military modernization.[2] The analytic consensus of international security scholars and researchers is that this modernization is focused on achieving a favorable military balance for the PRC in East Asia and potentially beyond, with an eye particularly to preventing the projection of US power within the so-called 'first island chain' that runs from the Philippines through Taiwan to Japan. Much of the PRC's effort reflects an attempt — at an extremely high cost, due to the breadth and depth of military technological requirements — to emulate US RMA achievements. But China is also seeking to develop its own unique competencies in Anti-Access / Area Denial (A2AD) capabilities that represent a particular offset to traditional US strengths in long-range power projection and network-enabled intelligence, surveillance, reconnaissance, and communications.[3] This procurement expansion has resulted in the People's Liberation Army (PLA) deploying a range of ballistic and cruise missiles, combined with long-range aviation, and a burgeoning submarine and surface naval force capable

[1] Oxenstierna and Westerlund (2013).

[2] See Heginbotham et al. (2015); Heath (2017); Colley and Cordesman (2015); Heath, Gunness, and Cooper (2016); Saunders et al. (2019).

[3] See Watts (2011), pp. 9-12. See also Watts (2013b), pp. 24-28; Office of the Secretary of Defense (2018a), pp. 59-64; Engstrom (2018), pp. 15-19. On the costs associated with China's military modernization program, see Robertson and Sin (2017). Recent analysis has alleged PRC efforts to bolster PLA modernization through a comprehensive effort to acquire foreign dual-use component technologies via its Military-Civil Fusion strategy. See Beaumelle, Spevack, and Thorne (2019) and Cheung and Hagt (2020). However, as this dissertation has contended, the key technologies that undergird contemporary qualitative military advantage are those related to systems engineering and the integration of component technologies into specialized systems-of-systems. As Gilli and Gilli have argued, the breadth and depth of technological requirements embodied in these integrated systems has likely remained a significant barrier to the diffusion of qualitative military capability. See Gilli and Gilli (2019).

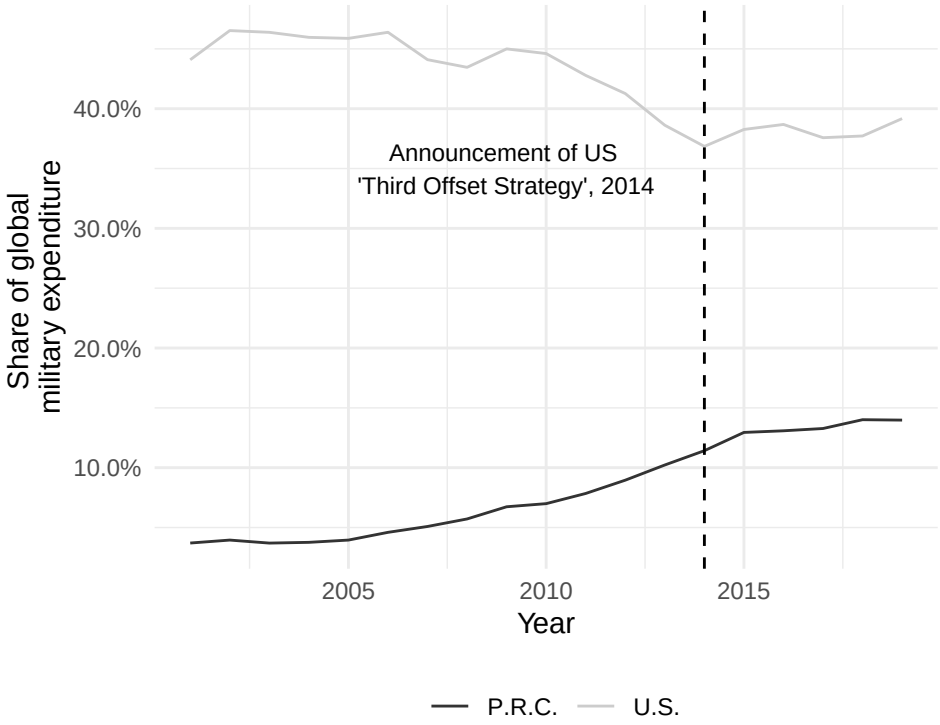

Figure 7.1: PRC versus US shares of military expenditure, 2001-2019. *Source: SIPRI (2020).*

of striking at forward-deployed US forces.[4] These weapons are increasingly enabled by space-based and terrestrial sensors, as well as modernized command, control, and communications systems.[5]

This expensive and expansive qualitative buildup of Chinese military power threatens to erode the United States' global strategic position, a point that has not been lost on US defense officials.[6] The result has been a counter-response from Washington, beginning with the 2011 announcement of the United States' 'pivot' of its global military posture towards Asia, but manifesting more clearly in procurement terms in the termination of US military spending cuts in 2014, and the November 2014 announcement of the 'Third Offset Strategy' (see Figure 7.1).[7] In line with the theory articulated in this dissertation, this response has been shaped by the still-dominant

[4]Office of the Secretary of Defense (2020b), pp.44-60.

[5]Easton and Stokes (2011); Heginbotham et al. (2015); Krepinevich (2015); Defense Intelligence Agency (2019).

[6]Heath and Thompson (2018). See also Office of the Secretary of Defense (2020a).

[7]Dombrowski (2015), pp. 5-6; Dian (2015).

structural position of existing US defense industrial suppliers, and the breadth of military technological requirements.

7.1.1 *US-PRC procurement dynamics*

For Washington, the PRC represents a uniquely difficult strategic opponent due to its comparable economic size and integration into global capitalist economy.[8] This offers Beijing the opportunity to not only match US investments in developing the breadth and depth of technological competencies necessary to produce modern weapon systems, but also to tap into global dual-use component supply chains in order to efficiently compete with the US defense industrial network.[9] It is this prospect of the PRC as a long-term strategic competitor with an equivalent ability to mobilize qualitative technological innovation that has led several analysts to conclude that Washington's long-running grand strategy of technology-driven predominance is now unsustainable.[10]

In particular, the PRC's maturing A2AD capabilities have generated deep debate regarding the future viability of key elements of US force structure. Two aspects of US force structure have attracted particular critical engagement: the current centering of US naval capabilities on a small number of large and highly-capable warships, and US reliance on a limited number of similarly bespoke space-based satellite platforms to collect and distribute information across its force structure. Analysts have questioned whether focusing procurement resources on these qualitatively exceptional platforms continues to make sense in light of rapidly evolving — and far cheaper — PLA A2AD

[8] Friedberg (2000), Chapter 9.

[9] This is facilitated by China's efforts to boost its centrality within international manufacturing, and its efforts to secure global market share in emerging dual-use industries. See Nouwens and Legarda (2018), pp. 5-6.

[10] See Layne (2014).

capabilities.[11] This has led to proposals for alternative force structure designs focused on procurement of less sophisticated, but more numerous assets that would more effectively distribute risk. For example, analysts of space security dynamics have contended that the commercial revolution in both launch capabilities and low-earth orbit satellite constellations affords an alternative model of intelligence, surveillance, reconnaissance and communications that could be both cheaper and more resilient.[12] In the case of US naval force structure, this debate has gone further, to posit a wholesale re-conceptualization of the US Navy to survive an era of maturing precision-strike 'systems of systems' that potentially allow for targeting of US fleets from beyond the range of naval aviation systems.[13] In both cases, researchers have posited that current force structure approaches potentially have significant implications not only for relative military capability, but also for crisis stability. Despite the innovative development of networked approaches to combining sensors, weapons, and command and control via the RMA, there are concerns that US military power increasingly risks sliding towards what Mary Kaldor termed a "baroque" order of battle centered on a handful of high-value platforms.[14] This potentially could incentivize adversaries to pursue first strike capabilities to annul US military advantages at the inception of hostilities.[15]

However, the theoretical framework I have laid out suggests that strong barriers exist within the US defense industrial network to impede a significant shift away from the current qualitative innovation focus that is the legacy of the Third Offset Strategy. In particular the increasing structural concentration of key prime defense contractors

[11] According to one broad estimate, "[e]xcluding cruise missiles versus surface ships (because it skews the results even more in favor of A2AD), the average cost of an A2AD capability is about one-fiftieth of the cost of the force-projection capability that it could neutralize in a combat operation." See Kelly, Gompert, and Long (2016), pp. 84-96.

[12] Finch and Steene (2011), p. 15; Hitchens and Chen (2008), p. 130.

[13] Clark and Walton (2019).

[14] Kaldor (1981).

[15] See Caverley and Dombrowski (2020), particularly pp. 682-683.

has entrenched their influence over procurement decisions. Since 2015 there have been a range of high profile US defense consolidations, including Lockheed Martin's acquisition of helicopter maker Sikorsky, United Technology Corporation's purchase of avionics manufacturer Rockwell Collins, Northrop Grumman's absorption of rocket producer Orbital ATK, and the merger of electronics giants Harris Corp and L3 Technologies[16] Indeed, consolidation of US defense producers is likely to continue in light of increasing technological requirements and the development costs associated with them (as well as the as yet unknown long-term implications of the COVID-19 pandemic). As a result, the structural influence of producers within the US defense industrial network is probably strengthening, and with it, support for ongoing qualitative innovation.

However, the United States is not alone in facing these structurally induced pressures. Dynamics within the PRC defense industrial network indicate strong parallels with the US experience of the structural implications of the increasing breadth and depth of military technological requirements, and with implications for PRC procurement capacity. Under President Xi Jinping, the PRC has undertaken reform of its defense industrial sector aimed at increasing efficiency and innovation capacity through corporatization and introduction of market-based procurement mechanisms.[17] These reforms have sought to encouraged greater participation by private sector entities as component suppliers to the key state-owned enterprises (SOEs) that dominate systems integration. This move could well improve technological transfer into the PRC defense industrial network. However, the ability of private firms to engage in contracting as systems integrator remains heavily constrained, posing effectively insurmountable entry barriers into the core of the defense sector. Exacerbating this has been substantial consolidation among defense SOEs. Analysts have argued that

[16]Harper (2021); Jacques and Bohan (2018).

[17]Kenneth Boutin, "Defence Technologies and Industrial Base" in Bitzinger and Nicu Popescu (2017), pp. 40-41.

the PRC's defense-industrial network was already overly consolidated, bolstering the power of SOEs that held dominated or monopsonistic positions.[18] As Tai Ming Cheung has observed,

> One of the biggest hurdles that PLA and civilian defense acquisition specialists point out is the defense industry's monopoly structure. Little competition exists to win major weapons systems and defense equipment because each of China's six defense industrial sectors is closed to outside competition and are dominated by a select handful state-owned defense corporations.[19]

Renewed consolidation has reversed limited moves from the late 1980s through to the mid-2000s that had seen the division of state monopoly arms producers into duopolies across key armament sectors. From 2008 onwards, the eleven large SOE defense producers dwindled to eight: most recently in November 2019 China's two naval systems integrators, China State Shipbuilding Corporation and China Shipbuilding Industry Corporation, were reunited as a single naval producer.[20]

The direction of travel in Beijing's reforms of the sector thus point to a further deterioration in the structural position of the state vis-à-vis producers. This is despite the efforts at political centralization pursued by President Xi. As analysts of PRC economic reform have argued, Xi is seeking to use consolidation to deepen control over the economy, as he has over wider Chinese society, creating clear conduits for centralized leadership to flow directly into SOE decision-making.[21] While these efforts are likely to result in an enduring centralized SOE structure, Beijing's capacity to exert central control over that structure is likely to be contingent on the particular

[18]Boyd, Lewis, and Pollack (2010), pp. 55-56; Raska and Bitzinger (2020), p. 94.
[19]Cheung (2018), p. 21.
[20]Nouwens (2020); Sarah Kirchberger and Johannes Mohr, "China's defence industry", in Kirchberger and Mohr (2020), pp. 35-68.
[21]See Leutert (2018).

constellation of political power under President Xi Jinping. There is no guarantee that this will persist into the next leadership generation. Viewed through the lens of the theoretical framework outlined in this dissertation, these developments suggest that over the long term the PRC leadership is likely to face a challenge to its defense industrial capacity from the reduction in its structural dominance vis-à-vis more powerful SOE defense producers. Overall, it is likely that the lack of appetite for serious structural reforms within the PRC defense industry has been compensated thus far by the magnitude of financial resources directed by Beijing to secure procurement of a world-class military, one that could provide an effective foil to the long-term threat to the survival of its regime posed by dominant US military power.[22] In the long term, this is likely to bolster the ability of those producers to assert their procurement interest in on-going qualitative military innovation within domestic PRC procurement plans.

This convergence of structural pressures for innovation in both the PRC and US defense industrial networks suggests the prospect of an emerging bilateral logic of competition between Beijing and Washington that is driven by internal 'arms wrestling' in their respective two-level games between producers and state customers. What then is the likely direction of this technological competition? One possibility is highlighted by the focus of both US and PRC planners on the potential paradigm-shaping impact of artificial intelligence (AI). In both countries, prominent advocates have contended that AI offers the potential to achieve new and resilient advantages in military capabilities for the country that is best able to implement it.[23] While US and PRC defense leaders have expressed concerns regarding the potential to be drawn into a qualitative arms race, the increasing push for AI development is increasingly attracting support

[22]Sarah Kirchberger and Johannes Mohr, "China's defence industry", in Kirchberger and Mohr (2020), pp. 35-68.

[23]This perspective has been captured in high-level strategic guidance issued by both countries. See Office of the Secretary of Defense (2018b); Xinhua News Agency (2017). See also Raska (2019).

from established and emerging defense producers.[24]

The United States has until recently been seen by both American and Chinese experts as holding an initial lead in AI and its military applications.[25] In 2016, the first victory of the US-developed AlphaGo AI over a human expert resonated in the PRC, catalyzing concerns that Beijing risked falling behind US leadership in AI.[26] This contributed to PRC efforts to drive the development of both civilian and military AI, dovetailing with Xi's push to accelerate "intelligentization" of the People's Liberation Army post-2017. These efforts in turn have sparked US concerns that it is at risk of losing its lead in this crucial emerging technology domain.

For both parties, the focus has been on not only the application of AI to develop autonomous weapon systems, but also utilizing AI to enhance the efficiency of data acquisition, transfer, and processing, as well as command and control.[27] As with the information technologies that undergirded the RMA, AI is an architectural technology. Indeed Michael Horowitz, Elsa Kania, Gregory Allen, and Paul Schare note that "AI is more akin to electricity or the combustion engine than a particular weapon, such as a nuclear device, or a particular platform, like a battleship."[28] Military-focused AI is viewed by both the US and PRC militaries as a specialized form of systems integration technology, an extension of the integrated sensor, processing, and targeting systems that underpinned the precision-guided revolution. In the case of AI, this innovation purports to extend the logic of that revolution by automating significant parts of the so-called 'sensor to shooter loop'. Again, in line with the precision-guidance revolution, military-focused AI integrates a range of dual-use component technologies: machine-learning algorithms, advanced computing and semiconductors, as well as data and processing capabilities, 5G and Internet-of-Things systems.

[24] Allen (2019), pp. 4-5.
[25] Michael C Horowitz (2018).
[26] Johnson (2019), p. 7; Michael C. Horowitz et al. (2018), p. 12.
[27] Michael C. Horowitz et al. (2018), pp. 13-14; Raska (2019).
[28] Michael C. Horowitz et al. (2018), p. 3

Ultimately, should AI prove to be paradigm-shifting systems technology, its strategic impact will rest on the relative ability of the United States and the PRC to exploit it efficiently. This will likely hinge on two factors. First, the historical cases analyzed in this dissertation suggest that strategic advantage is likely to pivot on the capacity of each state to effectively leverage their defense industrial networks to innovate in transforming civilian component technologies into military-specialized innovations. This will put the focus on the barriers to entry within the respective defense industrial networks that will govern the emergence of new systems integrators, or the capacity of existing players to reach out into the civilian marketplace. Second, the contest of strategic advantage in AI will be contingent on the capacity of both the US and the PRC to emulate each other's military-focused AI advances.[29] The barriers to this are likely to be significant, given that for the foreseeable future, AI algorithms will be 'narrow', focused on delivering specific tasks, and probably adapted to specific data-sources, sensors, and weapon systems.[30] At the same time, the development of these AI are likely to require extensive financial and human capital investments, as well as access to specialized — and sensitive — military data.[31] Both of these dynamics are likely to impose barriers to the diffusion of AI.

7.1.2 *US-PRC gatekeeper dynanmics*

US-PRC strategic competition and procurement dynamics also throw into relief the significance of gatekeeper capacity. Amid renewed great power competition and the resulting uptick in qualitative innovation, other countries are experiencing pressure to modernize their force structures to maintain strategic relevance. This is resulting in

[29]Johnson (2019), pp. 16-17.

[30]Michael C Horowitz (2018), p. 39. In contrast, 'general' AI would represent a flexible and adaptive form of artificial intelligence much more akin to human cognition. However, the technical pathway to achieving general AI is still speculative at this point.

[31]Lin-Greenberg (2020), pp. 62-63.

two significant dynamics. First, major second-tier military powers such as the United Kingdom and Japan are responding to this ongoing innovation by privileging pursuit of cutting edge weapons to maintain their own competitive standing. However, the wide breadth of military technological requirements, coupled with the limited scale of their own domestic defense industrial bases and the asset specificity of existing investments in U.S-derived military systems, is encouraging those states to deepen defense industrial ties with the United States.[32] This is likely to further increase dependence on Washington, and hence enhance the US ability to exert gatekeeper capacity to advance its strategic interests.

However, a second dynamic potentially cuts across this. For countries with less sophisticated military capabilities that are attempting to modernize within this competitive strategic environment, the PRC's own rapidly improving defense industrial capabilities offer an attractive alternative.[33] While generally judged by analysts as not being as qualitatively sophisticated as equivalent US systems, Beijing's military offerings can provide a significant boost to the quality of force structures in rapidly developing countries. As a result of this success, the PRC is increasing its global share of arms exports(see Figure 7.2).[34]

It is likely that the PRC's arms exports are detrimental to US strategic interests. As Beijing's global arms export relationships expand, strengthen, and in some cases are institutionalized, they provide the PRC with its own gatekeeper capacity. In particular, these arms sales support Beijing's broader push to expand its influence among developing countries.[35] While it is likely that China's capacity to utilize arms trading ties to advance its strategic interests still significantly lags that of the US

[32]Louth and Moelling (2016), pp.8-9.

[33]Office of the Secretary of Defense (2018a), p.23.

[34]See Stockholm International Peace Research Institute (2015). See also Caverley and Kapstein (2016). Significantly, the data suggests that this rise in market share is coming at least in the short term at the expense of Russia, not the United States. Raska and Bitzinger (2020), p.107.

[35]Li and Matthews (2017), p. 9

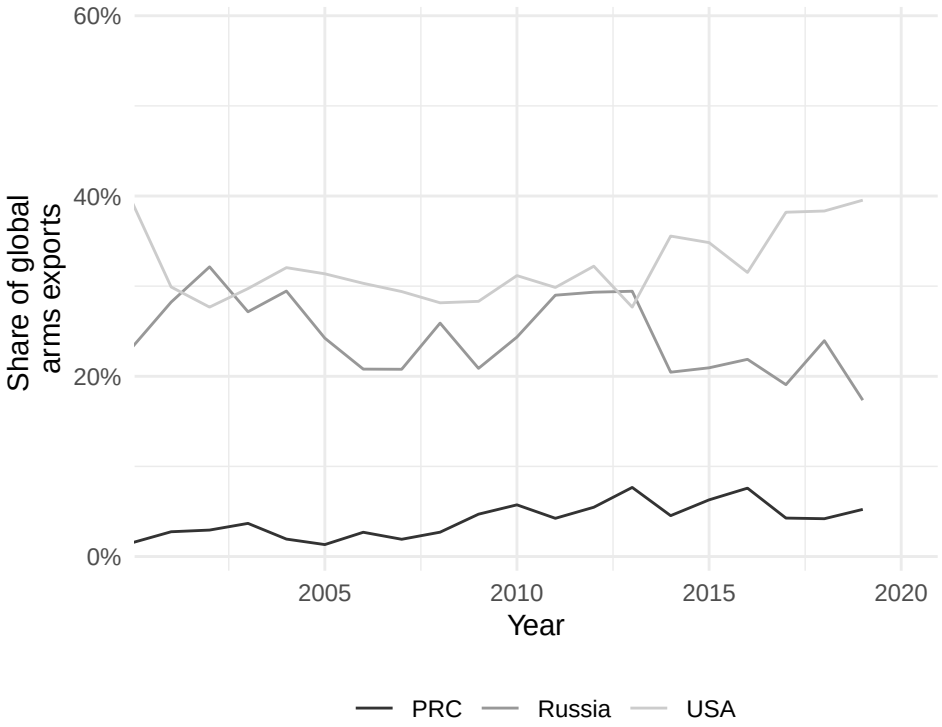

Figure 7.2: PRC versus US and Russian shares of global military exports, 1989-2019. *Source: SIPRI (2020).*

worldwide, it is probably becoming a more significant factor in the security dynamics of specific regions, such as Southeast Asia, South Asia, and Africa.[36] Indeed, 2/3rds of African militaries now operate PRC supplied military equipment.[37] China's arms sales also appear orientated to altering the strategic balance in specific regions. As Ling Li and Ron Matthews note, "[i]t is no accident that China's arms sales to Pakistan, Sri Lanka, Bangladesh and Myanmar have carried the important additional impact of containing the emerging threat of Asia's other mega-power, India."[38] These countries also sit adjacent to Beijing's key energy lifelines to the Middle East. Altering the military balance in favour of partners along this route offers the potential to reduce the P.R.C's own military requirements in the region, while smoothing geo-economic access to the region.[39]

[36]Yang (2020)
[37]Li and Matthews (2017), p. 3.
[38]Li and Matthews (2017), p. 10.
[39]Raska and Bitzinger (2020), p. 109.

Currently, despite strong growth, Beijing's arms exports lag behind those of the US. Over the long-term however, the growth in PRC arms exports is likely to put greater pressure on US dominance. This will become particularly acute as Chinese arms firms offer progressively more advanced systems for international export. As the qualitative gap between US and PRC weapon systems narrows, the price advantage of Chinese systems (a function primarily of lower labor costs) could threaten to disrupt Washington's structural position.[40] Arms importers may decide that these price advantages allow them to gain a greater number of sufficiently sophisticated systems with their scarce procurement funds, effectively striking a more advantageous balance of force structure quantity and quality from the perspective of overall military capability. Such an eventuality could rapidly alter the defense industrial and strategic situation both in the Indo-Pacific, and beyond.

7.2 *Insights regarding the nature and significance of technological change*

In addition to contributing to the understanding of contemporary and historical strategic dynamics, this dissertation also has implications for the wider debate on how technology is treated both theoretically in the academic study of international relations, and in the practitioner's conduct of strategic analysis. My contention — as embodied in the theoretical framework of this dissertation — is that technology has systematic and autonomous implications for states and producers. On the one hand, it shapes the military balance of power, and companies' commercial interests. And on the the other, the breadth and depth of military-required technologies define the potential for emulation, and hence the strategic implications of innovation.

This framing of technology may attract criticism on the grounds that it represents a form of hard technological determinism, i.e. in which technological change represents

[40] Caverley and Kapstein (2012); Caverley and Kapstein (2016), pp. 172-173.

an immutable force that recasts social relations.[41] In contrast, the constructivist approach towards technology studies emphasizes the obverse relationship: that specific technologies are socially-shaped. According to this perspective, specific technologies are a product of states and firms pursuing varying degrees of innovation based on their interests. Technological innovation is not merely remorseless: it is driven by the agency of actors, or their reticence. This analysis has frequently been applied to the military realm. As John Ellis has argued, adoption of specific weapons innovations have often been shaped by the beliefs of military elites regarding the nature of warfare.[42]

Yet, this explanatory tension is necessary only if the two approaches are held to be necessarily opposed, with resolution only possible through recognition of the universal explanatory superiority of one over the other.[43] The theoretical framework of this dissertation starts from a more pragmatic stance: that the relationship between technology and actors is not uni-causal and fixed in the abstract in one direction or the other. Rather, the specific relationship that is emphasized in any one theory is tied to the particular questions it is seeking to analyze. My theoretical framework takes a deterministic line because the questions I seek to address, are centered on the nature and trajectory of state capacity in the context of strategic competition, rather than the origin of specific technologies. Consequently, my approach describes a 'soft' deterministic relationship between technology and agency, in line with what Philip Scranton described as a "local determination", in which the nature of that determination is bound by the specific dynamics of interest.[44] Doing so allows me to focus on the interaction of technology with a second key variable — defense industry structure

[41] See Marx and Smith (1994), p. xii.

[42] Ellis (1975), pp. 16-17.

[43] As the literature in adjacent disciplines such as organizational studies has noted, there tends to be "pendulum swing" between determinism and social-construction in the treatment of technology that speaks more to the internal dynamics of the discipline than the subject matter. See Leonardi and Barley (2010).

[44] Scranton (1995), p.S37

— in order to articulate a crucial causal pathway to strategic outcomes. To put it simply, my stance is not that technology is actually and necessarily autonomous from social process; but rather that the distinct causal contribution of technology to strategic dynamics is significant and worthy of direct analytic focus, within the bounded context of the defense sector and international strategic competition.[45]

More broadly, I also frame the scope conditions of my study into the relationship between technological and political change as contingent on the level of analysis. This dissertation approaches military technology at the macro level i.e., it focuses on the systematic characteristics of that technology, in terms of what Allan Defoe has defined as "technological trends": the cumulative and aggregate nature of the technology within systems, rather than the specific manifestation of it as an artifact.[46] In my account, this results in a focus on the autonomous trajectory of the full breadth and depth of military technological requirements necessary to generate the systems of weapons that began to emerge through the industrial revolution. At this level of analysis, it can be credibly argued that technology change exhibits deterministic and cumulative characteristics, most significantly, the progressive and on-going expansion in the range and depth of military-required technologies, and the concomitant pressure to integrate them.

None of this is to deny that organizations and individuals shape the specific technologies pursued at any one time. These dynamics are vital in the analysis of the origins and significance of specific military technological choices, and their particular realization in the form of concrete artifacts of weapons and supporting infrastructure. They are also dynamics about which this dissertation's framework has little to say. By focusing on the shaping role of technology, I am making conscious trade offs in my analytic focus. However, I believe this is justified because of the insight it provides

[45]Walker (1985).
[46]Dafoe (2015), p.6

into the constraints on firm and producer behavior, and the strategic path dependencies this gives rise to. It is a core contention of this dissertation that significant insights into strategic dynamics and trajectories can be developed by exploring the implications of macro-technological dynamics like the breadth and depth of military technological requirements. Ignoring these macro dynamics — and their autonomous impact — divorces specific analyses of technological decisions from their crucial context.

7.3 *Potential extensions*

This dissertation has clear applicability to interrogating contemporary dynamics. However, there is also significant scope for theoretical elaboration and further empirical extension, across time and across political-economic systems.

First, there is scope to further test the application of this framework beyond the experience of dominant powers of recent modern history. This dissertation has sought to provide a theoretical framework articulating the relationship of defense industrial structure and the breadth and depth of military technological requirements to defense industrial capacity. However, the empirical cases explored in this dissertation have focused solely on so-called great powers, occupying the apex of the international security system and global defense industrial network. Consequently, this suggests scope to apply this mid-level theory to the analysis of other cases, such as the experience of France and post-Second World War Germany. There is also likely to be value in applying this framework to analyzing the experiences of middle powers with more limited defense industrial capacity, such as Australia, Sweden, and Canada. These cases are amenable to a similar process of analysis: exploring the implications of defense industrial structure and the scale of technological requirements for procurement choices in the face of a changing international security environment, and their capacity to

harness external defense industrial relationships to advance their strategic interests. The key shift would be one of conceptual focus: to view defense industrial capacity as a defensive approach to the maintenance of autonomy, as opposed to a well-spring of external influence.

Second, there is significant potential to build on the foundation laid in this dissertation to explore the defense industrial capacity of a wider range of global powers. With the exception of the vignette on the PRC provided in this final chapter, the empirical evaluation of the theoretical framework has focused on capitalist democracies during the industrial and post-industrial period of the last century and a half. As noted in Chapter 1, this has allowed for evaluation to limit variation on variables such as relative levels of economic development and political and economic institutions. However, there is no barrier in principle to extending this analysis to non-capitalist and autocratic countries, so long as due regard is paid to the institutional foundations of defense industrial relationships, and their implications for the particular fashion in which influence manifests between producers and customers. There is already a substantial research agenda on the political-economy of defense industries in both socialist command economies such as the Soviet Union, and capitalist autocracies such as the PRC.[47] Much of this research has focused on explaining the institutional evolution of these defense industrial networks, and the implications for their productivity and capacity for innovation. Little work has been done on addressing the key questions that have motivated this dissertation and its research framework: to what extent the structure of defense industrial networks within these different political-economies affect the state's ability to shape procurement priorities under varying technological conditions, and whether this generates variation in the capacity of the state to leverage its external defense industrial ties for national strategic benefit.

[47]See for example Yang (2020); Bitzinger (2015); Oxenstierna and Westerlund (2013); Reppy (2000b).

A further potential extension of the model outlined in this dissertation would seek to engage with micro-level foundations of specific technological choices. As articulated above, the macro-level influence of technology and strategy co-exists with micro-level shaping of technology by the social choices of actors. Greater effort can be made to link the two theoretically, ameliorating the concerns of technological determinism, while offering a coherent explanation of the reciprocal causality that links structures of technologies to agent-shaping of specific technologies.

7.4 *Conclusion*

This dissertation has provided a theoretical framework for assessing the strategic significance of state defense industrial capacity. The plausibility of this framework, and its relevance to contemporary strategic considerations surrounding US-China competition, indicate the utility of a more systematic assessment of its applicability, and the potential for further theoretical elaboration. This underscores the importance of ongoing efforts to center the study of defense industrial activities within both academic international relations research, and foreign and defense policy-making.

CHAPTER 8

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