Dual-Use Security Dilemma and the U.S.-China AI Technology Race

Chun Hey Brian Kot

Thesis submitted in partial fulfilment of the requirements for the degree of MPhil in International Relations at the Department of Politics and International Relations at the University of Oxford

May 2025

Word Count: 29,926

Abstract

What is driving the U.S.-China race to develop artificial intelligence (AI)? Building on defensive realism, this thesis introduces the concept of dual-use distinguishability—how easily a state can differentiate between a technology's military and civilian applications—to explain the dynamics of technological rivalry. Low distinguishability makes it harder for foreign states to differentiate between benign and malign uses of technologies, prompting them to adopt competitive actions to secure themselves against potential military action. While existing literature focuses on how technical features obscure a technology's end use, this thesis identifies two additional sources of ambiguity arising from a state's political economy. *State-business relations* describe the degree to which private interests are subordinate to state objectives. The more subordinate private firms are to the state, the more susceptible they are to government pressures to divert technologies to military use. *Civil-military integration* refers to the extent to which civilian and military industrial bases are mutually beneficial. The more integrated the civilian and military sectors, the likelier dual-use technologies in the civilian sector will find military applications. Through the methodology of process tracing and case study, the thesis accomplishes two objectives. First, it establishes country-level distinguishability as a tractable, observable feature of China's political economy. Secondly, it shows how variations in Chinese distinguishability have shaped U.S. threat assessments and export control policies since the 1990s. In achieving these, this thesis advances the debate by adding politico-economic dimensions to the predominantly techno-centric notion of the dual-use security dilemma.

Keywords: artificial intelligence, arms race, technology competition, security dilemma, dual use, distinguishability, state-business relations, civil-military integration, export controls, U.S.-China

Table of Contents

List of Abbreviations

AGI ..... Artificial General Intelligence
AI ..... artificial intelligence
CMI ..... civil-military integration
LLMs ..... large-language models
MCF ..... military-civil fusion
PLA ..... People's Liberation Army
PRC ..... People's Republic of China
RMA ..... Revolution in Military Affairs
SEZ ..... Special Economic Zone
WMDs ..... Weapons of Mass Destruction

List of Figures

List of Tables

Chapter 1

Introduction

The U.S.-China artificial intelligence (AI) competition escalated on October 7, 2022, when the United States enacted a policy that significantly restricts U.S. companies' export of advanced computing and semiconductor manufacturing items to China.[1] These technologies provide the crucial computing power for training advanced AI models. In the words of expert Gregory C. Allen, U.S. restrictions on these items are designed to "choke off China's access to the future of AI."[2] Observers were quick to note the tremendous anticipated economic costs to China. As one analyst puts it, without these advanced AI chips, "[Chinese companies] are basically going back to the Stone Age."[3] Another analyst believes that the economic costs will be "well out of proportion to Washington's cited military and intelligence concerns," arguing that new export controls were designed to "openly block China's path to become an advanced economic peer."[4] A semiconductor industry expert told the New York Times, "If you'd told me about these rules five years ago, I would've told you that's an act of war—we'd have to be at war."[5]

U.S. officials, however, have tended to downplay the economic implications of the October 7 controls, insisting that their rationale was to hinder China's military ambitions. The U.S. Department of Commerce, which is responsible for the export controls for dual-use items, justified the new controls by citing that the restricted items have facilitated China's military modernization efforts, including the development of weapons of mass destruction (WMDs). For

[1] U.S. Department of Commerce 2022
[2] Allen 2022
[3] Alden 2022
[4] Bateman 2022
[5] Palmer 2023

instance, the People's Liberation Army (PLA) has used supercomputers to "improve calculations in weapons design and testing including for WMD, such as nuclear weapons, hypersonics and other advanced missile systems, and to analyze battlefield effects."[6] U.S. Secretary of Commerce Gina Raimondo explained in November 2022 that the U.S. measures were aimed at undermining China's military capacity, "not seeking a decoupling from China."[7] In a major policy speech in April 2023, U.S. Treasury Secretary Janet Yellen reiterated that while it was "vital" to limit the Chinese military's access to certain technologies, the export controls were "not designed…to stifle China's economic and technological modernisation."[8]

These duelling perspectives highlight the complexities and ambiguities of the international politics of dual-use technologies, i.e., technologies that can be used for both civilian and military purposes. If we were to believe the U.S. officials' words that the export controls were nothing more than legitimate security-seeking behaviour targeting the Chinese military, how did the United States end up pursuing, as some would perceive, a disproportionate act of economic war? On the flip side, what role did China play in escalating the technology decoupling with the West? Was it an innocent victim unfairly targeted by discriminatory U.S. restrictions, or did its past policies contribute to a destabilizing dynamic?

Beyond the U.S.-China "chip war", it is crucial to explore how the dual-use nature of technology impacts international relations by complicating how states perceive each another's intentions and actions, especially as more and more technologies are portrayed in the media as the "latest front[s]" in the global race for technology leadership.[9] Emerging technologies—radically novel and fast-growing technologies with the potential to significantly impact social, political, and economic domains—are already characterised by great uncertainty and ambiguity over its ultimate impact.[10] The dual-use character of these emerging technologies adds an extra layer of ambiguity over its eventual impact on international security, fuelling anxiety and fear

[6] "Implementation of Additional Export Controls: Certain Advanced Computing and Semiconductor Manufacturing Items; Supercomputer and Semiconductor End Use; Entity List Modification" 2022
[7] Shepardson 2022
[8] Shepardson 2022
[9] Hui 2024
[10] Rotolo, Hicks, and Martin 2015

among states. How might a state tell if another state wants to deploy a technology for civilian or military purposes? What are the consequences if a state could not confidently distinguish between another state's peaceful and military intentions? How do the uncertainty and ambiguity surrounding emerging technologies complicate interstate dynamics in technological development?

Understanding the drivers of dual-use technological competition can help policymakers to promote technological innovations to meet today's urgent challenges without triggering destabilizing cycles of competition between states. Intense competition over technology not only strains international relations, but it can also derail important international conversations on mitigating AI risks.[11] For instance, competitive pressure might prompt states to deploy untested AI weapons on the battlefield, raising important ethical concerns such as an increase in the risk of inadvertent escalation and the risk of harming civilians.[12] Understanding the causes of technology competition is key to reducing international tensions surrounding technology development, facilitating dialogue on safety issues surrounding emerging technologies' use, preventing the possibility of great power conflicts, and promoting international science and technology exchange.

Main Argument

To guide the inquiry, my research addresses the question, **what is driving the U.S.-China AI race?** This thesis builds upon the concept of security dilemma to explain the dynamics of the AI competition. A security dilemma occurs when one state's effort to increase its own security inadvertently endangers another state's security.[13] Dual-use distinguishability—how easily a state can differentiate between a technology's military and civilian applications—modifies the security dilemma by creating an extra layer of how states perceive others' intentions with technological capabilities. Low distinguishability means that states cannot reliably ascertain others' peaceful intentions with dual-use technologies, increasing their fear and anxiety and driving competitive behaviour.

[11] Puscas 2023
[12] Canca 2023
[13] Jervis 1978

My central argument is that distinguishability is determined by not only the technical characteristics of a particular technology, but also the political economy of the country possessing dual-use technologies. *State-business* and *civil-military* relations are two important dimensions of country-level distinguishability. The former refers to the degree to which private interests are subordinate to state objectives, while the latter refers to the extent to which civilian and military industrial bases are interwoven. The more deeply intertwined state and business sectors are, the harder it becomes for foreign observers to distinguish between benign and malign uses of dual-use technologies. The same applies to civilian and military sectors: the greater the degree of civil-military integration (CMI) in a country's defense-industrial base, the more difficult it is to differentiate civil and military uses. Together, these two dimensions affect foreign threat perception toward a country's possession of dual-use capabilities, modifying the intensity of the technological competition.

Through a case study of U.S. export controls against China, I demonstrate that the United States' threat perception toward China's technological capabilities was influenced in part by its perception of China's distinguishability. Since the 1990s, the United States has had a policy of approving exports of dual-use items for civilian end-uses but denying exports that will directly and significantly enhance Chinese military capabilities. However, as China's state-business and civil-military distinguishability becomes more difficult to establish, the U.S. government is increasingly finding the policy of end-use distinction untenable. In recent years, Xi Jinping's policies to integrate various segments of Chinese society for national security purposes have only created extra ambiguities, prompting U.S. export controls to abandon the more targeted end-user approach in favour of a country-wide restriction on advanced technologies required for China's military modernisation. The United States' shift from a targeted approach to a more indiscriminate export control policy toward China has been a major vector of escalation in the U.S.-China AI competition.

This thesis advances the literature and public discourse in three ways. First, it expands the literature's understanding of dual-use distinguishability beyond its current technocentric focus. Drawing from the literature on comparative political economy, I provide a novel

operationalisation of the civil-military integration and state-business relations. The addition of country-level variable helps us avoid the pitfalls of techno-determinism, recognising that states do not perceive a technology in isolation—they assess where a technology fits within other states' political economy to determine the likelihood that the technology will be weaponised. By demonstrating the relevance of political-economic factors, my thesis offers a useful corrective to the current techno-centric discourse. The U.S.-China AI competition is not only, or even primarily, about the AI's technical capabilities and its associated strategic payoff; it is also a story of perception and misperception about one another's ambition and ability to coordinate societal resources to achieve strategic goals.

Second, this thesis validates the expanded conceptualisation of distinguishability and its causal relevance via case study and process tracing methods. Tracing the evolution of Chinese civil-military integration and state-business relations, I establish country-level distinguishability as a tractable, observable feature of China's political economy. China's military-industrial complex has evolved significantly from its Maoist past, in which defense requirements dominated economic production priorities, to its present form characterised by a highly integrated system blending multiple sectors of the Chinese economy. Its economy has also come a long way from a planned economy during the Mao era to a form of "state-permeated capitalism", in which the state uses a variety of formal and informal methods to promote, supervise, and direct state and private capital to achieve its strategic objectives.[14] I demonstrate the effect of distinguishability on the restrictiveness of U.S. technology export control, which has been a main source of tension between the United States and China. As more and more Chinese entities are believed to be linked to the PLA, the United States have consequently increased the dual-use trade restrictions against Chinese technology firms.

Third, my case study adds historical depth to the current discourse around the U.S.-China AI competition. Due to the novelty of AI technologies, analysts often focus on a more immediate timeframe when explaining the causes of the AI race. For instance, some might trace the origin of the Chinese frenzy for frontier AI models to the release of ChatGPT in November 2022. Impressed by the capabilities of OpenAI's significant AI chatbot, the Chinese tech firms

[14] Nölke et al. 2019

scrambled to provide domestic alternatives, pouring massive resources into catching up to their U.S. counterparts.[15] Others might trace the AI competition's beginning back to the United States' Third Offset strategy around 2014, when the United States decided to widen its technological superiority to counteract Russia's and China's increased military capabilities.[16] This thesis shows that the destabilising dynamics in the U.S.-China technology relations can be attributed to the 1990s, when a confluence of historical events propelled distinguishability as a salient variable in U.S. dual-use trade policy vis-à-vis China. This thesis also illustrates the deep historical roots shaping China's distinguishability today. By historicizing China's political economy trajectory, this thesis provides the critical contexts for interpreting China's current system.

Given this thesis's methodological limitations, my argument should be interpreted with caution. Its greatest drawback includes its reliance on a single case study approach, which undermines my theory's external validity. The single case study approach risks introducing bias into my conceptualisation of dual-use distinguishability, including the false dichotomies between liberal market economy (supposedly exemplified by the United States) and state capitalism (typified by China). Similarly, the relationship between civilian and military economic activities is complex, multifaceted, and dynamic, resisting simple characterizations of degree of civil-military integration. Despite these drawbacks, my thesis still provides a useful clarification of an analytic frame widely employed by U.S. policymakers to understand China. By articulating the logic of distinguishability and the security dilemma, this thesis seeks not to naturalise the discourse's legitimacy but to render them amenable to a more critical reading.

This thesis is structured as follows. The remainder of this chapter defends the framing of U.S.-China AI competition. Chapter 2 reviews existing explanations of this rivalry and identifies defensive realism as the theoretical framework offering the most useful and actionable insights into its underlying logic. Chapter 3 introduces the core theoretical argument, elaborating the concept of dual-use distinguishability and its relevance to the security dilemma associated with emerging technologies. It also outlines the methodological and intellectual approach that underpins the study and presents the empirical strategy. Chapter 4 operationalizes the

[15] Biever 2024
[16] Gentile et al. 2021

independent variable—dual-use distinguishability—through a case study of China, with two subsections analyzing the evolution of state-business relations and civil-military integration, respectively. Chapter 5 turns to the United States, examining how China's distinguishability has shaped the U.S. export control regime. Chapter 6 concludes by synthesizing the empirical findings, addressing potential limitations, and discussing the broader implications for both scholarly debates and policy.

Is an "AI Arms Race" Underway?

Public discourse often characterizes the pattern of global AI development as an "AI arms race"; the term is so popular that it even has a dedicated Wikipedia page.[17] But the academic literature has been less enthusiastic about the arms race framing; some might even dispute the existence of an AI arms race and hence the premise of this thesis. This section will defend viewing global AI development through the lens of interstate competition. Although neither the U.S. nor China is spending abnormal rates of military expenditure on developing AI-enabled weapons, they are nonetheless engaged in a race to outcompete each other in developing and deploying AI technology across sectors of their economies. The "AI arms race" does *not* denote a competition to build more AI-enabled armament than one's adversary; rather, "arms race" is used as a metaphor, albeit an imperfect one, to describe the destabilising, strategic interaction between states in developing and deploying AI technologies fuelled by mutual threat perception.

It is important to distinguish between two senses of the "AI arms race" framing because they are subject to different criticisms. In the narrower sense, an arms race can be defined as "the participation of two or more states in competitive, or interactive attempts to increase the quantity or quality of war material and persons under arms."[18] In the broader sense, "arms race" can be viewed as a metaphor for the competitive dynamics of global AI development in general, including but not limited to lethal autonomous weapons systems; "arms race" is but a metaphor for the competitive dynamics fuelled by the perceived threat of falling behind a competitor.

[17] "Artificial Intelligence Arms Race" 2024
[18] Sarkin and Sotoudehfar 2024

On the surface, the narrow AI-arms race framing appears reasonable because states are already developing and deploying weapons with varying degrees of autonomy. The majority of AI-enabled weapons currently deployed or developed have automated or autonomous features in their critical functions; by one figure, at least 30 countries deploy air and missile defence systems that have autonomous modes.[19] Other weapons systems—such as anti-personnel sentry weapons, combat air/ground/surface vehicles, guided munitions, loitering munitions—incorporate a spectrum of machine autonomy to perform critical tasks.[20] Observing aggressive efforts by armed forces around the world to integrate AI systems and technologies in their arsenals, Michael Raska and Richard Bitzinger conclude that an AI-driven "military-technology tsunami" is on the way.[21]

Among non-warring states, evidence for the existence of an AI arms race seems muted. Paul Scharre argues that what distinguishes an arms race from military modernisation is that in the former, there are abnormal rates of growth in the military expenditure of two or more nations.[22] Classic examples include the Anglo-German naval arms race prior to the First World War and the U.S.-Soviet arms race during the Cold War, both of which resulted in spiralling defence spending with little to no net gain in relative advantage over the other. AI military spending, Scharre argues, does not match that level of expenditure. Crude estimates of defence spending suggest that military AI investments are far below the levels constituting an arms race.[23] This applies to the United States and China, commonly highlighted as countries that are most intensely pursuing the AI arms race. While their respective militaries are aggressively pursuing digital modernisation, it is an overstatement to claim that they are devoting exorbitant sums specifically to developing AI-enabled weapons.

While Scharre disapproves of the notion that countries are racing to build AI defence systems, he recognizes that "[n]ations may very well be in a *technology race* to adopt AI across a range of industries."[24] In fact, this appears to be the common position among experts and

[19] Scharre 2024
[20] Bode and Huelss 2022, 18
[21] Raska and Bitzinger 2023
[22] Scharre 2021
[23] Scharre 2021
[24] Scharre 2021; emphasis added

analysts in Washington: although countries do not appear to invest abnormally large funds in building AI-enabled weapons, major powers (including the United States and China) are competing to lead in the development and adoption of AI technology in broad sectors of their economy.[25] In fact, a wide range of nations beyond traditional great powers are rushing to enhance their AI competitiveness through a spate of policy instruments. The Organisation for Economic Cooperation and Development (OECD) identifies over 1000 AI policy initiatives from 69 countries spanning across all continents of the world.[26] A 2020 review of 34 national strategies around the world concludes that "Nations are poised to invest significant public resources in AI systems, and the AI arms race is well underway."[27] The broad conception of the AI arms-race as a metaphor to describe the intense, competitive dynamics is appropriate for describing the global landscape of AI development.

There are objections to using the "arms race" analogy, even in its broad, metaphoric sense. For instance, Justin Sherman's 2019 essay argues that the arms race framing "fundamentally misunderstands the transnational nature of AI development and technological interdependence."[28] The analogy, he argues, ignores the fact that "AI is developed by a vast community of scientists, developers, and researchers who are not isolated within their respective countries."[29] This line of critique is repeated in Jeffrey Ding's view of the shortcomings of techno-nationalism as an interpretive frame[30]; the "arms race" perspective, both scholars contend, centres the nation-state as the primary actor in AI development, downplaying the extent to which interdependence and transnational cooperation have shaped the trajectory of AI research and development in both the U.S. and China.

While critics are right to point out the significance of transnational flows of expertise and knowledge to global AI research, this line of criticism underestimates the state's role in shaping the landscape of interdependence in the first place. As evidenced by the increasing weaponization of global economic flows and the return of economic nationalism in recent years,

[25] National Security Commission on Artificial Intelligence 2021
[26] "OECD's Live Repository of AI Strategies & Policies" n.d.
[27] Fatima, Desouza, and Dawson 2020
[28] Sherman 2019
[29] Sherman 2019
[30] Ding 2022

states are increasingly reasserting control over key aspects of international economic flows after decades of unfettered globalization.[31] Regarding AI development, states remain highly relevant and powerful in shaping incentives and governing the various inputs and outputs of AI. For instance, state-led industrial policies can significantly alter and even reverse the globalised landscape of AI development. While non-state actors such as technology companies and academia remain at the forefront of technology research and development, they are often incentivised and sometimes forced to respond to government policies, proving the relevance of state actors in AI competition.

Sherman's second objection is that "the arms race framing often prompts discussion of artificial intelligence as a single technology." Today's commentators largely use AI to refer to machine learning, through which computing power is used to execute algorithms to derive insights and identify patterns from data.[32] Even if the basic premise is relatively straightforward and coherent, this conception of AI, Sherman argues, belies a range of applications and use cases that require vastly different data models trained on different datasets and algorithms. Hence, relying on this general technology category risks creating underspecified and vague strategies and policies.

The assumption this criticism is that AI is best characterised by its functionality or capability (what the machine performs). However, there is no consensus that a capability-based framing is appropriate in all contexts. Even within the technical AI research community, there has been a lack of definitional consensus. A review of major textbooks about AI published between 1978 and 1993 finds that "AI" has been defined in at least four ways: systems that 1) think like humans, 2) act like humans, 3) think rationally, or 4) act rationally.[33] Divergent definitions occur outside the AI research community as well. A 2020 survey finds that "while AI researchers favor definitions of AI that emphasize technical functionality, policy-makers instead use definitions that compare systems to human thinking and behavior."[34]

[31] Farrell and Newman 2023
[32] Buchanan 2020
[33] Russell and Norvig 2016
[34] Krafft et al. 2020

When it comes to policymaking, a human-based conception of AI has certain benefits. It enables policymakers to safeguard policies against the constantly evolving characteristics of AI and to account for the full range of possible future social consequences. Forgoing a precise definition of AI in favour of a focus on the impacts of AI systems can lead to a more "future-proof" instrument that is less likely to need to be updated as technology evolves.[35] Each regulatory agency can then create more precise definitions of AI based on the local context and its mandate. A single, universal definition of AI is not strictly necessary for creating sensible policies. With careful thought, policymakers can still outline parameters to achieve their policy goals.

Furthermore, as general-purpose artificial intelligence takes the spotlight in the U.S.-China competition, it has become less useful to conceive of AI according to its functionalities. Foundation models—large, machine learning models trained on vast amounts of data—such as the ones that power U.S. company OpenAI's ChatGPT or Chinese firm DeepSeek's V-3 can be used for a variety of purposes. These models are evaluated on the basis not of its capability to perform specific tasks, but of its ability to adapt to wide-ranging contexts robustly. The White House's October 2024 AI National Security Memorandum, for instance, focuses squarely on frontier AI models, or "general-purpose AI system near the cutting-edge of performance," indicating that policymakers are more concerned about advancing general-purpose AI than regulating AI with specific use cases.[36] Since the strategic implications of AI adoption and innovation are only beginning to emerge, it is sensible for governments to adopt a broader, more future-proof conception of AI, rather than build strategies around a precise definition of AI that might become less relevant as the technology evolves.

In summary, the broad "AI arms race" framing illustrates a general competitive dynamic between states in harnessing AI's transformational potential. While the metaphor is imperfect and comes with the baggage of connoting Cold War-style, militaristic competition, the state-centric framing still provides useful analytic insights. First, it acknowledges the states' importance in shaping the trajectories of AI development through policy instruments and

[35] O'Shaughnessy 2022
[36] The White House 2024

resource mobilisation. This recognition is particularly important as analysts increasingly observe a return of great power competition in contemporary global politics. Second, this framing encapsulates the competitive dynamic between states that stem from their mutual threat perception. The "arms race" framing evokes a strong sense of mutual insecurity stemming from traditional understandings of security. If we acknowledge that the source and nature of such insecurity have evolved beyond pure militaristic terms—to encompass, for example, modern conceptions of economic security[37]—the "AI arms race" can aptly describe the actions that states take due to their perceived insecurity of falling behind their peers in developing AI technology.

[37] Bulman 2021

Chapter 2

Literature Review

This chapter assesses the potential causes of the U.S.-China AI race. Rational explanations focus on the strategic potential of new technology, but disagree on why states want power in the first place and the implications of competition. Non-rational explanations are sceptical of drawing a straightforward relationship between AI's strategic potential and competitive behaviour. The *domestic politics* argument explains states' competitive behaviour in terms of internal, domestic interests. The *constructivist* argument focuses on the social construction of AI's strategic value, examining how social interactions and discursive practices can render certain policies rational.

This literature review aims to identify the most promising avenue for further research. I contend that the defensive realist argument—if integrated with constructivist contributions—offers the most useful and actionable insights about the logic of U.S.-China AI competition. Based on the insights derived from the literature review, the subsequent chapter will develop my theoretical contribution in greater detail. Due to the nascency and evolving nature of interstate AI competition, there is a dearth of credible empirical research on the topic. I draw my conclusion based on not just the theories' empirical soundness but also their promise in prescribing sound policymaking, analysing their logical and normative implications.

AI and Power

Rational explanations of AI competition usually begin with the premise that AI is an important strategic asset. States perceive AI as crucial for achieving a "decisive military advantage" over potential adversaries.[38] One of AI's most valuable contributions is in empowering commanders to make better and faster decisions.[39] AI's ability to integrate data

[38] Katzke and Futerman 2024

[39] "Lt. Gen. Jack Shanahan Media Briefing on A.I.-Related Initiatives within the Department Of" n.d.

from different battlefield sensors is a central enabler of new warfighting concepts emphasising joint-domain operations. The U.S. Department of Defense's Joint All-Domain Command and Control (JADC2) strategy, for instance, aims to connect sensors from all of the military services—Air Force, Army, Marine Corps, Navy, and Space Force—into a single network. It aims to use artificial intelligence algorithms to process the data to identify target and then recommending the optimal weapon to engage the target.[40] With increased clarity of the operational picture thanks to AI, soldiers are equipped with greater situational awareness and are empowered to execute their mission with greater confidence and initiative.[41]

As the National Security Commission on AI notes, AI can potentially be applied and integrated in "every facet of warfighting", impacting "every domain from undersea to outer space, as well as in cyberspace and along the electromagnetic spectrum."[42] It is difficult to anticipate the full range of military advantages resulting from the use of AI, as AI's general-purpose nature will likely transform military effectiveness in broad, delayed, and indirect ways.[43] What's clear is that AI is widely believed to have the potential to upset the military balance of power, generating pressures for militaries around the world to acquire and adopt AI technologies in their arsenals.

Over a long time horizon, AI's contribution to *economic power* is potentially more salient to strategic competition than its contribution to military power. Economic power is the most fungible resource, convertible into a variety of power-resources such as military power and even soft power.[44] Technological change has shaped the rise and fall of great powers throughout history by activating differential growth rates and shifting global economic balances, which in turn gradually impinge upon the political and military balances of power.[45] As economists have established that the automation of production has driven economic growth since the Industrial Revolution, AI is poised to boost productivity growth across broad swaths of the economy by

[40] Hoehn 2022
[41] Watling 2023
[42] National Security Commission on Artificial Intelligence 2021, 79
[43] Ding and Dafoe 2023
[44] Beckley 2018
[45] Ding 2021; P. M. Kennedy 1989

automating tasks that were previously thought to be impossible to automate.[46] The prospect that AI could facilitate the innovation process by generating new ideas portends the creation of compounding, self-reinforcing cycles of productivity boosts.[47]

Although some economists have quipped that AI's impact so far seems to appear "everywhere but in the productivity statistics", others have argued that AI has not yet been diffused widely and complementary innovations have been developed and implemented, leading to a lag in the technology's observable economic effects.[48] As time progresses, complementary technologies across different economic sectors will be able to take advantage of the automation advantages offered by AI, boosting productivity and economic growth. For general-purpose technologies, achieving diffusion and wide-ranging adoption throughout the economy contributes more to national power in the long run than merely housing the most cutting-edge technologies.[49] Instead of devoting most resources into R&D and pushing the technological frontiers, it might make more strategic sense to train engineers who can adapt general-purpose technologies like AI to a range of different economic activities.

Rational Explanations of AI Competition

While the literature above demonstrates AI's importance to the accumulation of power, it does not explain what drives states to desire power in the first place. A prevalent view within the study of technological competition adopts the offensive realist assumption that states seek to maximise power and attain hegemony.[50] Along with other structural realist explanations, offensive realism assumes that the international system is anarchic, meaning that there is no higher authority above sovereign states to enforce agreements or adjudicate disputes. Offensive realists argue that in an anarchic system, the surest way a state can ensure its survival—assumed to be the predominant aim of a rational state—is to accumulate as much power as possible so that

[46] Aghion, Jones, and Jones 2017
[47] Aghion, Jones, and Jones 2017
[48] Brynjolfsson, Rock, and Syverson 2017
[49] Ding 2021
[50] Mearsheimer 2014

it can neutralize or deter any potential challenges to its security. Therefore, even if states are security-seeking and desire nothing more than their own survival, anarchy still drives them to accumulate as much power as possible. Since technology improves a state's military and economic power, it logically follows that states will seek to enhance its technological capability by as much as possible.

In line with this, a number of recent studies address the role of emerging technologies in hegemonic transition, in which a rising state seeks to displace a dominant state. Focusing on contemporary U.S.-China relations, Andrew Kennedy and Darren Lim's 2018 paper theorises the "innovative imperative" of rising states to pursue technological modernity to challenge the dominant state.[51] They argue that because innovation is essential for sustained economic growth, rising powers that aspire to achieve primacy must prioritize technology innovation. To fend off the rising state's challenge to its security and order preferences, the dominant state is likely to cut off supply of the relevant technology and defend the prevailing international order. In this view, China as a rising power is leveraging technological innovation to hasten a power transition vis-à-vis the United States and achieve hegemony. Threatened by China's rise, the United States imposed measures to undercut China's access to technology, creating cycles of intense competitive behaviour. James Johnson similarly frames the United States' increasingly wide-ranging and draconian steps to counter China's AI development as a bid to maintain its hegemony over a rising rival.[52] In his telling, the United States' pursuit of AI capabilities has been in large part driven by the need to secure U.S. hegemony against the rise of revisionist and dissatisfied powers, especially China and Russia.[53] U.S. leaders are convinced that emerging technological capabilities would provide a decisive advantage for the US and "offset" its perceived weaknesses in other areas, such as the quantity of conventional forces.

These narratives largely adopt the offensive-realist assumption that the pursuit of power can be an end in itself. Such narratives are inherently zero-sum: because states strive to maximise power and achieve hegemony, their goals are largely incompatible because there can only be one

[51] A. B. Kennedy and Lim 2018
[52] J. Johnson 2021
[53] J. Johnson 2021

hegemon. While these portrayals of AI competition as a contest for supremacy are plausible, it is too fatalistic to characterize states' security goals as invariably incompatible. For policymakers interested in mitigating technological competition and its detrimental consequences, they must confront the difficult challenge of identifying overlapping interests between states—a task for which offensive realism presents limited insights.

Moreover, the offensive realist account pays insufficient attention to 1) the action-reaction dynamic of the U.S.-China relationship, and 2) how the dynamic has evolved over time. It is unlikely that China embarked on a strategy of technological self-strengthening without any regard to its threat perception and deep-seated suspicion of U.S. intentions; nor did the United States decided to support AI development in isolation from its perception of rising Chinese capabilities. States rarely make strategic decisions independently of each other. They act according to their perception of others' intentions and capabilities, and their action in turn affects how others perceive them and respond. Therefore, even when a technology has high strategic value, it does not necessarily follow that competing in that technology is rational. Defensive realists would argue that maximising material capabilities by extracting strategic value from dual-use technology could be counterproductive if it invites balancing from other states.

As an alternative, less fatalistic account, defensive realism can provide equally valid insights about the causes of technological contests while capturing the action-reaction dynamics between dyads. Whereas the offensive realist account portrays states' goals as conflictual, defensive realism allows a degree of compatibility in states' interests and hence greater room for exploring the various conditions under which technological competition can be mitigated. It also lends itself to the inquiry of how one state's increase in technological capabilities can trigger a destabilising spiral.

Central to defensive realism is the concept of the security dilemma. In the classic formulation, a security dilemma occurs when one state's effort to increase its own security inadvertently endangers another state's security.[54] Due to anarchy, states perceive a lot of uncertainty about other states' intentions. In particular, they are uncertain whether other states

[54] Jervis 1978

are 1) security-seeking actors hoping to maintain the status-quo, or 2) revisionists aiming to change the international order via aggression and force.[55] Fearful of the grave consequence of losing sovereignty, states must be vigilant about the possibility that their neighbours might turn into aggressors. They must provide for their own security by acquiring military power to resist potential threats to their sovereignty.[56]

Accruing military power entails procuring both defensive and offensive capabilities, which are hard to distinguish from one another. Offense-defense indistinguishability has important implications for the security dilemma, because it means that even when a state procures defensive armaments, there is always a chance that another state would interpret the defence procurement as a preparation for aggression. In an anarchic, self-help international system, the accumulation of military power in one state, even if for purely self-defence reasons, creates fear and anxiety in a neighbouring state, prompting the latter to build military power as a precautionary measure.

Many scholars have analysed U.S-China relations and their impact on the wider region through the lens of the security dilemma.[57] The use of security dilemma theory to explain U.S.-China relations is best contextualised with the wider debates around "China rise."[58] China's rapid rise in both economic and military terms has changed the balance of power in the region. Its neighbours are perceiving China's build-up in material capabilities as potentially threatening. A variety of reasons—such as China's tendency to dismiss other states' concerns, its low transparency about actual military spending, capabilities and intentions, and strategic mistrust between China and other key players in the region[59]—have exacerbated that threat perception, prompting East Asian states to pursue internal (strengthening their own military capabilities)[60] and external balancing (deepening military cooperation with the United States)[61] against China. In turn, China perceives its neighbours' balancing acts as potentially threatening and opts to

[55] J. D. Fearon 2011
[56] Jervis 2017
[57] Christensen 1999; 2002; Liff and Ikenberry 2014; Tran 2018; Breuer and Johnston 2019
[58] J. S. Johnson n.d.
[59] Liff and Ikenberry 2014
[60] Liff and Ikenberry 2014
[61] Christensen 1999

double down on bolstering its military, plunging regional dynamics deeper into a downward spiral.

This body of scholarship lays the foundation for this thesis because they encapsulate a plausible overarching logic shaping the interaction between the United States and China. However, the traditional security dilemma literature offers limited utility for analysing the specific domain of technology due to its excessive focus on military competition. Much of the literature on U.S.-China security dilemma focuses on such phenomena as arms races, military build-up, military alliances, and military modernisation. While certain aspects of existing security dilemma analysis—including the uncertainties generated by international anarchy—are applicable to non-military domains, other insights cannot be readily imported to non-military domains such as dual-use technology competition.

The existing security dilemma literature's primary concern for military capabilities offers limited utility for understanding today's technology landscape (see Table 1). For instance, there is no scholarly consensus on what offence and defence mean in non-military contexts, particularly in interpreting issues of economic interdependence. Are export controls—employed by the U.S. to hinder China's AI progress—*defensive* because they aim to protect existing critical assets from transfer to foreign powers, or *offensive* because they undermine the targeted state's ability to develop its own technology industry?[62] To return to the opening example of U.S. semiconductor export controls against China, the United States' sense of threat emerged not from weapons like tanks or ballistic missiles, but from microelectronic components that have little military utility on their own. While semiconductors are integral to producing modern, advanced military systems—including many precision-guided weapons like cruise missiles and drones—semiconductors are not identical to weapons and "should not be assumed to pose a threat to other nations in the same way that new military technologies often are."[63] For semiconductors to pose a military threat, many preconditions must be met; one must specify the steps by which a dual-use item becomes perceived as a military threats.

[62] Some scholars distinguish between protective and promotive measures, but the ambiguity regarding whether either measure is threatening (or offensive) remains. See Gehrke 2022.
[63] Brundage 2023

Table 1. Difference between classic and dual-use security dilemmas

	CLASSIC SECURITY DILEMMA	DUAL-USE SECURITY DILEMMA
ASSUMPTIONS	Anarchy Uncertainty about intentions States as rational actors	Anarchy Uncertainty about intentions States as rational actors
SOURCES OF CAPABILITIES	Independent	Interdependent (due to globalisation)
TRIGGER	Increases in military capabilities	Increase in dual-use technological capabilities
TYPES OF UNCERTAINTY	Offense-defense indistinguishability	Dual-use indistinguishability (nested within offense-defense indistinguishability)
ACTION	Increase military capability via arms buildup	Increase technological capability via geoeconomic measures

A few scholars have attempted to apply the lens of the security dilemma to the technology domain in the hopes of transcending the concept's military connotations and origins. In fact, both Darren Lim and James Johnson—cited above as proponents of the supremacy-centric view of AI competition—have suggested the security dilemma as a potential interpretive framework to view U.S.-China relations. Lim and Ferguson posit the existence of a "technology security dilemma" between the two countries: "Each side is taking measures in the technology domain that it deems necessary and legitimate to safeguard its national security. In turn, the other

side interprets such actions as degrading of its own national security and responds accordingly, triggering a spiral of tit-for-tat reactions fuelled by mutual insecurity."[64]

Elsa Kania and Adam Segal similarly characterize the action-reaction dynamic of U.S.-China security relations as "techno-security dilemma", in which efforts to promote innovation in one country provoke new innovation initiatives in another.[65] Johnson's book *AI and the Bomb* dedicates an entire chapter exploring in detail how the structural and non-structural traits of AI technology might intensify "AI-security dilemma dynamics."[66] Crucially, Johnson's book chapter recognizes the importance of AI's dual-use (in)distinguishability—the relative ease (difficulty) in distinguishing a technology's civilian and military uses—as an aggravator of security dilemmas.[67] As will become clear in my Theory section, Johnson's work and the cluster of studies on dual-use technology he references has greatly influenced my thinking on this thesis.

Non-rational Explanations of AI Competition

The literature reviewed thus far can be characterised as rationalist, strategic choice theories, in that they assume states to be unitary rational actors making purposive decision to achieve their interests under international constraints and opportunities.[68] But states often fail to act rationally, and scholars have developed a range of theories to explain outcomes in international politics that deviate from a rational baseline. I will now turn to two non-rational theories of AI competition, focusing on domestic politics and constructivist explanations.

The *domestic politics* argument interrogates the interests and ability of subnational entities—including private companies, non-governmental organisations, and different government bureaucracies—to influence states to pursue competitive policies in AI. Contestations between different societal stakeholders are playing out along various dimensions.

---

[64] Lim and Ferguson 2019
[65] Kania and Segal 2021
[66] J. Johnson 2023
[67] J. Johnson 2023
[68] Glaser 2010

First, there is the concern that private interests are overriding public interests in setting the AI policy agenda. Private technology companies have become crucial geopolitical actors because of their outsized role in shaping a state's digital capabilities and their contribution to matters of international and domestic politics, including national security and defence. Political scientist Ian Bremmer has even coined the term "technopolarity" to describe "an emerging world order in which the largest technology companies rival nation-states as the primary players in international affairs."[69] These companies enjoy quasi-monopolistic control of technologies and infrastructures vital to the pursuit of military objectives, granting them outsized leverage vis-à-vis the state.[70]

Whereas states value national security, firms prioritise profit. Hence, if private interests manage to capture the state, they can sometimes yield irrational outcomes from the state's perspective. For instance, Paul Lushenko and Keith Carter argue that AI competition is "largely driven by 'tech bros' and other entrepreneurs who stand to profit immensely from militaries' uptake of AI-enabled capabilities."[71] They contend that the profit motives of the AI defence businesses, funded by venture capitalists, can drive the defence acquisition process "over and above the legitimatizing narratives of national security and patriotic pride."[72]
However, to my knowledge, this evidence for this hypothesis remains anecdotal and yet to be systematically tested. Few studies have theorised how technology companies exert their clout to influence state behaviour and shape outcomes specifically in international security.

A second version of the domestic politics hypothesis takes a broader view on the balance of power between different stakeholders in foreign policy. Hugo Meijer's 2016 book, *Trading with the Enemy*, argues that the U.S. technology trade policy toward China since the end of the Cold War reflects the struggle between the "Control Hawks", "Pro-Trade" camp, and the "Run Faster".[73] Media reports continue to frame the recent U.S. export controls over advanced AI chips as a tug of war between tech giants that wish to continue selling to as many export markets

[69] Bremmer 2021; Eurasia Group 2023
[70] Coveri, Cozza, and Guarascio 2024
[71] Lushenko and Carter 2024
[72] Lushenko and Carter 2024
[73] Meijer 2016

as possible and the hawkish policymakers hoping to throttle China's access to AI technology.[74] Control Hawks' growth in influence would explain the increasingly restrictive regime of export controls against China. Relatedly, several scholars have analysed the increasing dominance of China Hawks in Washington.[75] This unbalanced scene of United States' AI policymaking could become irrational, as the China hawks dominating Washington advance competitive policies without reasonable checks and balances to address the potential blind spots of their policy ideas.

The domestic politics of Chinese behaviour has received much less scholarly attention, partly due to the Chinese political system's lack of transparency. Exceptionally, Matt Sheehan has produced a series of papers tracing the origins of China's AI regulations. He argues that contrary to popular conception, China's AI governance "has not been created by top-down edicts from the Chinese Communist Party (CCP) leadership"; instead, Chinese AI regulations are "the product of a dynamic and iterative policymaking process driven by a mix of actors from both inside and outside the Chinese party-state" across four layers of the "policy funnel".[76] The implication is that China's competitive behaviour could be a result of an imbalance between these social groups rather than being driven by a top-down unitary rationality. Examining China's Digital Silk Road (DSR)—a component of the Belt and Road Initiative that focuses on exporting Chinese digital technology—Jing Chen and Jinghan Zeng have argued that DSR was shaped by the "economic and political struggles among domestic actors and the shifting socio-political landscape."[77] In this sense, China's competitive behaviour in expanding its digital presence around the globe can be seen as driven by the corporate interest of Chinese digital companies rather than national interest.

While domestic politics explanations are sometimes casted as a competing account vis-a-vis rational theories, this is not necessarily the case. Depending on how one defines a rational baseline, the compatibility between rational and non-rational theories could vary. Scholars commonly distinguish between two versions of rationality. *Substantive rationality* assesses whether a behaviour is appropriate to the achievements of given goals under certain conditions

[74] L. Lin and Ward 2025
[75] Carothers and Sun 2023; McCourt 2022; Cerny and Truex 2024
[76] Sheehan 2024, 2
[77] J. Cheng and Zeng 2024

and constraints; *procedural rationality* is concerned with the process by which decisions are made and whether they result from appropriate deliberation.[78] Although China Hawks' dominance in Washington might undercut procedural rationality due to groupthink, the policies they advocated could nonetheless be *substantively rational* if it helps maintain U.S. technological hegemony, defined by the offensive realists as a rational objective. To the extent that rational theories in IR are justified to focus on substantive rationality and abstract from the process by which decisions are made, criticising these theories on the grounds of procedural rationality does not constitute a direct challenge to rational theories.

The lack of a rational account of dual-use competition blunts the appeal of the domestic politics explanation of competitive behaviour. Absent a rational assessment of what states should do, it is not obvious why domestic actors fanning the flames of AI competition is problematic or requires scholarly scrutiny. As Charles Glaser puts it, bad outcomes, including arms races and AI competition, "could simply reflect a dangerous international security environment, not flawed policy decisions. Therefore, theories of suboptimal behaviour, whether built on arguments about domestic politics or errors in individual decision making, rely at least implicitly on a rational theory."[79] Even if we accept the argument that private companies, rather than unitary rational states, are driving the U.S.-China AI competition, we must appeal to a rational baseline in order to appreciate how much private interests are distorting rational inter-state politics.

The *constructivist* explanation of AI competition focuses on the social construction of AI as an opportunity and threat. Ingvild Bode, Cecilia Ducci, and Pak K. Lee argue that the U.S.-China "tech war" arises from "the incremental build-up of social meaning associated with actors performing "tech war" narrative practices rather than a strategically executed narrative plan," tracing how the liberal "capitalist peace" master narrative has given way to the realist, "tech war" master narrative.[80] Alva Markelius et al expertly dissect the construction of the AI hype, defined as "as a trending global fixation and prioritisation of AI-related technologies, ideas and investments."[81] One of the most powerful mechanisms behind the AI hype is the creation of

[78] Simon 1976
[79] Glaser 2010
[80] Bode, Ducci, and Lee 2025
[81] Markelius et al. 2024

narratives and imaginaries that portray emerging AI technologies as necessary and inevitable tools for the safety and prosperity of nations. Since the advent of AI is believed to be inevitable, the "fear of missing out" on the strategic value of AI drives states to invest large sums in AI-related technologies.[82] For instance, the most prominent AI firms are aggressively pushing the frontier of AI capabilities, with some explicitly aiming to develop artificial general intelligence (AGI)—a hypothetical form of AI that possesses human-level intelligence. Although whether AGI is truly achievable remains contested, the potentially enormous economic and strategic payoff of possessing highly capable and intelligent machines could lead to the fear of missing out, fuelling a race dynamic.

These studies refuse to take for granted the security imperative created by emerging technologies or assume its rationality. Rather, they trace the process by which the indispensability of AI is socially constructed through discursive practices.[83] Like the domestic politics argument, the constructivist argument is not necessarily incompatible with the rationalist account. As James Fearon and Alexander Wendt have pointed out, there is no fundamental opposition between rationalism and constructivism. While rationalism often posits a relatively stable definition of interests to play out the strategic choices, it does not strictly require these interests to be fixed, at least in the "thin" conception of rationality which does not specify the content of desires or beliefs.[84] This allows complementarity with constructivism's inquiry of how ideas can shape interests. In other words, the constructivist insight that AI threats are discursively construed can complement, rather than compete with, the rational theories explored in the previous section.

Some scholars have already attempted to merge rational theories with constructivist insights. Amir Lupovici explores in depth the social construction of the dual-use security dilemma.[85] In a traditional security dilemma, the destructive potential of weapons (whether for

[82] Markelius et al. 2024
[83] Buzan, Wæver, and Wilde 2022; The Copenhagen school of securitization argues that for an issue to be understood as a matter of security, the threats to a referent object must be constructed as existential, so as to justify extraordinary measures outside the bounds of normal politics.
[84] J. Fearon and Wendt 2002, 59
[85] Lupovici 2021

offensive or defensive purposes) is often posited to be self-evident. In a dual-use security dilemma, states face what Eric Van Rythoven calls the "securitization dilemma", or "a difficult choice where a securitizing move represents a powerful and attractive opportunity for political mobilization, but with the danger of perverse and unintended consequence."[86] That is, State A must determine whether an opponent's possession of civilian technology would pose military threats and whether to securitize the technology. The securitizing act may facilitate the mobilization of domestic support for a desired policy, but it may also prompt State B to counter-securitize, decreasing both states' security.[87]

Lupovici's formulation of the dual-use security dilemma suggests that the dual use meaning of technologies is at least in part socially constructed and that countries could have learned from others to view certain technological developments as threatening. This thesis acknowledges the constructed nature of international threats, but it endeavours to go further by examining the interaction between material conditions and the act of securitization. When does it make sense for a state to securitize a technology, and when does it not? What explains states' different reactions towards the same objective material conditions? These questions contain important policy implications, and the securitization literature does not provide readily actionable insights to them.

Conclusion

The literature reviewed in the previous section has identified the potential drivers of the U.S.-China AI competition. Each of these perspectives suffer from severe drawbacks when viewed in isolation. The non-rational perspectives reviewed above fail to establish a rational baseline for state behaviour in developing technology. Domestic-political explanations do not necessarily render AI competition irrational. According to neoclassical realism, the pressures of anarchy are filtered through domestic institutions, which might exaggerate, underestimate, or otherwise misinterpret the opportunities and threats posed by anarchy. Domestic actors' drive to

[86] Van Rythoven 2020
[87] Lupovici 2021

develop AI technology could simply be a rational but mediated response to pressures originating from the international structure.[88] The constructivist perspective examines the process by which certain objectives, such as investing in AI, become construed as rational, but it does not provide a firm stance on the validity of these objectives. As such, it provides limited utility to policymakers choosing between different policy options. Without a rational benchmark, these accounts do not illuminate the conditions under which it might be strategically desirable for states to compete in AI development—and vice versa, how and when it might be strategically desirable for states to mitigate AI competition.

Rational explanations hold greater promise in yielding actionable policy insights, but modifications are required to rectify their drawbacks. The offensive realist explanation tends to be fatalistic. It downplays the interdependence between states, neglecting that states often behave in response to another state's action. As defensive realists would argue, maximising material capabilities by extracting strategic value from dual-use technology could be counterproductive if it invites balancing from other states. If foreign states reveal highly credible signals of conciliatory or cooperative intentions, it could be irrational to ignore these signals and insist on aggressive competition. In other words, offensive realism provides limited support for a nimbler policymaking which requires a state to adjust one's behaviour in light of new information about another state's behaviour or intentions.

Defensive realists' own explanation for the AI competition—relying on the security dilemma concept—offers greater flexibility in addressing real-world challenges, but it requires some theoretical adaptation before it becomes useful for viewing the contemporary U.S.-China AI competition. For one, the traditional security dilemma literature has a heavy focus on strategic interactions involving military and nuclear armaments. It should be updated to account for the fact that AI is not solely, or even primarily, a military technology. Several scholars have attempted to move beyond the literature's concern with military competition and have proposed to interpret U.S.-China competition through the lens of the "technology security dilemma", but these attempts remain limited for understanding the origins of states' threat perception toward AI. James Johnson's account advances the literature by emphasising how the dual-use nature of

[88] I am grateful to Ian Seow for suggesting the relevance of neoclassical realism.

AI fuels mutual threat perception[89], but his framing is still techno-deterministic, failing to recognise that material capabilities do not determine perception and that different states react differently to another state's possession of dual-use technology.

[89] J. Johnson 2023

Chapter 3

Theory

To address the nuanced effects of modern technologies on the security dilemma, a number of recent works suggest that dual-use distinguishability should be considered. Distinguishability affects the dynamics of the security dilemma because it impacts the level of uncertainty when states perceive each other's motives with technology development.[90] Dual-use distinguishability—how easily a state can differentiate between a technology's military and civilian applications—creates an extra layer of uncertainty to how states perceive one another, modifying the level of fear and anxiety experienced by states in a self-help, anarchic international system. Low distinguishability means that a revisionist state can easily mask their military use of the technology as civilian. It also means that a status-quo state will have a hard time convincing another state of its peaceful intentions, as the latter cannot confidently infer that the technology will not be used for military purposes.

When a state is insecure, its fear for the worst-case scenario—that its neighbour weaponises a dual-use technology to enhance offensive military capabilities—might dominate its strategic thinking, prompting it to treat the neighbour's dual-use technology as *de facto* military technology. Low distinguishability's effect on the security dilemma can be especially severe when the technology is believed to have a high strategic value. Such perception can prompt the insecure state to improve its technological capabilities relative to its opponent by promoting its own technological development and/or undercutting that of its opponent, as they attempt to secure themselves against possible military action from the state. This leads to spiralling cycles of competitive behaviour in the AI technology race.[91] Figure 1 bellow illustrates the mechanism by which distinguishability prompts competitive behaviour.

---

[90] Vaynman and Volpe 2023b

[91] A complete dual-use security dilemma involves two levels of uncertainty: dual-use distinguishability and geoeconomic distinguishability. Due to space constraints, this MPhil thesis—especially the empirical analysis—will focus on the former. For theoretical completeness, I will attempt to sketch out the main theoretical components of geoeconomic distinguishability in Appendix A.

However, the literature's understanding of distinguishability remains limited by its techno-centrism. This chapter proposes expanding the conceptualisation of dual-use distinguishability by incorporating macro political economy factors. I suggest that perception of distinguishability varies not only by technology, but also by country according to their politico-economic configuration. Specifically, I argue that *state-business* and *civil-military* relations are two critical dimensions of country-level distinguishability. The more deeply intertwined state and business sectors are, the harder it becomes for foreign observers to distinguish between benign and malign uses of dual-use technologies. The same applies to civilian and military sectors: the greater the degree of civil-military integration in a country's defense-industrial base, the more difficult it is to differentiate civil and military uses of technology. Together, these two dimensions affect foreign threat perception toward a country's possession of dual-use capabilities, modifying the intensity of the technological competition.

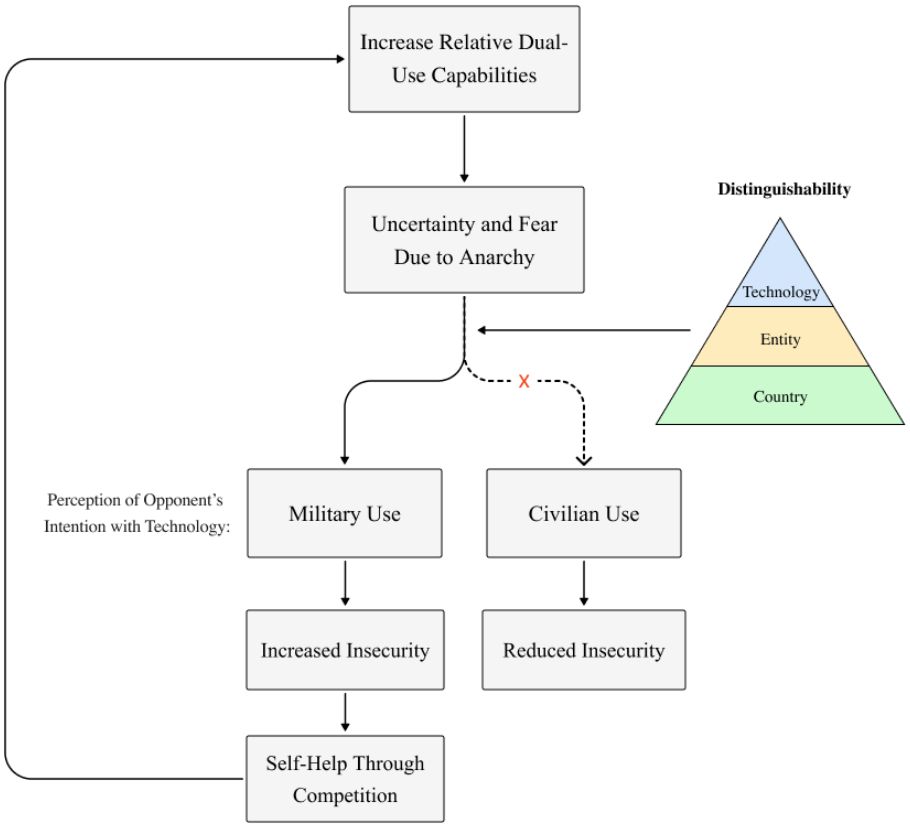

Figure 1. Distinguishability moderates the dual-use security dilemma

Conceptualising Dual-Use Distinguishability

Technology-level determinants. The literature has focused on technology-level determinants of dual-use distinguishability.[92] This conceptualisation suggests that distinguishability varies by technology, treating each technology as a unit of analysis. Adopting the distinguishability concept, Alan Hickey, a geopolitics analyst at OpenAI, created the most comprehensive framework for analyzing distinguishability for foundational AI models, large-scale machine learning models that serve as a basis for various downstream tasks.[93] He argues that four factors during the AI development cycle shape the distinguishability of foundational AI models: model inputs, capabilities, system use cases, and system deployment. The essential *inputs* to AI models—data, algorithms, and compute—are characterized by versatility and broad applicability, making it challenging to differentiate between civilian and military intentions. The *capabilities* of foundation models vary; it will be harder to establish distinguishability for high-capability models that can easily transition across different use cases. The system *use cases*—the specific tasks users intend for the model to perform and how they guide its operation—will impact distinguishability depending on whom the user is and what operational context the model is embedded in. Finally, *deployment* concerns the degree of overlap between civilian and military applications.[94]

However, relying too much on the technology-level characteristics to explain perception risks falling into techno-centrism. Technological characteristics could not account for the variance in how countries perceive others' possession of dual-use technologies. Material capabilities do not determine perception, and states react differently to other states' possession of material capabilities.[95] Hence, the U.S. is less troubled by Taiwan's longstanding dominance in the advanced semiconductor supply chain than by China's technological rise in the last decade. Moreover, the technocentric framing of distinguishability only partially matches how states perceive and make policies about dual-use technologies. In addition to complying with country-

[92] Vaynman and Volpe 2023a, 605–6
[93] Hickey 2024
[94] Hickey 2024
[95] Wendt 1992

agnostic multilateral export control regimes, states often design export controls to address entity- and country-specific concerns.

Entity-level determinants. On an entity level, states' export control regimes tend to restrict the sales of dual-use items to entities that are known to be closely linked to the military of their respective home countries. These entities are believed, prima facie, to deploy the imported technologies for military use, altering the military balance of power between the exporter and importer and fuelling the exporters' threat perception. For example, the U.S. maintains a number of lists to identify entities and persons; export of technologies to these parties are subject to onerous licencing requirements and due diligence. The Entity List identifies foreign parties that engage in activities "contrary to U.S. national security and/or foreign policy interests."[96] The Military End User List identifies foreign parties that are at risk of using or diverting technology to a military end use or military end user in China, Russia, or Venezuela.[97] The Unverified List consists of a list of parties whose bona fides have not been verified and which may be linked to foreign parties working to undermine U.S. national security.[98] Emulating the U.S. system, China has created its own lists of concerning foreign parties. On the Chinese "Watch List", which is similar to the U.S. Unverified List, are entities that do not cooperate with end-user or end-user verification requirements. The Unreliable Entity List incorporated extraterritorial measures into its framework and implemented reporting obligations for financial institutions regarding any export-control violations.[99]

Two factors influence how a state determines the degree to which a particular entity's possession of dual-use technologies will be used for advancing the strategic objectives of its home country. The first factor, as alluded above, is the entity's relationship with military end use or end-users of its home country. The closer it is to military end-use or end-users, the likelier it will be perceived as threatening. One indicator of this relationship is the frequency of transactions between the entity and military end-users: the more frequently an entity has supplied technology for military end-uses, the more likely it will be perceived as threatening. The second

[96] Bureau of Industry and Security n.d.
[97] Bureau of Industry and Security n.d.
[98] Bureau of Industry and Security n.d.
[99] Nouwens, Shagina, and Green 2025

factor influencing entity-level distinguishability, which is less explicitly mentioned in export control regulations, is the degree to which the state can influence the firms' behaviour. For instance, ownership structure can reveal the degree of control exerted by different stakeholders. State-owned enterprises are entirely controlled by the state, while private owned enterprises are more insulated and enjoy greater autonomy from state influence. A company subject to government influence can be coopted, coerced, or otherwise induced to use technologies to achieve the government's strategic objectives.

The two dimensions are analytically distinct because, in theory, an entity could develop technology that serves military or civilian end-uses regardless of how much the state controls it. A state-owned enterprise can produce only commercial goods, and a private contractor can exclusively produce military equipment. In practice, of course, there are much overlap along the two dimensions. In certain political economies, such as that of China, most prominent defence enterprises are state-owned.

Still, focusing too much on individual entities risks missing the bigger picture if the phenomenon of indistinguishability is systemic and structural. Sometimes, states may take systematic effort to obfuscate military and civilian end use or conceal the state's involvement in private companies to avoid drawing foreign suspicion. If one entity is targeted by export controls, a new entity under an ostensibly different identity could be set up to resume prior activities. Since end-use verification is costly and difficult, the new entity would buy itself much time to import restricted technologies before law enforcement finally catches them. This "whack-a-mole" approach can be "leaky" and riddled with loopholes. Hence, if the obfuscation of military end use or concealment of state involvement are endemic and persistent in one state, another state might formulate country-level policies to close these loopholes.

Country-level determinants. If patterns of entity-level indistinguishability are perceived to be the norm rather than the exception, the state will generalise indistinguishability to the whole nation. This practice is evidenced by states' organisation of export controls and other technology restrictions at the country level. They tend to ban countries that are known to exploit dual-use technologies for military or repressive uses and relax restrictions of dual-use exports to

countries that exclusively promote beneficial civilian uses. The U.S. Department of Commerce, for instance, issues the Commerce Country Chart to specify whether government approval is required to ship a dual-use item to a specific destination country.[100] The European Union's dual-use export controls policy requires exporters to obtain authorization from the relevant authorities, which will be determined based on the dual-use items' end-use, end-user, country of destination.[101] China's new dual-use regulations similarly vary export restrictions based on countries of destination based on national security and other foreign policy concerns.[102] Inferring from states' policy and enforcement practices, it is clear that country-specific variables, in addition to technology- and entity- specific variables, account for states' threat perception of other states' possession of dual-use technologies.

Mirroring the entity-level analysis, I suggest that country-level distinguishability is shaped by two dimensions. First, the degree of integration between the civilian and military sectors of a state's national economies affects perceptions of distinguishability. According to expert Richard Bitzinger, civil-military integration (CMI) refers to the "process of combining the defense and civilian industrial bases so that common technologies, manufacturing processes and equipment, personnel, and facilities can be used to meet both defense and commercial needs."[103] A high level of civil-military integration means that technological capabilities possessed by the civilian sector will likely create positive spillovers to the military domain. The increased military capabilities will in turn threaten foreign neighbours. Hence, *the greater the perceived integration between a state's civilian and military sectors, the likelier foreign states will perceive that dual-use technologies in the civilian sector will be diverted to military applications.*

There are several indicators of the degree of CMI in a country. To my knowledge, there is no authoritative scholarly consensus on how to operationalize CMI in a way that is valid across different defence-industrial bases and historical contexts. Due to the dearth of authoritative literature on the "varieties of CMI", I derive these indicators inductively from my preliminary

[100] "Commerce Country Chart" 2023
[101] "Dual-Use Export Controls | EUR-Lex" n.d.
[102] Pan and Tan 2024
[103] Bitzinger 2021, 10

research on defense industrial practices and the case study in Chapter 4. I focus on metrics that are likely to affect foreign perceptions of distinguishability.

First, the existence of national-level strategies or institutional frameworks promoting CMI may reflect both the state's intent to coordinate military and civilian sectors and the degree of pre-existing fragmentation. But one must be careful when interpreting this metric, as civilian and military sectors may develop strong ties even in the absence of centralized coordination. For instance, the U.S. discourse frames China's "military-civil fusion" (MCF) strategy in recent years as anomalous and threatening, scholars have shown that the United States not only surpasses China in the scale and maturity of its techno-security state, but also exhibits deeper hybridization of public and private institutions in defense innovation.[104] Indeed, China has long viewed the United States' defense-industrial base as a threat and a model to emulate since the late 1990s, identifying it as a "high-priority techno-security threat" since late 1990s.[105]

Second, the prevalence of "spin-on" processes—military adoption of commercially developed innovations—is a useful proxy for CMI. For instance, the United States has institutionalized pathways for civilian innovation to enter the defense market through organizations such as the Defense Innovation Unit (DIU).[106] In China, legal reforms allowing for civilian participation in defense procurement, as well as the creation of a centralized clearinghouse for defense procurement notices, indicate efforts to absorb civilian innovations into defense.[107] Measuring the proportion of defense capabilities sourced from commercial firms, or the share of civilian-origin technologies in military systems, provides insight into the practical depth of integration. Prevalent "spin-on" activities will heighten foreign concerns about transferring technology to civilian firms, given the risk that these ostensibly civilian entities could later pass the technology to the military.

Third, defense "spin off"—the reorganization of defense enterprises into commercial entities—would create nominal civilian entities with deep historical ties with the military. This phenomenon is prevalent in formerly defense-driven economies. As their external security

[104] Cheung 2022, 298
[105] Cheung 2022, 298
[106] Harper 2020
[107] Lafferty 2019

environment improves, they may find it unnecessary to sustain the military's enormous presence in the economy, hence facing the incentive to convert chunky defense conglomerates into more efficient civilian units geared towards commercial markets. These enterprises may be nominally civilian and commercially driven, but their origin makes it challenging to distinguish the enterprises' civilian-facing side and their defense-oriented past.

Additional factors will likely influence foreign perception of distinguishability. For example, growing openness among civilian tech firms to cooperate with the defense sector—evident in the shift among U.S. AI companies from initially rejecting defense applications to increasingly embracing them[108]—can signal reduced separation between civilian and military spheres. It is difficult to encapsulate the diverse historical and contextual factors influencing perception in this conceptualization of CMI, but I will endeavor to describe them in the empirical case study.

The second dimension of perception of country-level distinguishability is the degree to which private commercial interests are subordinate to state influence. *The more subordinate private firms are to the state, the more susceptible they are to government pressures to divert technologies to military use.* The "varieties of capitalism" (VoC) literature offers some insights for operationalizing the relationship between the state and business.[109] Capitalism, at least in its liberal form, is predicated upon a formal and institutionalised separation or economic and political power, and different forms of capitalism have varying degrees of such separation.

In particular, two ideal types are helpful in delineating the relative balance of power between state and market interests. On one end of the spectrum, in liberal market economy (LME), economic activities are primarily coordinated through competitive markets and formal contracts. Investment is financed primarily through global capital markets.[110] In LMEs, the corporate governance of most large firms is dominated by non-state actors—usually minority shareholders and transnational financial investors—who make decisions to maximise shareholder

[108] Bego 2024
[109] Hall et al. 2001
[110] I selectively discuss institutions that likely impact foreign threat perception about dual-use technology. For a more comprehensive view of the institutional features of different forms of capitalism, see Nölke et al. 2019, 194-6.

value rather than advance political objectives. On the other end of the spectrum, state-permeated market economy (SME) adopts a mode of coordination involving "reciprocal mechanisms of loyalty and trust between members of competition-driven state-business coalitions," reconciling the developmental interests of state managers with the profit interests of private business.[111] Enterprises in SMEs raise investments through internal savings and loans by national banks, usually at a preferential rate from the state (e.g., cheap credit). Corporate governance is usually dominated by national capital and controlled by actors close to the state through ownership structures or other forms of direct and indirect control. Additionally, legal cultures and institutional regulatory capacity would influence the degree to which the government has leverage over private businesses.

To summarize, indistinguishability—created by intertwined state-business and civil-military relations—increases foreign suspicion toward a state's possession of dual-use technologies. The addition of entity- and country-level variables help us avoid the pitfalls of techno-determinism by noting that states do not perceive a technology in isolation—they assess where a technology fits within other states' political economy to determine the likelihood that the technology will be militarised. A summary of the analytical framework for dual-use distinguishability can be found in Table 2 below.

[111] Nölke et al. 2019, 194

Table 2. Summary of analytic framework for dual-use distinguishability

LEVEL OF ANALYSIS	ATTRIBUTES	INDICATOR	OPERATIONALIZATION EXAMPLES
TECHNOLOGY[112]	1) Inputs	Sensitivity and traceability of inputs	Commercial off-the-shelf (COTS) components vs sensitive inputs (e.g., uranium, radiation-hardened components)
	2) Capabilities	General-purpose vs narrowly tailored capabilities	High-capability AI models are applicable across domains; vs domain-specific systems are not
	3) Use cases	Nature of operational tasks performed	ISR (intelligence, surveillance, reconnaissance), logistics, medical diagnostics, etc.
	4) Deployment	Similarity and transferability between civilian and military deployment	Degree to which civilian and miltiary deployments are specialized; degree to which civilian scientific advances can spillover to military domains
ENTITY	1) Relationship with Military	a) Defense contracts / history of cooperation	Share of revenue from defense clients; joint projects with military-linked institutions
		b) Military background of executives	Number of board members or executives with prior military affiliations
		c) Involvement in military-linked R&D consortia	Membership in defense innovation zones, labs, or joint platforms

[112] Hickey 2024, 8

		d) Ownership structure	Degree of state or military-affiliated shareholder ownership
	2) Relationship with State	a) Ownership structure	State-owned, mixed-ownership, private with state investors
		b) Corporate governance	Presence of party organisations; board appointment procedures influenced by state; presence of government "golden shares" and veto rights
		c) State support	Reliance on subsidies; access to grants, preferential loans, tax credits, or other financial support; designation of the entity's sector as strategic
		d) Government background of executives	Number of leadership with past government experience
COUNTRY	1) Civil-Military Integration	a) National-level strategy and coordination body	Existence of Military-Civil Fusion strategy and associated high-level policy coordination bodies
		b) Prevalence of spin-ons	Laws or policies facilitating civilian participation in military R&D/procurement
		c) Prevalence of spin-offs	Military-origin tech or firms re-entering civilian market
	2) Business-State Relations	a) Economic coordination mode	Degree of state planning; use of industrial policy; strategic emerging industries; Share of state capital in high-tech sectors or dual-use firms
		b) Corporate governance	Prevalence of state-owned shareholders throughout the economy; influence of the party-state in corporate decision-making
		c) Legal securitization of commerce	Legal mandates for party cells in private firms; legal mandates for firms to support state objectives

	d) Institutional enforcement capacity	Authority and reach of agencies in interfering with commercial deals

Methodology and Sources

Given this thesis's focus on U.S.-China AI competition, I adopt a single case study approach. I will focus on studying the U.S. perception towards China's dual-use distinguishability, rather than Chinese perception towards U.S. distinguishability, for two reasons. First, the United States, with its dominance in various AI-related sectors—including its centrality in the global semiconductor supply chain and capacity to weaponize interdependence[113]—has disproportionate control over the "escalation ladder" in the bilateral competition. Understanding the drivers of U.S. action, therefore, offers insights into the broader dynamics of the competition. Second, the United States has exhibited greater variability in its perception of China over time. U.S. policy has shifted from a pro-engagement attitude during China's reform era toward strategic competition in recent years.[114] By contrast, China's perception of the United States appears more stable. For instance, Rush Doshi argues that China has pursued a long-term grand strategy to displace U.S. influence in Asia.[115] While Chinese threat perceptions may vary in emphasis, the overarching stance has consistently treated the U.S. with suspicion.

The objective of the case study is twofold. First, since one of this thesis's objectives is establishing the relevance of country-level distinguishability as a variable, I will demonstrate the viability of operationalizing CMI within the case study. I use within-case analysis to provide stylized narratives of how these two dimensions of China's political economy have evolved over time. This way, I can capture the historical nuances specific to China's political economy that the conceptualization misses, highlighting potential ways to enrich it. This strengthens my iterative, abductive method for conceptualizing dual-use distinguishability and theorizing its impact on AI competition.

[113] Beaumier and Cartwright 2024
[114] See, for example, Friedberg 2022
[115] Doshi 2021

I rely primarily on English data sources for tracing distinguishability to understand Anglophone analysts' perception of China. Regarding CMI, I will refer to the academic and gray literature published by U.S.-based authors to study how U.S. practitioners have been describing and understanding China's CMI efforts. In particular, the China Aerospace Studies Institute, whose mission is to advance the U.S. Department of Defense's understanding of the "capabilities, development, operating concepts, strategy, doctrine, personnel, organization, and limitations of China's aerospace forces," has released two guides for studying China's Military-Civil Fusion (MCF) effort.[116] These sources rely on "a well-known set of official speeches, policies, white papers, and reports from official Chinese media outlets, and draws heavily upon authoritative books and journal articles from the Chinese Communist Party, State Ministries, and military strategists."[117] I use these reference guides and the associated primary sources they reference to portray a stylized narrative of China's historical CMI development. Regarding state-business relations, I rely on English-language secondary sources to identify standardized narratives about China's economic evolution. Barry Naughton and Nicholas R. Lardy, both renowned for their expertise on the Chinese economy, have written extensively on different phases of China's economy. I include aspects of China's economic story that align with my framework for how state-business relations relate to foreign perception of distinguishability.

The second objective of my case study is to demonstrate causality between the independent variable—distinguishability—and the dependent variable. Focusing on a single case allows me to control for the unique features of China's defense-industrial base and trace how changes in distinguishability over time have shaped foreign perceptions. This approach avoids the challenge of cross-national comparisons by examining temporal variation within China's civil-military integration and state-business nexus. Moreover, the probability that the U.S. will perceive something as unacceptable likely depends on the norm at the time and the pace of normative change. Therefore, a single case study that detects changes longitudinally is best suited for studying the evolution of threat perception.

[116] Stone 2021; Stone and Wood 2020
[117] Stone and Wood 2020

The dependent variable in this study is the U.S. threat perception towards China's dual-use capabilities. I operationalize this perception using the restrictiveness of U.S. export controls on China, which serves as a proxy for the perceived risk that dual-use exports would contribute to China's military modernization. The underlying assumption is that as the U.S. government perceives greater risk, it will respond by tightening restrictions on technological flows to China. This is a sound assumption especially given the longstanding U.S. arms embargo on China following the 1989 Tiananmen Massacre. If the U.S. comes to view China's dual-use technologies as effectively indistinguishable from military technology, it is likely to restrict their transfer in the same way it restricts arms exports.

To analyze export control restrictiveness, I will examine changes in U.S. export control policy. Hugo Meijer's book, *Trading with the Enemy,* masterfully weaves together official policy documents, congressional debates, and elite interviews to track the evolution of U.S. export control policies vis-à-vis China, providing important contexts about the rationale behind U.S. policymaking. It is also a great reference to identifying additional sources related to U.S. policymakers' perception towards China on national security matters. Where appropriate, I will use the U.S. Entity List as a key data source. Established in 1997 to counter WMD proliferation, the List's scope expanded in 2007 to include entities deemed "contrary to the national security or foreign policy interests of the United States."[118] Exporters are restricted from transferring specified U.S.-origin goods, technologies, and software to listed parties.[119] Because the Entity List reflects U.S. assessments of specific organizations within a country, analyzing aggregate data and trends can reveal U.S. perceptions of how pervasive or systematic China's entity-level indistinguishability is—and whether it views the issue as generalizable to the entire country. An increasing number of Chinese entities added to the List for diverting technologies to military use would suggest that the U.S. views indistinguishability as an increasingly pervasive feature of China's political economy. Moreover, the Federal Register provides justifications for listing decisions, offering insight into the U.S. government's reasoning over time. To analyze trends in these justifications, I developed a web-scraping tool to collect listing data and used a large

[118] Kilcrease and Frazer 2023
[119] Bureau of Industry and Security n.d.

language model to classify the rationale for each listing. A full methodological discussion of the scraping and labeling process can be found in Appendix B.

If my theory is correct, I should expect 1) degree of CMI in China varies over time and 2) such variation impacts the restrictiveness of U.S. export control as well as threat perception. My hypotheses can be stated as follows:

> *H1: The greater the perceived integration between China's civilian and military sectors, the more restrictive U.S. technology export controls will be.*

> *H2: The greater the perceived subordination of Chinese business interests to state objectives, the more restrictive U.S. technology export controls will be.*

Importantly, this thesis does not seek to offer a mono-causal or mono-variate explanation for the broader U.S.-China AI competition. This approach does not preclude the relevance of other variables; it recognizes that the rivalry is shaped by a constellation of factors, including geopolitics and alliances, regional dynamics, domestic political pressures, and ideological divergence. Instead, this thesis aims to isolate and explore one underexamined but plausibly significant variable: how the perceived indistinguishability between civilian and military technological capacities—shaped by the structure of a state's political economy—influences threat perceptions related to dual-use technologies. By focusing on this specific variable, the thesis contributes to a more granular understanding of the mechanism driving AI competition.

Note on Conceptualisation

My conceptualisations of civil-military integration and state-business relations utilize Weberian ideal types. They are made for analytic purposes and should not be taken as literal truths. Certain limitations of such ideal-typification should be stated upfront. Regarding CMI, a major challenge is demarcating the boundary between civilian and military spheres, especially since ostensibly civilian goods—such as food or infrastructure—can indirectly support military operations. Under heightened enmity and distrust, such a distinction would likely prove meaningless. For instance, the 1909 Declaration of London attempted to regulate the seizure of

contraband during wartime according to the goods' contribution to military capacity: "Absolute contraband" refers to products used exclusively for war; "conditional contraband" could be used for both military and peaceful purposes; and "free goods" were unlikely to be used in war. These distinctions were immediately abandoned on the break of World Wars I and II, as conditions of total war led to the perception that any additional economic resources released by trade would ultimately be devoted to military capabilities.[120]

Furthermore, many interactions between defence and commercial technological activities would qualify as indications of CMI. The most commonly discussed CMI processes are spin-off (i.e., military products find commercial applications) and spin-on (i.e., commercial products find military applications), but civil-military technology interactions could also involve subtler forms of interdependencies such as defense procurement demand pull, concurrent development of military and civilian applications from the same prototype, and shared infrastructure for defence programs and emerging commercial industry (see Appendix C).[121] These relationships indicate the symbiotic relationship between defence and the rest of the economy, which could be difficult to disentangle unproblematically.

Moreover, by generalising from messy empirical realities, ideal-typification often discounts historical and contextual factors. The United States and China differ in their approaches to CMI in part due to historical contingencies. The United States began absorbing civilian technological expertise into defense during World War II (e.g., recruiting scientific talents from universities and industry), whereas China, as a latecomer, had to build a dual-use economy rapidly from scratch through state-led initiatives. These divergent historical trajectories complicate cross-case comparisons. Does the United States exhibit greater integration due to a long history of organic development, or does China appear more integrated because of its coordinated, "whole-of-nation" approach? These questions underscore the difficulty of placing countries along a single civil-military continuum.

[120] Mastanduno 1985, 510-1
[121] Alic et al. 1992, 64

Operationalizing state-business relations runs into similar problems: it is problematic to reduce the complexity and varieties of state economic intervention into a one-dimensional continuum. As a review article on comparative state capitalism notes, "[t]he debates about what institutions and forms of intervention to include (or not) and about how to measure/quantify features such as 'strong state intervention' are potentially endless (the proliferation of typologies attests to that)."[122] Even for countries categorised as "liberal market economy"—suggesting limited state intervention—scholars have recognised that the state has always proactively created, regulated, and participated in the market. Rather than "an anomaly or a deviance from liberal, market-based capitalism… [s]tate capitalism is an immanent potentiality, an impulse which is contained in the form of the capitalist state and built into its DNA."[123] Attempts to categorise state influence on national economies necessarily entail a selective use of analytic and conceptual components in order to render messy empirical realities into manageable frameworks.

One could argue that although state intervention pervades most economies, including liberal market economies, it is still possible to detect varying degrees of intrusiveness of state intervention. Using legal prerogatives to compel firms to behave in a certain way is more intrusive than market-oriented forms of intervention, such as offering tax incentives or subsidies. Intrusiveness of state intervention can be a useful criterion, but it does not always capture the complexity of state-business distinction. If the distribution of credits is monopolised by the state, the state would arguably have more leverage in steering firm behaviour. Market-oriented policies—as opposed to micromanaging business-making decisions of individual enterprises—could simply be a more effective way to achieve the same goal: motivating private actors to act in the state's strategic interests. What Anglophone observers criticise as domineering behaviour could reflect their fixation on misleading dichotomies between market and state, as well as between Western liberalism and Eastern authoritarianism.[124] The United States' concern about distinguishability could be the result of its self-identification in relation to an alien Other rather than of an objective assessment of China.[125] This means that distinguishability as a policy concern was never intended to provide a clear-eyed understanding of China's political economy;

[122] Alami and Dixon 2020, 78
[123] Alami and Dixon 2023, 85
[124] Zhang and Lan 2023
[125] Pardo 2014, 47

it is a constructed difference used to substantiate the U.S. self-identity as a free world leader, its exceptionalism, and its place in the world. In sum, it is difficult to offer a clearly delimited conceptualisation of state capitalism without "fetishising some specific institutions and forms of intervention at the expense of others that might be less visible but equally important"[126]

Despite these drawbacks, I argue that introducing the concepts of state-business and civil-military distinguishability adds value to both academic and policy discourse. First, since these terms are frequently invoked by Western and Chinese policymakers and scholars alike, clarifying their analytical underpinnings can illuminate the motivations and logic driving policy decisions. Using the same lexicon and conceptual frames as policymakers increases researchers' proximity to their positionality, helping us better empathize with the constraints they face—particularly the need to make decisions under time pressure and incomplete information, often relying on intellectual shortcuts such as ideal types. Retaining these terms also serves an indexical function, allowing this research to meaningfully engage with existing academic and policy debates.

Second, these conceptual logics must first be fully articulated before they can be subjected to reflexive critique. Because the literature has yet to develop a complete causal theory, this research provides a starting point for interrogating the instability and limits of rigid conceptualizations; positing a concept could be "a means for problematising the current aggregate expansion of the state's role as promoter, supervisor and owner of capital across the world economy."[127] Crucially, my characterizations of civil-military integration and state-business relations reflect perceptions rather than fixed, objective conditions. Distinguishability is not a material fact but an interpretation—a lens through which certain political-economic configurations are assessed. By adopting a constructivist ontology and emphasizing the ambiguous and socially constructed nature of these relations, this research avoids reifying them as static, natural categories.

[126] Alami and Dixon 2020, 84
[127] Alami and Dixon 2023

Chapter 4

Evolution of China's Distinguishability

Distinguishability is a central component of the dual-use security dilemma characterising modern technology competitions, modifying the level of fear and anxiety experienced by states in international anarchy. This chapter applies my conceptual framework of dual-use distinguishability to China. It traces variations in two dimensions of Chinese distinguishability—state-business relations and civil-military integration—over time. In doing so, this chapter sets up the independent variable in my causal hypotheses.

First, this chapter argues that China's economic reforms since the 1970s has steadily reduced the state's intrusion into the economy, leading to the perception of greater state-business separation. Western observers, however, tended to overstate the extent of China's economic liberalization due to their biased view about modernization trajectories. Thus, despite the continuities in state control, Western observers were blindsided by Xi Jinping's attempts to re-assert the state's dominance over the economy in the past decade, viewing them as an unprecedented reversal of the private sector's autonomy.

Second, this chapter traces the evolution of the relationship between China's civilian and military sectors. It finds that reforming Mao's defense-oriented national economy was a priority for Chinese reformers in the 1980s. Emphasis was initially put on defence conversion, spinning off large state-owned defence enterprises into civilian commercial entities. In the 1990s, the arrival of the Revolution in Military Affairs (RMA) convinced Jiang Zemin to construct a world-class technology army. As the locus of innovation has moved to the commercial sector, the Chinese government has enacted a series of reforms to encourage the civilian tech sector's participation in the defense industry. Xi Jinping's Military-Civil Fusion (MCF) strategy represents a maturation of decades of Chinese efforts to institutionalize the integration between the civilian and military spheres.

State-Business Relations

After the People's Republic of China (PRC) was established in 1949, the new leadership took the first few years to develop the direct mechanisms to implement a Soviet-style command economy. In pursuit of socialism, they eliminated distinctions between the private and public economic sectors. Farmers lost title to their land and were organized into production teams within communes. Markets were replaced by five-year plans, administered by the newly established State Planning Commission in 1953, to allocate resources and investments. Important banks, industries, or enterprises were nationalized and brought under the ownership and direction of the state.[128] In this planned economy, the state dictated resource allocation to serve political ends, erasing the autonomy of private actors. This collapse of state-private distinction in early PRC economic policy laid the foundation for China's longstanding fusion of political and economic spheres—a pattern that continues to shape foreign perceptions of its dual-use technologies today.

In the 1950s, Chinese government planners directly allocated resource, severely curtailing market forces such as prices and profit incentives. State-owned enterprises dominated core industries, subordinating individual economic-decision-making to national development goals.[129] The central government maintained control over the economy through several mechanisms. First, it owned all large factories and other key strategic sectors—those with extensive upstream and downstream linkages. In the countryside, land was collectively owned by peasants. Second, central planners assigned production targets and directly distributed inputs across producers. For instance, Chinese planners prioritised resource flow to heavy industries by manipulating prices. Agricultural produce, owned by peasant collectives, were priced artificially low, while industry products, owned by the state, were assigned high prices—effectively subsidising manufactured goods with cheap farm products. Third, the Communist Party controlled managerial appointments, ensuring compliance with Party goals over independent economic reasoning.[130] These structural features—a lack of market forces and the subordination

[128] Dernberger 1999
[129] B. J. Naughton 2018, 66
[130] B. J. Naughton 2018, 70-72

of economic decision-making to political authority—persisted through the tumults and crises until 1978. In this context, the erasure of distinction between state and private interests meant that foreign states, particularly adversaries like the United States, saw no meaningful economic actors in China outside the influence of the Communist Party.

The reform and opening up period saw a relaxation of state control, providing a more permissive environment for China's nonstate sector, including private entrepreneurs.[131] In 1987, a Chinese Communist Party document, for the first time, mentioned private enterprises, characterising the "existence of the individual economy and a small number of privately-owned enterprises" as "unavoidable".[132] The constitution was amended in the following year, supplying the legal basis for private enterprises in the economy. By 1997, the party elevated the role of individual and private enterprises to "an important, integral part of China's socialist market economy.[133] Jiang Zemin's "Important Thought of the Three Represents", ratified by the CCP in 2002, allows private capitalists to join the party, solidifying the political legitimacy of private entrepreneurs in China.[134] The constitutional amendment on assurances for private property in 2004 and the announcement on the Property Law in 2007 reinforce the legal rights and protections given to China's private sector.[135]

This high-level political support for private enterprises was paired by policies to downsize the state sector and cultivate market forces within the economy. The Third Plenum of the 14th Party Congress in November 1993 "marked a major turning point on China's road to a market economy" for calling for the creation of market-supporting institutions, emphasizing the separation of state-owned enterprises from the government, and endorsing the privatization of smaller state-owned firms.[136] In 1995, the Central Committee endorsed the idea of "grasping the large and releasing the small" (*zhuada fangxiao* 抓大放小), inaugurating the dramatic

[131] Policies permitting the operations of private firms are different from policies actively supporting private sector growth. Cf. Haggard and Huang 2008, 339.
[132] Lardy 2001, 19
[133] Lardy 2001, 19
[134] Tsang and Cheung 2024a, 79
[135] Nölke et al. 2019, 48
[136] Qian and Wu 2003, quoted in Lardy 2014, 45

downsizing of the state-owned sector. Small and medium SOEs, mostly in the rural areas, were allowed to privatize—usually in the form of sale of shares to employees—while large SOEs underwent corporatization (instead of privatization), as provided by the 1994 Company Law. They were reorganised into joint stock companies or limited liability companies, designed to give managers more authority to ensure the alignment of interests of managers and government owners (e.g.., having a board of directors) and to allow diversification of ownership, sometimes through a public listing.[137] The overarching theme of this period was separating the enterprises from government (*zhenqi fenkai* 政企分开), freeing economic entities of state intervention to make them more efficient and streamlined.

By relaxing the state's grasp on the economy, these market friendly policies encouraged individual entrepreneurship, unleashing private actors in spurring economic growth. The private sector is now arguably the most vibrant, competitive, and innovative sector in the Chinese economy.[138] The productivity, efficiency, and innovativeness of the private sector is evident in China's high-tech digital industry. China's largest tech firms, Baidu, Alibaba, and Tencent (collectively known as the BATs) have majority non-state ownership and public listings in major stock exchanges around the world. In fact, the BATs were all established in the late 1990s and early 2000s with significant foreign capital involvement, and foreign investors have taken controlling stakes, as well as corporate board membership, in these tech giants.[139] The BATs have since become significant players in China's AI technology ecosystem. Each has developed its own large-language models (LLMs) with capabilities rivalling that of U.S. counterparts: Alibaba's Qwen, Tencent's Hunyuan, and Baidu's Ernie models all achieved remarkable success in AI benchmarking tests.[140] Other prominent companies in the digital tech sector, including those named in the so-called Chinese National AI Team such as Huawei, SenseTime, or iFlyTek[141], operated with significant participation of nonstate actors domestically or overseas, whether through a corporate governance structure that allowed more autonomy than before or enhanced participation of private capital.

[137] Lardy 2014, 45
[138] Lardy 2014, 121; Brandt and Thun 2021
[139] Shen 2019, 36
[140] SuperCLUE n.d.
[141] Larsen 2019

To be sure, despite these reforms, it is still problematic to establish a clear demarcation between private and state domains in China. Leading Chinese digital technology firms are more accurately characterised as "hybrid firms" for having a mix of both public and private ownership, with central and local governments often holding minority stakes in these companies. The Chinese government's involvement in the economy has "financialised" and become less overboard: influence is exerted through state capital and ownership of shares rather than micromanaging business decisions.[142] Without information on the precise contribution of capital and the distribution of share ownership in corporatized firms—which could be further obscured by convoluted, highly nested shareholding structures—it can be challenging to establish whether the controlling owner or shareholder is private or state.[143] Moreover, even when Chinese tech firms are not majority state-owned, they tend to have complex histories and ties with Chinese political authorities; they could be a spin-off enterprise from a state-backed enterprise (e.g., Lenovo), received generous economic and policy support from the state, or their management have deep ties with the Communist Party (e.g., Huawei).[144]

While it is inaccurate to characterise these firms as free from party-state influence, these new, hybrid forms of ownership increased the credibility of claims that the separation between corporate decision-makers and political authorities had grown wider. For one, the financialization of state economic intervention entails a delegation of authority to asset-managing firms, both state and private, representing a less intrusive form of state economic intervention. For instance, a 2013 Party decision encouraged the establishment of "state-owned capital operation companies" (*guoyou ziben yunying gongsi* 国有资本运营公司) to shift from "managing enterprises" to "managing capital", signifying the state's intention to lessen its direct interference in corporate decision-making.[145] These reforms created and deepened the impression that Chinese enterprises were enjoying greater management operational autonomy than in the past.

[142] H. Chen and Rithmire 2020
[143] Lardy 2014, 63
[144] B. J. Naughton 2018, 338
[145] H. Chen and Rithmire 2020

Other aspects of public-private entanglement, such as the complex ties between entrepreneurs and the Communist Party—remained a contentious issue, but many foreign companies and governments were willing to navigate and cope with what they deem a special configuration of a familiar capitalist paradigm. Business motives were believed to be the ultimate driving force behind Chinese private entrepreneurs' political involvement, not unlike the lobbying activities conducted by corporates in Western capitalist societies. According to this narrative, Chinese businesspeople joined the Communist Party, became delegates to the National People's Congress (NPC) or the Chinese People's Political Consultative Conference (CPPCC), or otherwise cultivated ties with party or government officials to advance their business interests in these political bodies.[146] The cultivation of *guanxi* ("connections") was a self-preservation strategy by businesses in the absence of a strong legal system and well-established property rights, rather than a voluntary participation in the state's political agenda.[147] While the "thick embeddedness" of capitalists with the party-state did create a strong shared interests of government and businesses, co-optation was more palatable to foreign observers wary of state influence than coercion.[148]

Hence, China's economic reforms fostered the perception among Western policymakers and businesses that Chinese firms were becoming commercially driven and increasingly autonomous from the party-state. The narrative that China was undergoing a Western-style modernization further boosted Western actors' confidence in deepening economic engagement with China. Economic liberalization, the narrative goes, would lead to political liberalization by empowering the middle class, strengthening the rule of law and civil society, and spreading liberal ideas.[149] Although not everyone is convinced that clear state-business distinctions existed, the reforms created enough ambiguity to support the narrative that private firms had greater room for independent decision-making, imbuing confidence among Western observers that deepening commercial ties with China was both safe and profitable.

---

[146] Lardy 2014, 120
[147] McNally 2011
[148] Nölke et al. 2019, 47
[149] Friedberg 2022

This perception did not necessarily reflect the true conditions of the Chinese public-private relationship nor the Chinese leadership's intentions with reforming the economy. Chinese leaders repeatedly expressed their intention to forge a unique economic system rather than conform to the model of Western liberalization. Yet, Westerns have failed to take these proclamations at face value. A telling anecdote about former U.S. President George H.W. Bush's visit to China in 1998 exemplifies the zeitgeist. When asked how China's privatization plan was proceeding, Chinese Premier Zhu Rongji attempted to explain that China was simply corporatizing—rather than privatizing —its state assets. President Bush reportedly dismissed the distinction, responding that "we know what's going on" no matter what the Premier said.[150] The perception that China was conforming to the capitalist principle of state-market separation was a primary driving force behind the West's increased economic engagement with China. This perception overlooks the selectivity and boundness of China's adoption of elements of market economy. Assuming China was on a liberalization trajectory, they were blindsided by the changes Xi Jinping made to the economy.

Upon becoming the paramount leader, Xi has implemented a series of reforms to assert the party-state's control over the economy, making it increasingly difficult for private firms to credibly claim immunity from party-state influence. First, he initiated regulatory and legal reforms to securitize large swathes of economic activities. National security-related laws passed in recent years compel "firms, individuals, and other organizations" to provide information or support the government on matters of national security. Xi Jinping has broadened the definition of national security by passing the 2015 National Security Law, which elevated economic stability as a core component of national security; the 2017 National Intelligence Law requires that "an organization or citizen shall support, assist in and cooperate in national intelligence work in accordance with the law and keep confidential the national intelligence work that it or he knows" (Article 7).[151] The scope of these security laws explicitly applies to private organisations, and provides very little legal recourse for the private enterprises to push back against these legal requirements.

[150] Wu 2016, 292
[151] Pearson, Rithmire, and Tsai 2022, 147

Second, Xi has strengthened the party-state's role in corporate governance. The CCP has long influenced Chinese businesses and SOEs through the party committee, which was technically required by party regulations for any organisation with more than three CCP members. Whereas party committees used to be relatively powerless and intermediate, under Xi Jinping, the party committee takes on a more direct, immediate control over key decision-making of SOEs; they are now expected to initiate key strategic decisions, and then pass them on to the CEO to draw up a concrete proposal.[152] These changes are consistent with Xi's proclamation that the party must "exercise leadership over all areas in every part of the country"—expressed at the 19th National Congress and incorporated into the CCP's constitution— and that the party should lead "all aspects of corporate governance."[153]

Crucially, these reforms extend beyond SOEs. In 2018, the central government required all domestically listed companies to establish party cells[154]; in 2019, the CCP encouraged all private enterprises to carry out party-building efforts, including maintaining and funding party cells.[155] Moreover, companies have been encouraged to amend their charter to give the party a greater role in the businesses. These "encouragements" first targeted SOEs (giving party control over decision-making or control over personnel, or symbolic adjustments), but were later extended to joint ventures, attracting deep scepticism among foreign businesses.[156] For instance, using both rhetorical and behavioural measures of party influence, Mueller, Wen, and Wu have observed a sharp increase in party influence in all listed Chinese firms since the 19th National Congress in 2017, when the "Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era" was incorporated into the Chinese constitution.[157] While some scholars have argued that the Party's influence over domestic private and foreign-owned firms have been more rhetorical than behavioural (i.e., operations were not affected), the mere appearance of party influence in business decisions is enough to draw suspicion from foreign governments and businesses.

[152] B. Naughton and Boland 2023, 9
[153] B. Naughton and Boland 2023, 9
[154] Blanchette 2019
[155] L. Y.-H. Lin and Milhaupt 2021
[156] Blanchette 2019
[157] Mueller, Wen, and Wu 2023.

The government's acquisition of "golden shares" has also enabled meddling in the corporate decision-making of private businesses. Officially known as "special management shares", these shares are sometimes very small, but tend to give the government board seats, voting power, and sway over business decisions.[158] Different entities controlled by the Chinese government have separately acquired golden shares—a symbolic 1% stake—in key subsidiaries of tech companies such as Alibaba, ByteDance, and Tencent, allowing the government to access online data, monitor these companies' business activities, and influence key business decisions.[159] For example, with its 1% stake in Douyin, ByteDance's main Chinese entity, the Cyberspace Administration of China was allowed to name an official specialising in data security and algorithmic governance to the company's board—and he reportedly enjoys veto rights over decisions as minute as which content was allowed on Douyin.[160]

Third, Xi Jinping has strengthened the party-state's role in manipulating market forces to achieve his strategic vision. Xi has prioritized the pursuit of the "China dream" of national rejuvenation by promoting technological innovation and utilizing the "new productive forces"—new energy, new materials, advanced manufacturing, and digital technology. Key to achieving this vision is the "whole-nation" or "new type of whole-nation" approach, which refers to the combination of state steerage and market forces to achieve strategic objectives.[161] This approach entails using policy instruments, especially industrial policies, to steer market forces to support technological innovation and industrial upgrading. The *Made in China 2025* (MIC 2025) industrial policy, unveiled in 2015, epitomises China's "grand steerage" approach.[162] It is a ten-year plan to upgrade the technological sophistication of its manufacturing base by developing ten key high-tech industries, including next-generation information technology, and advanced robotics and artificial intelligence. The plan mobilises a suite of tactics at the government's disposal, ranging from setting explicit targets to providing direct subsidies and facilitating forced technology transfer, to achieve its ends.[163]

---

[158] Wei 2023
[159] Ye 2023
[160] Wei 2023
[161] Tsang and Cheung 2024b, 304
[162] B. Naughton 2020
[163] Institute for Security & Development Policy 2018

State capital has become a major instrument of government intervention, providing the firepower for policymakers to respond to financial crises or facilitate industrial upgrading.[164] For instance, the creation of "government industrial guidance funds" has been instrumental in upgrading and indigenizing China's strategic sectors, including semiconductors and artificial intelligence, and central and local government funds have served as venture capital (VC) for emerging technology firms.[165] Governments at various levels have set up dozens of funds—including the National Integrated Circuit Industry Investment Fund established by the Ministry of Industry and Information Technology—to boost China's microelectronic industry and achieve self-reliance. The Economist Intelligence Unit estimates that China has invested more than $150 billion into its domestic semiconductor industry since 2014 through these funds.[166]

Government-backed VC is particularly important for supporting early-stage firms in strategic and emerging industries, including AI, due to the significant risks and uncertainties involved. Data compiled by Beraja et al show that China's government VC funds have invested $912 billion, twenty-three percent of which have been directed to 1.4 million AI-related firms across China.[167] The dollar amount does not capture the full impact of government VCs. In China's low-information environment, government VC funds serve as an exclusive source of information to guide private market investment and address information asymmetries between the state and private actors: 71% of Chinese AI firms with both government and private VC funding received government investment first, serving as a signal for private VCs to follow.[168] The increased intensity of China's financial support in strategic industries has raised questions about the distinction between the state and private actors, as even the most dynamic, entrepreneurial private companies have likely received state support at certain stages of their development.

[164] H. Chen and Rithmire 2020
[165] H. Chen and Rithmire 2020
[166] "China Boosts State-Led Chip Investment" 2024
[167] Beraja et al. 2024
[168] Beraja et al. 2024

While these industrial policies appear similar to the developmental models of the East Asian tigers, China's version has distinctive features which makes it likelier to draw suspicion from Western observers. For one, the scale of the Chinese government's investment far exceeds that of East Asian governments, even when adjusted for inflation. According to one figure, Japan's government research and development expenses in 1994 was US $10.1 billion, paling in comparison with the Chinese equivalent of US $458 billion in 2024.[169] Moreover, the East Asian developmental state model mostly focuses on economic growth, while China under Xi Jinping emphasizes the marriage of economic strength and national security. For instance, the promotion of strategic industrial sectors outlined in MIC 2025 aims not just to spur economic productivity but also to achieve technological self-reliance and remove potential chokepoints that could be weaponized by Western advanced industrial nations. Just as Japan's and Germany's pivot toward economic autarky precipitated World War II, China's turn to technological autarky could be seen as preparation, if not indication of the intention, for a more conflictual relationship with the West.[170]

Last but not least, the Chinese government has wielded informal carrots and sticks to exact political fealty from private entrepreneurs. The CCP has disciplined a series of high-profile private sector capitalists, including Alibaba Group's founder and Ant Group chairman Jack Ma, who once seemed irreproachable for being an e-commerce pioneer and acknowledged CCP member. Ma "disappeared" from public view after Chinese regulators halted Ant Group's initial public offering in 2020 and only resurfaced in a high-profile meeting with Xi and other business leaders in 2025.[171] Other prominent Chinese business tycoons were similarly targeted by a mix of legal and extralegal measures. Xiao Jianhua, one of China's wealthiest and most politically connected financiers, was abducted from a Hong Kong hotel in 2017.[172] Ye Jianming—chairman of CEFC, China's largest private oil company, second only to state giants PetroChina, Sinopec, and China National Offshore Oil Corporation—was detained in 2018, reportedly under the direct order from Xi. Many of CEFC's international assets, spread across countries participating in the

[169] Tsang and Cheung 2024b, 304
[170] DiPippo 2022
[171] Olcott and Wu 2025
[172] Zhong and Stevenson 2021

strategic Belt and Road initiative, have since been transferred to a Chinese state-owned company.[173]

The use of intimidation tactics on private businesses was coupled with other forms of political signalling, including rhetorical pressure and propaganda.[174] In a February 2025 meeting between Xi and leaders of prominent Chinese tech companies like Huawei, Xiaomi, CATL, and BYD, Xi called on private enterprises to "have ambition to serve the country" in the technological showdown with the United States.[175] Even businesses in Hong Kong—long thought to be relatively autonomous from Beijing's interference under the "One Country, Two System" arrangement—are now expected to show patriotism. In March 2025, when Hong Kong company CK Hutchison sought to sell its expansive overseas port businesses—seen as strategically important to Xi's maritime expansion agenda—to a U.S.-led consortium, CCP propagandists launched a barrage of rhetorical attacks at the company, accusing the company of "profit-seeking and unrighteous" behaviour and proclaiming that entrepreneurs must be patriotic.[176] Chinese regulators may even intervene to stop the deal all together, demonstrating their intolerance towards letting commercial interests override what they perceive as national security concerns.

In short, Xi has initiated a sweeping crackdown on the autonomy of private business interests, reasserting the role of the state in steering China's economic trajectory. Xi's reforms have contributed to the perception that, as former Secretary of State Antony Blinken once described, "In China, there's really no distinction between private companies and the state."[177] While there are recent attempts by Xi to restore business confidence and increase support for the private sector—recognising that the private sector's dynamism is key to overcoming the country's sluggish growth—these measures are likely too little, too late.[178] Perception among foreign policy practitioners has hardened around the meme that state-business distinguishability

[173] Marsh n.d.
[174] Almén and Carlsson 2025
[175] Stevenson 2025
[176] Kot and Au 2025
[177] Wei 2023
[178] Pettis 2025

does not credibly exist within China. As discussed later, such a perception has coincided with a sharp deterioration in technological relations between China and Western nations, fuelling an increasingly restrictionist agenda towards China. As Scott Kennedy, a China expert at a prominent Washington think tank puts it, "The blurring of the line is pushing policy makers in the U.S. and other countries to take a broadly restrictive position on Chinese companies." [179]

Civil-Military Integration

Since the early days of the PRC, Chinese leaders have theorized the interaction of economic activity across the military and civilian sectors. Early PRC leaders viewed the Soviet Union's emphasis on heavy industrial development as key to rapid industrialization. This model, in their view, linked economic development directly to national defense by making critical materials like steel available for weapons production. The outbreak of the Korean War reinforced the CCP's conviction in the Soviet model and accelerated the fusion of national defense and economic planning.[180] The war heightened perceptions of external threat and underscored the need for a self-reliant heavy industry, as the United States—formerly a provider of military-industrial support during World War II—had now become an adversary on the Korean peninsula. In a 1951 speech, a high-level Chinese official declared "the consolidation of national defense" through "strengthen[ing] national defense-related heavy industries" a "top priority".[181] In September 1953, Premier Zhou Enlai defined the "basic task" of the First Five-Year Plan as "concentrating major effort on developing heavy industry, laying a foundation for China's industrialization and the modernization of national defense."[182]

This logic of synergising heavy industrialisation and national defense requirements was institutionalised in the First Five-Year Plan (FYP) in 1953, which prioritised defense-relevant industrial capacity over civilian needs. The plan dramatically increased investment in heavy industry at the expense of consumption, channelling over half of all investment into industrial

[179] Wei 2023
[180] Bian 2015, 210
[181] Quoted in Bian 2015, 209
[182] Quoted in Bian 2015, 209

development, especially producer goods like metallurgy, machine building, electric power, coal, petroleum, and chemical industries.[183] Furthermore, the government emphasised large-scale, capital-intensive manufacturing, with 156 Soviet-aided projects replicating entire Soviet factories and transferring technology and industrial know-how.[184] Economic planning subordinated household consumption to the imperatives of national strategic priorities.

Dominated by heavy industry and defense-related production, China's command economy was not a functional dual-use system; civilian and military production competed against each other. After the Korean war, CCP leaders lamented that heavy military spending drained resources from economic development.[185] Mao Zedong criticized this rigidity at a 1956 State Council meeting, advocating that "in production, the defense industry should pay attention to dual-use capabilities," meaning that production equipment should be adaptable for both peacetime civilian and wartime military uses. [186] His vision reflected the principle of *junmin liangyong* 军民两用, often translated as "dual-use," referring to the convertibility of production capacity between the two spheres. Mao's vision was formally codified in 1957, when the Second Ministry of Machine Building released the 16-character policy guideline—*junmin jiehe, ping zhan jiehe, yijun weizhu, yimin yangjun* 军民结合 平战结合 以军为主 以民养军—calling for military-civil integration, wartime-peacetime integration, military primacy, and civilian support for defense.

While the policy represented an early articulation of dual-use strategy, it remained largely aspirational, and efforts to expand civilian production were short-lived. Heightened security threats in the 1960s—including the Sino-Soviet Split, U.S. presence in the Vietnam War and other parts of Northeast Asia, the 1962 border clash with India, and hostilities over the Taiwan strait—triggered a substantial militarization of China's economy.[187] In 1964, Mao Zedong rejected a draft of the Third Five-Year Plan (1965–1970) that aimed to improve living standards

[183] Lardy 1987, 157-8
[184] Giorcelli and Li 2021
[185] Stone 2021, 15
[186] Ge 2021
[187] Sun and Wang 2018, 23

by boosting consumer goods following the Great Leap Forward.[188] Instead, he launched the Third Front policy (*sanxian jianshe* 三线建设) , a massive initiative to build a self-sufficient military-industrial complex from scratch in China's mountainous interior.[189] The strategy aimed to shield China's industrial base—then concentrated on the vulnerable eastern seaboard—from potential U.S. or Soviet strikes and ensure the country's ability to mount a military response.[190] Over the next 15 years, the central government devoted over 205.2 billion RMB to construct 2,000 large and medium factories, along with railways, utilities, laboratories, and other supporting infrastructure, in China's interior regions.[191] This scale of investment reflected a wartime posture in which defense production took clear precedence over civilian needs. As expert Barry Naughton describes, between 1969 and 1971, China experienced "pervasive militarization" of the economy, as economic resources were poured into the Third Front construction projects.[192]

As Deng Xiaoping and other reform-minded assumed power after Mao's death, they determined that the acute security threats of the 1960s and early 1970s had sufficiently subsided. With improved foreign relations—most notably the U.S.-China rapprochement—China could afford to scale back military preparedness and lessen the extensive militarization of the economy. The shift ushered in a period of *defense conversion* (*junzhuanmin* 军转民), aimed at reconfiguring the defense economy to support economic development. The conversion process involves "spinning off" a large segment of the defense economy from military to civilian operations. During the period, many defense enterprises ventured into commercial activities far outside their traditional economic activities. By the end of the 1990s, over 80 percent of the defense sector's annual output consisted of civilian products.[193]

Defense conversion introduced a degree of civil-military ambiguity, as former defense enterprises increasingly engaged in civilian markets while retaining close ties to the military. The

[188] B. Naughton 1988, 352
[189] Kendall and Meyskens 2024
[190] B. J. Naughton 2018, 83
[191] Dong 2019, p 63
[192] B. J. Naughton 2018, 86
[193] Cheung 2013, 55

crucial role of the Third Front construction in supporting China's vibrant, market-oriented regions exemplifies the intertwined nature of civil and military sectors in China. Due to Deng's de-emphasis on military industrial projects, the People's Liberation Army Engineering Corps, a military labour force supporting the Third Front construction, transferred 20,000 troops to the Shenzhen special economic zone (SEZ) in 1979 to convert idle military capacity into a resource for stimulating economic growth in the coastal south. The Engineering Corps, equipped with skilled personnel and more advanced technology and equipment than civilian industries, "not only efficiently built the infrastructure that facilitated economic exchanges during China's marketization but also transferred military engineering technologies and Maoist labour mobilization methods to the civilian realm."[194]

In some cases, the transformation of Third Front enterprises entailed not a straightforward conversion into civilian corporates, but a strategic reorganisation into more economically efficient military enterprises by fostering new technological capabilities.[195] Huawei, one of China's most digitally innovative companies today, is a case in point. Its founder, Ren Zhengfei arrived in Shenzhen as part of the Engineering Corps' relocation and founded Huawei as a private company four years after the Corps officially dissolved in 1983.[196] Huawei has since been a crucial supplier of telecommunication equipment to the PLA. Ren's military background, as well as the company's business ties with the PLA, has been a source of suspicion from U.S. policymakers.[197]

Another example is China Electronics Corporation (CEC), a state-owned conglomerate producing dual-use electronics and one of China's largest companies, owning a total of 22 subordinate enterprises and 14 listed companies.[198] It was formed in 1989 by consolidating the electronics firms under the Fourth Ministry of Machine Building, which controlled most of China's scarce electronics expertise during the Third Front construction. One of its subsidiaries, Zhenhua Electronics Corporation (振华), traces its roots back to the Third Front project in

[194] Zhou and Weng 2024, 908
[195] B. Naughton 2024
[196] Zhou and Weng 2024, 917-8
[197] Gallagher 2022
[198] "China Electronics Corporation" 2019

Guizhou, the site of an ambitious attempt to build a military electronics complex. The establishment of the Shenzhen SEZ offered opportunities to spin off these military electronics firms in the Guizhou complex into more efficient, competitive enterprises. After the Guizhou base was restructured into Zhenhua, it moved substantial operations to Shenzhen to engage in production and export, as well as the important and dissemination of technical and market information. By mid-1987, more than 1000 such enterprises had been created by military and electronics firms from Third Front provinces like Sichuan, Shaanxi, and Guizhou in the SEZs.[199] While both CEC and Zhenhua have a substantial civilian production base, their core mission continues to be supplying military electronics to support the PLA's military modernization efforts.[200]

While the defense conversion moniker suggests a one-way diffusion of technology from the resource-rich and skilled military sector to civilian markets, benefits can flow from the opposite direction as well. Defense enterprises' transformation into business corporations in SEZs allowed them to import foreign technology, access foreign investment, emulate Western management practices, and access export markets. These resources in turn improved the economic viability of cash-strapped defense enterprises and boosted their technological innovation. An official Chinese study of the defense conversion process assessed that "without foreign directed development, the production of civilian goods would not have enjoyed such great success."[201] From an economics perspective, entering the civilian markets was a great way for defense enterprises to diversify its revenue streams, maximise the possible sales from a common technology, hedge against the swings in government and commercial demand, and achieve economies of scale and scope.[202]

From a strategic perspective, corporatisation can obfuscate the defense enterprises' military past, increasing their credibility in the eyes of foreign investors and importers and allowing easier access to foreign investment and technology. For example, until it was targeted by U.S. sanctions in 2020, China Electronics Technology Group Corporation (CETC)—not to be

[199] B. Naughton 1988, 382-3
[200] B. Naughton 2024
[201] Quoted in Cheung 2013, 61-63
[202] Alic et al. 1992, 178

confused with CEC—and its subsidiaries had managed to enter into joint ventures and supplier arrangements with some of the world's largest electronics companies, including IBM, Sun, HP, Cisco, and Oracle.[203] Through a subsidiary called the 54th Research Institute, CETC even established a joint venture with prominent U.S. defense contractor Harris Corporation, forming the Hebei Far East Harris Communications Company in 2005.[204] The joint venture reportedly manufactured a wide range of communications products, including military-grade communications field switches and private mobile radio systems, for Chinese and Russian end-users.[205] A major part of CETC's appeal to foreign technology firms was that it "operates in many ways like a civilian commercial entity and appears eager to start profitable joint ventures that offer access to the Chinese market."[206]

Due to the perceived economic and technological benefits, embedding defense-oriented industries within the civilian economy became central to Chinese strategic thinking in the early 2000s. In July 2000, Jiang Zemin introduced the concept of "embedding the military within the civilian" (*yujun yumin* 寓军于民). This approach was codified in the Tenth Five-Year Plan (2000–2005) and emphasized in subsequent Party documents, which called for integrating military needs into civilian sectors and aligning defense industries with market principles.[207] The 2003 Third Plenum of the Sixteenth Party Congress elevated *yujun yumin* as a strategy for "mutual promotion and coordinated development of the defense and civilian technological sectors."[208]

The security environment in the late 1980s and early 1990s provided further impetus for China to strengthen national defense through civilian resources. In particular, the United States' decisive victory in the first Gulf War in 1991 deeply impressed upon PLA leaders the significance of "revolutionary in military affairs." The Chinese military closely studied the first

[203] Luce 2012
[204] "Digital Telephone Switches Manufacturer, Voip Solution, High Reliability Supplier - Hebei Far East Harris Communications Co., Ltd." n.d.
[205] Luce 2012
[206] Luce 2012
[207] Central People's Government of the People's Republic of China 2000
[208] Cheung 2013, 185; Central People's Government of the People's Republic of China 2003

Gulf War and concluded that the nature of warfare had fundamentally shifted: the advent of new technologies had brought about Local Wars Under High-Technology Conditions (*gaojishu tiaojian xia jubu zhanzheng* 高技术条件下局部战争), which showcased not only long-range, precision strike weapons, but also a highly unified command and control system through the extensive use of information technology.[209] To prepare the PLA for such wars, Jiang's government released a new strategy titled "Military Strategic Guidelines for the New Period" (*xinshiqi guojia junshi zhanlue fangzhe*n 新时期国家军事战略方针), laying out the direction of PLA's military modernisation.[210] In 1995, the Central Military Committee proposed building a "technological strong military" (*keji qiangjun* 科技强军), prioritising quality over quantity and technological concentration over human power concentration.[211]

The strategy kickstarted a decades-long shift towards a technology-centric military modernization. Subsequent PLA military strategies reinforced the central role of information technology. The 2004 Defense White Paper noted that as the worldwide Revolution in Military Affairs was gaining momentum, the PLA must be prepared to "win local wars under the conditions of informatization" (信息化条件下的局部战争).[212] It called on the PLA to "[take] advantage of progress in government and social sectors in the field of informatization" and "[establish a scientific research and production system and information mobilization mechanism that *integrates military and civilian efforts* to promote the informatization process of both the PLA and the government."[213] The PLA's view of war would later evolve from "informatization" to "intelligentization" in the 2019 Defense White paper, highlighting the growing military application of new and emerging technologies—including artificial intelligence, quantum information, big data, cloud computing, and Internet of things.[214]

These strategies generated great military demand for high-tech products, which could not be satisfied by a defense industrial base siloed from civilian innovations. The demand for narrow

[209] D. Cheng 2011, 154
[210] D. Cheng 2011, 160
[211] Sun and Wang 2019, 30
[212] "Informatization" is sometimes translated as "informationalization".
[213] State Council Information Office 2004. Emphasis added.
[214] State Council Information Office 2019

but deep specialization in next-generation technologies required the participation of an expanded number of industries in defense technology development and production.[215] For instance, Chinese researchers have cited statistics claiming that the equipment used in military operations in the first Gulf War was assembled from more than 1,000 industrial technology categories, up from roughly 160 used for World War II.[216] Moreover, the technology demands of modern combat have far exceeded the research and production capacity of military academic, research, and defense industry institutions. By the 2000s, China's civilian sector's capacity for technological innovation has already surpassed its military counterpart, reversing the previous trend where the Chinese defense industry monopolised the technical expertise for advanced technology.[217] Hence, the PLA must diversify the sourcing of technology by tapping into the civilian market in order to fulfil the military's demanding technological standards.

China's push for "military-civil fusion" (*junmin ronghe* 军民融合) emerged amid the PLA's growing demand for high-technology warfighting capabilities. Chinese leader Hu Jintao first proposed the need to tread a path of "military-civil fusion with Chinese characteristics" (*zhongguo tese junmin ronghe* 中国特色军民融合) in 2007, during the 17th National Congress of the Chinese Communist Party.[218] Xi Jinping further institutionalized MCF, elevating it to the status of national strategy. Since the early days of his tenure, Xi has stressed MCF's importance in uniting the dual priorities of economic development and defense modernization. At a 2015 meeting with PLA representatives ahead of the 2015 National People's Congress, he announced a new phase in CMI reforms, transitioning from "initial integration" (*chubu ronghe* 初步融合) to deep integration (*shendu ronghe* 深度融合).[219] In March 2016—following Politburo approval of the "The Opinion on the Integrated Development of Economic Construction and National Defense Construction" (*guanyu jingji jianshe he guofang jianshe ronghe fazhan de yijian*《关于经济建设和国防建设融合发展的意见》)—MCF was officially elevated to the status of national strategy. In January 2017, the government launched the new Central Commission for

[215] Lafferty 2019, 634-5
[216] Quoted in Lafferty 2019, 634
[217] Lafferty 2019, 634
[218] Central People's Government of the People's Republic of China 2007
[219] Lafferty 2019, 640

Integrated Military and Civilian Development (*junmin ronghe fazhan weiyuanhui* 军民融合发展委员会) to improve the top-level coordination and design of MCF strategy.

MCF refined previous dual-use concepts proposed by Chinese strategists. First, it broadened the thinking on CMI beyond the mere "combination of the civilian and military sectors" toward a deeper, systematic integration; whereas previous CMI represents a mere mechanical interaction between parts, MCF is analogized as a chemical or nuclear fusion. Second, the initiative broadened the scope of CMI, allowing the use of all available economic resources—including capital, technology, human capital, facilities, and information—to promote the defense industry.[220] As Xi explained in his work report in the 19th Party Congress, China's ambition is to mobilizes all state and societal resources to enhance China's "comprehensive national power" (*zonghe guoli* 综合国力). Specifically, this would require developing a "deep pattern of military-civil fusion" and building an "integrated national strategic system and capabilities" (*jiangou yitihua de guojia zhanlue tixi he nengli* 构建一体化的国家战略体系和能力).[221] MCF is a major component of China's broader effort to unify resources from the political, economic, military, technological, diplomatic, and cultural domains.

Operationally, MCF consists of two major components: defense conversion and civilian participation in defense (*min can jun* 民参军). Since the former has already been sufficiently institutionalized since Deng's reforms, the latter offered the greater room for expansion under Xi. The government has gradually lowered the barrier for private enterprises to enter China's defense industry. In 2005, for the first time, a State Council regulatory document granted formal permission for non-public sectors of the economy to compete for defence research, development, and manufacturing contracts, as well as participating in the restructuring of state-owned defense industrial corporations according to the relevant provisions.[222] The 2005 legal reforms provided greater legal clarity and policy heft to the role private actors in providing capabilities to the PLA.

[220] Cheung 2019, 599
[221] Huang and Ma 2019
[222] Central People's Government of the People's Republic of China 2005

After lowering the barrier to civilian participation in defense procurement, the next step is to promote awareness of such opportunities. One such initiative is the launch of the online All-Army Weapons and Equipment Procurement Information Network (*quanjun wuqi zhuangbei caigou xinxi wang* 全军武器装备采购信息网) in January 2015, which became the PLA's first authorized clearinghouse for defense procurement notices.[223] To be sure, due to security concerns, civilian actors are not expected to be involved equally in all phases of procurement or all types of military systems. For sensitive projects, procurement contracts are likely reserved for enterprises with the appropriate level of security clearance. This explains why civilian firms' overall involvement in military production remains limited: according to official sources, in 2016 less than 3.5% of the relevant civilian enterprises in China participated in military development and production.[224]

But civilian companies are uniquely positioned to provide high-tech components and subsystems, including high-end integrated circuits, semiconductors, and processors. These items are usually less sensitive and straightforward to procure, as they can be commercial-off-the-shelf (COTS) and do not require the PLA to reveal sensitive specification information to untrusted private companies. With their reliable production capacity buoyed by commercial market demand, civilian firms can deliver COTS products at scale and pace. Importantly, civilian companies often have better access to foreign dual-use technologies than their military peers. Since China's domestic military-industrial complex has yet achieved full self-reliance on advanced technology production, civilian companies' import of such products "may help overcome export restrictions in the country of origin while allowing China to hide [its] weaknesses and its military intentions."[225]

Moreover, publicly available evidence suggests that the PLA increasingly relies on commercial-off-the-shelf solutions to fulfill its need for AI-related capabilities. In a 2021 report, researchers at the Center for Security and Emerging Technologies (CSET) analyzed 343 AI-related procurement contracts published by the Chinese military in 2020. The capabilities

[223] Lafferty 2019, 639
[224] Cited in Evron 2021, 41
[225] Evron 2021, 34-5

procured encompass autonomous vehicles, predictive maintenance and logistics, information and electronic warfare, simulation and training, command and control, automated target recognition, as well as intelligence, surveillance, and reconnaissance (ISR).[226] Among the 273 PLA suppliers identified in the study, private Chinese technology companies—rather than SOEs or their subsidiaries—are the most common suppliers of AI-related equipment, accounting for 60.8% of known suppliers.[227] Notably, these companies consist mostly of recently established companies specializing in intelligent software or sensors. Two-thirds were founded since 2010 and one-third since 2015, and most of them are small and medium-size enterprises, with registered capital of less than $1 million.[228] These newly established, nimble, and specialized entrants to China's defense market play a key in role in filling the void left by SOEs and defense-spinoffs created in the 1990s and 2000s, which are proving too stagnant, bureaucratic, and slow-moving to satisfy the PLA's voracious demand for high-technology equipment.

The strategic imperative to exploit technology from the civilian sector is a clear focus of China's New Generation Artificial Intelligence Development Plan (*Xinyidai rengong zhineng fazhan guihu*o 新一代人工智能发展规划), which aims to establish China as the world's premiere global AI innovation centre by 2030. Noting that "the development of AI [is] […] a major strategy to enhance national competitiveness and protect national security," the strategy emphasizes the need to use AI to make "leapfrog developments" in military capabilities, relying on radical technological breakthroughs to surpass the United States.[229] To extract the maximum strategic value from AI, the strategy sets out military-civil fusion as one of its core missions. More specifically, it requires the promotion of "bidirectional technology transfer and resource-sharing" between the military and civilian domains" in order to achieve "a new pattern of deep civil-military integration characterized by full-element, multi-domain, and high-efficiency collaboration."[230]

[226] Fedasiuk, Melot, and Murphy 2021, 13.
[227] Fedasiuk, Melot, and Murphy 2021, 32.
[228] Fedasiuk, Melot, and Murphy 2021, 32.
[229] Roberts et al. 2021
[230] Central People's Government of the People's Republic of China 2017

In sum, Xi's MCF strategy represents a major push to mobilize civilian-origin technology in support of national defense requirements. This push is especially evident in advanced technological areas, in which civilian firms often enjoy superior technological sophistication and know-how, greater access to foreign advanced technology, reliable and scalable production capacity. The civil-military relationship was no longer a one-way "spinoff" from military to civilian sector; it involves "spin-on", or civilian participation in the military, and the development of dual use technologies.[231] While the long-term success of MCF remains uncertain, Xi appears committed to deepening integration between China's civilian and national security sectors. Since the late 2010s, Chinese officials have begun to replace the MCF label with a more ambitious framing: the construction of an "integrated national strategic system" (*yitihua guojia zhanlue tixi* 一体化国家战略体系). Overseen by the Central Military-Civil Fusion Development Commission, this new framework seeks to align civil, security, and military institutions into a unified system—pooling strategic resources across jurisdictions to achieve common objectives.[232] Given this trajectory toward the securitization of broad swathes of Chinese society, it is becoming increasingly difficult for foreign states to draw clear lines of civil-military distinguishability within China's political economy.

[231] Sun and Wang 2019, 33-4
[232] Cheung 2023

Chapter 5

Evolution of U.S. Export Controls

How has the United States reacted to variations in China's dual-use distinguishability? And how does this relate to the bilateral AI competition? This section argues that since the Tiananmen embargo against China, the United States has traded with China under the principle of distinction: technology transfer to civilian end-use or end-users are permitted, but dual-use items destined for military end-use or end-users are restricted. Such an arrangement was possible as U.S. policymakers believed they could reasonably differentiate between civilian and military actors in China. This belief was likely deepened by changes in China's political economy, including progress in corporatising state-owned enterprises and increased political acceptance and legal protections for private entrepreneurs. Rather than imposing a blanket embargo on dual-use trade to China, the U.S. government favoured case-by-case restrictions through instruments like the Entity List. However, this tailored approach is coming under increasing stress. Due to Xi Jinping's various efforts to leverage private, civilian enterprises to achieve China's strategic aims, the United States has experienced greater pressure to match the sweeping scope of Xi's initiatives by widening its export controls. As the United States sanctions more and more Chinese technology firms for allegedly aiding China's military modernisation, it has realised the ineffectiveness of targeting individual entities, pivoting to country-level controls, escalating U.S.-China tensions.

Table 3. U.S. export controls varies with Chinese distinguishability

Time Period	**State-Business**	**Civil-Military**	**U.S. Export Controls**
Mao	Indistinguishable	Pervasive militarization of economy	Total embargo
Deng, Jiang, Hu	More distinguishable	Defense conversion, followed by civil-military integration	Liberalization

Xi	Less distinguishable	Less distinguishable	Increasing restrictions

From Embargo to Trade Liberalization

The United States imposed a total trade embargo on China shortly after the PRC's establishment. The Truman Administration initially resisted calls for a total embargo on the new PRC to undermine Communist regimes around the world, but U.S. openness to trade with China did not last long.[233] Following China's entry into the Korean war, Washington swiftly coordinated multilateral trade restrictions against China, aiming to delay the PRC's modernization and weaken its military capacity. In May 1951, the United States successfully pushed for a UN General Assembly resolution to embargo strategic goods to China and North Korea. By 1952, the United States and its allies had imposed a complete embargo on all items controlled by the Coordinating Committee for Multilateral Export Controls (COCOM), a body established in 1949 to coordinate the Western bloc's export controls.[234] This embargo was even harsher than those imposed on the Soviet Union and Eastern bloc countries, a policy known as the "China differential". While European and Japanese allies abandoned the China differential in 1958 and resumed limited trade with China, the United States maintained sweeping restrictions until 1971. That year, U.S. exports to China were virtually non-existent, and imports were limited to agricultural products.[235] During this period, U.S. policymakers did not believe in any meaningful distinction between China's civilian and military economic sectors. Fundamental tensions in the two countries' foreign policy bred deep suspicion and distrust. The United States insisted upon a strategy of economic denial based on the assumption that any resources China gained through trade—even in the civilian sector—would ultimately support its military development.[236]

[233] X. J. Chen 2006
[234] Foot 1997, 53
[235] Meijer 2016, 36
[236] Mastanduno 1985, 507

However, as diplomatic relations gradually thawed, rising trust enabled the selective reopening of economic ties. Strategic considerations dominated the United States' decision to improve relations with China and erase technology transfer barriers. The United States wanted to bolster China's technological modernization—and by extension, military capabilities—to cultivate a strategic counterweight to the Soviet Union. The Nixon administration lifted the embargo on non-strategic exports to China in 1971, paving the way for broader engagement. In 1979, the two countries formally normalised diplomatic relations; after the signing of U.S.-China Agreement on Cooperation in Science and Technology, civilian scientific and technological cooperation began to grow.[237] As one former U.S. official who served in the U.S. Embassy in Beijing (1982-1983) and the State Department's Office of Chinese and Mongolian Affairs (1983-1985) explained, the liberalization of US export controls in the 1980s "was overwhelmingly strategic, it had nothing to do with commercial factors."[238]

U.S.-China military cooperation in the second half of the 1980s illustrates the strategic logic of U.S. technology transfer to China. During this period, the United States approved transfers of dual-use technologies—and even nonlethal military equipment—to China on a case-by-case basis.[239] Most of these transactions were commercial, but some were conducted through official U.S. military assistance, as Reagan made China eligible for certain military purchases under the Foreign Military Sales (FMS) program in 1984. Over the next half-decade, China acquired a series of American weapons systems, including factory equipment for producing artillery munitions and projectiles, torpedoes, artillery-locating radar, and even technical assistance for modernizing its fighter jet programs. [240] Concerns over distinguishability were moot in these exchanges: the United States did not oppose enhancing China's military capabilities at the time and was, in fact, directly contributing to them.

While these military systems' contribution to Chinese warfighting capabilities was likely marginal, the strategic alignment significantly bolstered China's long-term technological development by improving China's access to the global dual-use technology trade. More and

[237] Meijer 2016, 36
[238] Meijer 2016, 60
[239] Meijer 2016, 59-60
[240] Finkelstein 2010, 7

more American technology firms wanted to sell their products in China, and the resultant backlog in COCOM export license applications prompted the United States and COCOM partners to enact major liberalization of multilateral controls between 1985 and 1987.[241] The new China "Green Line" policy made a range of dual-use items—including computers, software, instrumentation, telecommunications equipment, and semiconductor manufacturing—eligible for exports without prior COCOM approval.[242] Sensitive military technology relating to nuclear weapons and delivery systems, intelligence gathering, electronic warfare, antisubmarine warfare, power projection, and air superiority was still subject to the presumption of denial. Hence, commercial sales of dual-use components and technical assistance, rather than whole sophisticated military systems, accounted for the majority of U.S. technology transfer to China in the 1980s.[243]

The strategic alignment created room for a broader set of actors—most notably U.S. business interests—to engage with China, increasing the breadth and depth of technological interdependence between the two countries. As scholar Hugo Meijer describes, "although the initial impetus and the underlying rationale for export control liberalizations in the 1980s were strategic—namely, to foster US- China cooperation against the common Soviet adversary—the gradual thickening of bilateral economic relations and growing technology transfers came to create, within the American society, vested interests favoring the expansion of technology transfers**.** The high-tech industry began to exert pressures on the US government to expand dual-use trade and to loosen restrictions on exports to the PRC."[244]

The Rise of Distinguishability

Distinguishability only became a salient matter when the military relations between the United States and China soured in late 1980s and early 1990s. A series of events led to the deterioration in security relations. First, the United States, together with European allies, imposed an arms embargo against China after the PLA cracked down on peaceful protestors in

[241] Meijer 2016, 77
[242] Meijer 2016, 78
[243] Meijer 2016, 86
[244] Meijer 2016, 100-1

June 1989, halting the transfer of military technologies to the PLA. Second, the dissolution of Soviet Union removed a common threat and the strategic rationale for U.S.-China security cooperation in the first place. Third, during the 1990s, the re-emergence of Taiwan as divisive issue between the United States and China made military relations increasingly difficult. The PLA's show of force in the 1995-1996 Taiwan Strait Crisis only deepened military tensions between the two powers.[245] Due to the deteriorating security relations, the United States had become concerned about China's military modernization and its effect on regional stability in East Asia.

Despite these security concerns, U.S. dual-use trade with China continued to undergo *de facto* liberalization. The United States and COCOM gradually slashed the number of items on their control lists; COCOM dissolved altogether in 1994, and the Wassenaar Arrangement became the primary institution for regulating the global trade in dual-use items in 1996. Wassenaar was a significantly weaker regulatory framework: it is a voluntary export control regime that has no agreed upon target countries.[246] This institutional setting diluted U.S. decision-making authority over nations who did not share the same security concerns. European allies saw China more as an economic opportunity than a potential military threat and were reluctant to forgo the commercial opportunities of technology sales to China. At the same time, as the Tiananmen sanctions prohibited the transfer of military technologies, China had increasingly relied on foreign, commercially sourced dual-use technologies for supporting the PLA's military technology development in fields like microelectronics, computers, telecommunications equipment, and space.[247] A former senior official working on the U.S. Defense Department's China-related policies describes that in the mid-1990s a "strong feeling" emerged within the US government that "particularly because of the Tiananmen sanctions [. . .] the dual-use route would become much more attractive to the Chinese. Their hardware and platforms were mostly coming from Russia, but in terms of dual-use it was sort of free rein among the Western economies."[248]

[245] Finkelstein 2010, 10-1
[246] Fergusson and Kerr 2020
[247] Meijer 2016, 127
[248] Quoted in Meijer 2016, 127

As the United States could no longer sustain a united front on export controls against China, unilateral restrictions would prove counterproductive to U.S. national security interests. If U.S. firms refused to sell dual-use items to China, other firms would gladly fill the gap, resulting in little increase in U.S. security but a drastic decrease in U.S. technology firms' commercial competitiveness. Given the growing commercialization of the U.S. defense-industrial base, if U.S. technology firms suffered, the capabilities of the U.S. military would also be dented. Hence, a new cohort of U.S. policy officials, known as the "Run Faster" coalition, argued that it was in the United States's national security interest to loosen its export control policy in response to foreign availability of dual-use items. Still, the Run Faster camp could only credibly claim that export control liberalization enhances U.S. national security if the traded items would not directly contribute to the PLA's modernization.

It was in this context that the principle of end user distinction emerged as a way of balancing the economic benefits of commercial technology ties with China and the security risks of enhancing the PLA's technological capabilities. Under the principle of distinction, exports to civilian entities in China were subject to less stringent licensing requirements than those to military end users. Crucially, ongoing reforms in China's political economy lent greater credibility to the belief that Chinese civilian and military end-users could be feasibly and meaningfully distinguished. As reviewed in Chapter 4, the 1990s was a critical period for the growth of China's private sector. Not only did private entrepreneurs receive high-level political support from the CCP, but the state sector also underwent a series of reforms to create greater room for private entrepreneurial activities. Many state-owned enterprises underwent corporatization, giving corporate managers greater autonomy in decision-making as well as diffusing the stakeholder and ownership structures; small and medium SOEs were allowed to privatize altogether. At the same time, Chinese defense conglomerates, associated research institutes, and other production firms were reorganized into corporations, posing as civilian commercial entities to source technologies from international markets. The appearance of growing separation between enterprises and state prerogatives likely strengthened U.S. confidence that distinguishing public from private actors in export controls was both feasible and aligned with U.S. commercial and security interests.

Cognitive biases likely fuelled U.S. overconfidence about the prospects of further economic liberalization in China. While the reform period significantly expanded the scope for private entrepreneurship in China, the Chinese government has always retained important levers of control over the economy, as well as expressed their opposition to emulating Western modernization. But Western commentators underestimated these continuities, as the zeitgeist in the 1990s was one of liberal triumphalism.[249] Partly thanks to the collapse of the Soviet Union and the apparent victory of Western liberal capitalism, Western commentators assumed that commercial interaction with China would lead to gradual but steady economic and political liberalization, which entails a more autonomous private sector and a diffusion of interests in policymaking.[250] Such a perception, based on the West's wishful assumption of the inevitability of liberalization rather than a sober assessment of Chinese political economy, could explain the United States' willingness to liberalize export controls on dual-use items.

For instance, high-performance computers (HPC) have long been incorporated in military systems such as precision cruise missiles, electronic suites of military aircraft, command and control systems, unmanned aerial vehicles, and surveillance systems; its strategic significance only sharpened in the age of big data and artificial intelligence.[251] In 1996, the U.S. Commerce Department removed license requirements for HPC exports under a performance threshold called million theoretical operations per second (MTOPs), and organized target countries into four tiers with increasing levels of control.[252] For Tier 3 countries, which include China, a dual control system was established, such that US firms could export to Chinese civilian end-users and end-uses can import computers up to 7,000 MTOPs without a license, while exports to military end-users or end-uses were subject to the more restrictive 2,000 MTOPs threshold.[253]

The role of distinction in U.S. export controls was reinforced in the "China Rule" in 2007. Published by the U.S. Department of Commerce, the rule reaffirmed that the "overall policy of the United States for exports to the PRC of [of items controlled on the Commerce

[249] Fukuyama 1989
[250] Campbell and Ratner 2018
[251] Ezell 2022
[252] Meijer 2016, 86
[253] Meijer 2016, 86

Control List for reasons of national security] is to approve exports for civil end-uses but generally to deny exports that will make a direct and significant contribution to Chinese military capabilities."[254] In addition, it established a Military End-Use List for 20 highly sensitive product categories, including certain HPCs, telecommunications equipment, and other advanced, militarily relevant technologies. A license is required if the exporter knows, has reason to suspect, or is informed by the government that the listed item is or may be intended for military end-uses in China. Concomitantly, the China Rule also established the Validated End-User program to allow U.S. exporters to transfer certain eligible items to trusted civilian end-users in China without a license.[255] Hence, the U.S. government had effectively waived license requirements for items controlled for national security reasons destined for civilian end use in China in sectors such as aerospace, computing, and semiconductors until reforms in 2020. In 2020, it was estimated that 18.1% of $124.6 billion in U.S. exports to China that year ($22.6 billion) involved dual-use technologies that were subject to export controls—97.9% of those went to China without a license.[256]

Exploiting Plausible Deniability?

The Entity List exemplifies the attempt to differentiate between good and bad end-users in light of broader dual-use trade liberalization. First established in February 1997 and administered by the U.S. Commerce Department, the Entity List began as an effort to raise public awareness about entities that contribute to the diversion of items to weapons of mass destruction (WMD) programs, but its scope expanded in 2007 to include parties that are engaged, have been engaged, or risk being engaged in "acting contrary to the national security and foreign policy interests of the United States," including supporting China's military modernization.[257] U.S. exporters are restricted from transferring U.S.-origin items subject to the Export Administration Regulations (EAR) to listed entities or persons.[258] Compared to other U.S. sanctions listings, such as the Specially Designated Nationals and Blocked Persons (SDN) list—

[254] U.S. Department of Commerce 2007
[255] Meijer 2016, 294
[256] Casey and Sutter 2022
[257] Kilcrease and Frazer 2023
[258] Bureau of Industry and Security n.d.

which fully blocks the designated person from engaging in transactions involving any U.S. actors—the Entity List focuses specifically on restricting the transfer of technology to certain entities.

Aggregate data on the Entity List reveals historical patterns about U.S. perception of the scale of entities supporting China's military modernization.[259] As of April 2025, Russia (1083) and China (1065) have by far the highest number of entities placed on the Entity List (see Table 4). By comparison, third-place United Arab Emirates only has 185 entities on the list. While Russia and China have always been two of the top destinations targeted by the Entity List, they significantly outpaced the rest of the world due to a number of geopolitical events. With regards to Russia, the U.S. declared Russia's occupation of Crimea in 2014 a national emergency. It imposed a range of punitive sanctions against Russia and Russian entities, including an uptick of 75 additional Russian actors placed on the Entity List in 2016.[260] The steepest increase in Russia entities listing came after its full-scale invasion of Ukraine in February 2022, as the U.S. and its allies attempted to restrict the transfer of technology items to Russia's war machine (see Figure 2).

Unlike Russia, China is not a war aggressor, a fact which makes its Entity List numbers even more striking. Between 1997 and 2019, there has been a steady increase in the number of Chinese entities on the list, but the number skyrocketed in 2019. On May 21, the first Trump administration added Huawei to the Entity List, barring the Chinese company from receiving all U.S.-made items subject to U.S. dual-use export controls, effectively cutting Huawei off from the global supply of computer chips. The original justification primarily cited Huawei's role in violating U.S. sanctions against Iran,[261] but other political calculations—such as pressuring China to make concessions in the bilateral trade negotiation—also influenced the decision to make this sweeping restriction.

[259] See Appendix B for the method of obtaining such data.
[260] U.S. Department of Commerce 2016
[261] U.S. Department of Commerce 2019

Within Washington, Huawei's military ties have long been a subject of U.S. scrutiny.[262] For example, one of the most formative events for U.S. perception towards Huawei was the U.S. House Permanent Select Committee on Intelligence hearing in September 2012, where U.S. representatives questioned a Huawei executive on the company's ties to the Chinese Communist Party. The Committee report found that Huawei failed to provide clear, complete, and credible information about its corporate structure, decision-making process, and relationships with the Chinese government and military, among other information requested.[263] As journalist Eva Dou recounts, the report would "prove to have lasting influence beyond the political moment, and it would be cited repeatedly by US officials and foreign governments over the years."[264] Huawei's close ties with the Chinese government have prompted concerns about espionage and were a major reason a host of Western countries have banned the use of Huawei equipment in their telecommunications networks.[265] The public scrutiny and criticisms of Huawei epitomises the Western perception that Chinese technology giants could not be credibly distinguished from the Chinese government.

Table 4. Top 10 countries with the most Entity Listing (as of April 2025)

Country	Count
Russia	1083
China	1065
United Arab Emirates	185
Pakistan	182
Iran	114
Turkey	76
Malaysia	48
United Kingdom	46
Singapore	37
Belarus	35

[262] Gallagher 2022
[263] Rogers and Ruppersberger 2012
[264] Dou 2025
[265] Jones 2024

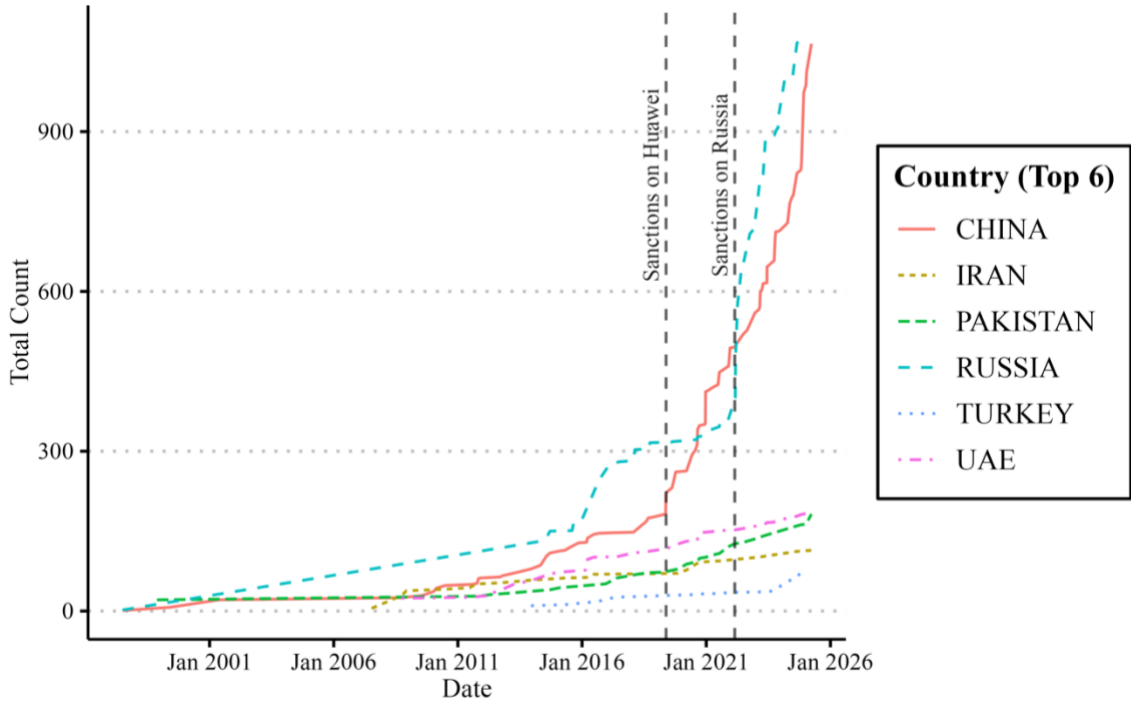

Figure 2. The number of entities on the U.S. Entity List since 1997
Source: Author's compilation.

Hence, the Huawei sanctions have set a high-profile precedent for targeting Chinese entities that are suspected of having close ties with the Chinese government. Since Huawei's addition to the Entity List, the number of Chinese entities have grown by almost six-fold. Among the justifications for sanctioning Chinese entities, the most common is the diversion of technology to military end-use in China.[266] The keyword "military modernization" is found in the justifications for at least 471 Chinese entities on the Entity List, and "military-civil fusion" is cited for 175 Chinese companies.[267] As Figure 3 shows, whereas the number of entities sanctioned under other justifications—such as human rights abuse, and diversion to sanctioned destinations like Iran or Russia—have increased only moderately, more than 580 entities have been targeted for supporting military end-use in China between 2019 and 2025, accounting for 66% of all new additions (Table 5).

[266] See Appendix B for a detailed account of the data curation and labelling methodology.
[267] I counted the number of entities whose first citation in the Federal Register contained the keywords "military modernization" and "military-civil fusion". Some citations may contain both keywords.

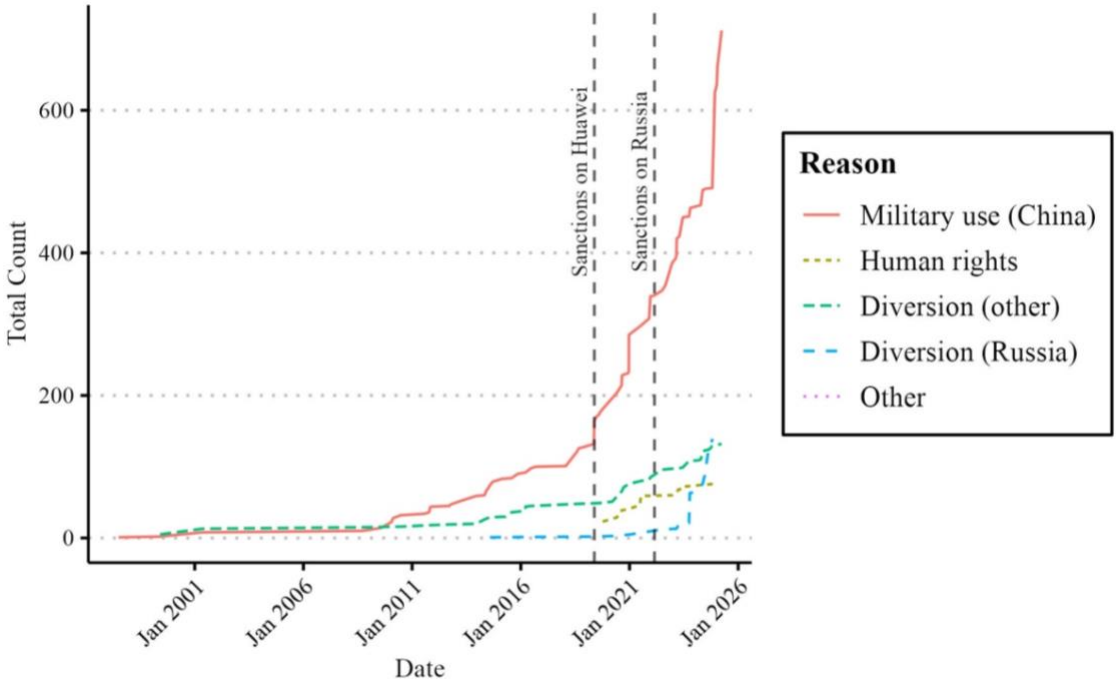

Figure 3. The number of Chinese entities on the U.S. Entity List since 1997
Source: Author's compilation.

Table 5. Increase in Chinese Entity Listing between May 2019 and March 2025

Reason	**May 18, 2019**	**March 28, 2025**	**Difference**
Military end-use in China	132	712	+ 580
Diversion (Russia)	2	132	+ 130
Diversion (Other)	48	139	+ 91
Human Rights	0	76	+ 76

The dramatic increase in entity listings reflects the U.S. government's willingness to go after companies it perceives as aiding and abetting China's military modernization programs. Similar U.S. efforts have emerged to target companies affiliated with China's military industrial complex. For instance, the first Trump administration signed an executive order in November 2020 to ban U.S. investors from purchasing or investing in securities of companies identified by the U.S. Department of Defense as Communist Chinese Military Companies (CCMC).[268] The

[268] Kilcrease and Frazer 2023

subsequent Biden administration remade this into the Chinese Military Industrial Complex (CMIC) list and moved this under the jurisdiction of the Department of Treasury. The CMIC list does not prohibit U.S. persons from engaging with the listed entities in non-securities transactions, but it does highlight the potential risks of doing business with Chinese military companies posing as civilian entities. Separately, the Department of Defense, as required by Section 1260H of the William M. ("Mac") Thornberry National Defense Authorization Act for Fiscal Year 2021, maintains a list of Chinese Military Companies Operating in the United States. The list does not bar American companies and organizations from doing business with the listed entities, but it can add pressure to the US Treasury Department to sanction them.[269]

Together, these instruments have led to a large number of Chinese AI-technology firms being targeted, sanctioned, or otherwise alleged to warrant heightened scrutiny due to their connection to the Chinese government and/or the military. As shown in Table 6, many of the targeted companies are privately held or publicly traded; most of them have received state support in one form or another throughout their history. These designations are far from uncontested; some listed companies have sued the U.S. government for misidentifying them as Chinese military companies. Xiaomi (smartphone producer) and Hesai Technology (the world's biggest maker of laser sensor for electric vehicles) have used legal pressures to force the U.S. Department of Defense (DoD) to remove them from the Chinese Military Companies blacklist,[270] and Advanced Micro-Fabrication Equipment (semiconductor manufacturer) is trying to do the same.[271] Notably, the DoD voluntarily removed Xiaomi and Hesai from the blacklist without a court ruling, leading some analysts to speculate that it backed down not due to a lack of evidence, but to avoid the risk of disclosing classified intelligence in court.[272] These legal disputes highlight the difficulty of establishing these companies' relationship with China's military-industrial complex.

The growing number of Chinese entities targeted by U.S. export control lists reflects a broader perception that more firms are tied to China's military-industrial base. Given the

[269] Hoskins 2025
[270] Sevastopulo and White 2024
[271] Xu 2024
[272] Xu 2024

expansive scope of China's efforts to leverage private and civilian firms for military modernization, an entity-by-entity approach to technology restriction appears increasingly inadequate. In response to this perceived rise in entity-level indistinguishability, the United States has turned to country-wide, blanket restrictions as a catch-all insurance policy

The export controls announced on October 7, 2022, represents the shift toward country-level restrictions, imposing licensing requirements on advanced computing and semiconductor manufacturing technology destined to the PRC. As the Department of Commerce's Bureau of Industry and Security (BIS) explained, these measures were intended to restrict China's ability "to produce advanced military systems including weapons of mass destruction; improve the speed and accuracy of its military decision making, planning, and logistics, as well as of its autonomous military systems; and commit human rights abuses."[273] While BIS has long restricted the export of semiconductors and other items specifically designed or modified for military, space, or WMD applications, the October 7 rule marked a significant departure by targeting unmodified commercial items that could nevertheless enhance China's ability to develop and produce advanced conventional and nuclear weapons. As export control experts Martijn Rasser and Kevin Wolf describe, this rule reflected the U.S. government's belief that "[t]he very existence of indigenous capabilities to develop or produce advanced node semiconductors and supercomputers in China is a national security risk, *regardless of any particular application, end user, or end use*."[274] Subsequent updates to the rule only reinforce this logic, with the October 2023 update explicitly referencing China's MCF strategy.[275]

The AI Diffusion Framework, announced in January 2025, went even further by incentivizing third countries to join the technology blockade against China. The framework divides all countries into three tiers, which determine both access rights and security requirements for importing advanced AI chips and certain AI model weights from the United States.[276] In Tier 3, China continues to face heightened restrictions, but Tier 2 countries are also required to prevent the risk of diversion to Tier 3 countries in order to become eligible for

[273] U.S. Department of Commerce 2022
[274] Rasser and Wolf 2023; emphasis added
[275] U.S. Department of Commerce 2023
[276] Heim 2025

importing AI technologies from the United States.[277] The framework is the clearest indication yet of the United States' ambition to stem global flows of AI technologies to China.

Looking forward, the U.S. government is likely to continue citing distinguishability concerns in targeting the Chinese AI industry. In the beginning of 2025, after releasing large language models that could rival those developed by leading U.S. firms, Chinese company DeepSeek has attracted the attention of U.S. regulators. News reports suggest that the latest round of U.S. semiconductor chip restrictions against China could be motivated by alleged ties of DeepSeek's researchers to the People's Liberation Army and other institutions in China sanctioned for aiding the Chinese military.[278] The fact that many of China's frontier AI models are open-source—meaning they could be freely adapted by any users for whatever purposes—only compounds the fear that AI advances in China's civilian economy would spill over to security and military domains. While public evidence linking DeepSeek and other Chinese tech firms to the PLA remains limited, one thing is clear: the U.S. government is adopting a "better safe than sorry" approach in restricting technology flow to Chinese AI companies.

[277] Heim 2025
[278] Mickle et al. 2025

Table 6. Major Chinese technology companies targeted by U.S. sanctions[279]

Company	Entity List	Entity List Reason	CMIC	DoD 1260H	AI Significance	Ownership	Government Connection
Alibaba Cloud Computing Ltd. (Alibaba Cloud)					National AI champion; developer of Qwen LLMs	Publicly traded	Subject of regulatory scrutiny
DeepSeek					Leading LLM developer in China	Private	Popularity of DeepSeek's models attracted government praise and support
ByteDance					Parent company of TikTok; developer of Doubao LLMs	Publicly traded	Government maintains a "golden share" and a seat on the board of a subsidiary in China
Baidu					National AI champion; developer of Ernie LLMs	Publicly traded	Was designated an AI champion
Beijing Zhipu Huazhang Technology Co., Ltd (Zhipu)	x	Military modernization			Leading AI startup; developer of GLM series	Private	Received state-backed funding
iFlytek	x	Human rights			National AI champion	Partially state-owned, publicly traded	Assisted government surveillance in Xinjiang
SenseTime Group, Inc.	x	Human rights	x	x	National AI champion	Publicly traded	Assisted government surveillance in Xinjiang; government maintains "golden share" in the company
Tencent Holdings Limited				x	National AI champion; developer of Hunyuan LLMs	Publicly traded	Was designated an AI champion
Qihoo 360 Technology Company	x	Military modernization		x	Prominent internet security firm; developer of Zhinao LLM	Publicly traded	Assisted government surveillance in Xinjiang

[279] Author's compilation. Source: Bloom 2025; https://www.superclueai.com/; https://www.opensanctions.org; U.S. Federal Register. This is not an exhaustive list of major AI companies in China.

Beijing Academy of Artificial Intelligence	x	Military modernization			Leading AI laboratory; developer of WuDao LLMs	Private, non-profit	Sponsored by the government
Semiconductor Manufacturing International Corporation (SMIC)	x	Military modernization/diversion to Huawei	x	x	Leading logic chip manufacturer in China	Partially state-owned, publicly traded	Backed by the state-owned China Integrated Circuit Industry Investment Fund
Cambricon Technologies Corporation Limited	x	Military modernization			Leading AI processor chip designer	Partially state-owned, publicly traded	Spun out from the Chinese Academy of Sciences (CAS)
Shanghai Yitu Network Technology Co., Ltd. (Yitu)	x	Human rights	x	x	National AI champion; leader in facial recognition technology	Private	Assisted government surveillance in Xinjiang; was designated an AI champion
Yangtze Memory Technologies Co., Ltd	x	Military modernization/diversion to Huawei		x	Leading memory chip manufacturer in China	Primarily state-owned	Backed by investments from the Hubei provincial government and the state-owned China Integrated Circuit Industry Investment Fund
Huawei Technologies Co., Ltd	x	Engaging in activities contrary to U.S. national security	x	x	National AI champion	Private	PLA supplier; received state support
HiSilicon Technologies Co., Ltd (HiSilicon)	x	Diversion to Huawei			Chip designer; Huawei subsidiary	Private	Received state support
Cloudwalk Technology Co., Ltd.	x	Human rights	x	x	Leader in facial recognition technology	Publicly traded	Assisted government surveillance in Xinjiang; incubated by the Chinese Academy of Sciences (CAS); funded by state-backed investment institutions
SZ DJI Technology Co., Ltd (DJI)	x	Human rights	x	x	Largest commercial drone; company in the world; developer of AI-driven drones	Private	Assisted government surveillance in Xinjiang; received funding from state-backed institutions
Megvii Technology Limited	x	Human rights	x		National AI champion	Private	Assisted government surveillance in Xinjiang;

	received funding from state-backed institutions

Chapter 6

Conclusion

My empirical findings have largely supported my argument that diminished distinguishability fuels competitive action in the U.S.-China AI competition. To recap, this thesis has analysed the factors shaping the design of U.S. export controls against China. The United States had initially insisted on maintaining the total embargo against China, imposed after the PRC's entry into the Korean war, until 1971. That year, U.S. leaders decided to cultivate strategic relations with China in order to counter their common threat of the Soviet Union. Technology transfer formed an important pillar of revitalising the bilateral relationship. In the 1980s, it became an explicit U.S. objective to bolster China's economic and military modernization; the United States even provided direct military technologies to the PRC through an official military assistance program, which would have been unimaginable in today's contentious bilateral relationship.

Strategic considerations initially drove the liberalisation of U.S. dual-use export controls. However, as the United States imposed an arms embargo against China in the aftermath of the Tiananmen crackdown, it needed greater assurance that dual-use trade would not benefit the PLA. Distinguishability—the ability to differentiate commercial and strategic/military use of dual-use technology—became a focus of U.S. export controls, as the U.S. government attempted to impose stricter licensing requirements for items destined for military end-use or end-users but lessen the restrictions for civilian-uses. This was partly driven by U.S. business interest in selling technologies that were already commercially available in world markets, as well as by a novel understanding of national security that ties the U.S. technology base's wellbeing to U.S. military power. To implement this new consensus, Washington has created regulatory instruments, including the Entity List, to identify Chinese companies at risk of diverting dual-use items to military modernization programs in China. The logic underlying these instruments is differentiation, imposing strict rules against military applications while relaxing restrictions for commercial use.

In recent years, organising U.S. export controls around the principle of distinction has proven more challenging. Within Washington, there has been an increasing perception that different segments of Chinese society have been engaged in a coordinated, "whole-of-nation" approach to achieve Xi Jinping's broadened conception of national and economic security. China has adopted the ambitious military-civil fusion (MCF) strategy to integrate technology from the civilian sector into the PLA's modernisation efforts. It has also strengthened the party-state's institutional control over business interests. Crucially, Xi's initiatives have bucked Western assumptions that China would further liberalize. As discussed in Chapter 4, China's economy has come a long way from the planned economy during the Mao era to a more hybrid form of socialist market economy. It has also evolved significantly from a heavily defense-oriented economy to one that encourages civilian participation in dual-use commercial markets. These trends fostered a perception among U.S. businesses that pure commercial interests in China were sufficiently autonomous from the Chinese government and military. Coupled with a distinction-based U.S. export control policy, U.S. businesses believed could cultivate dual-use trade with China without significantly aiding the Chinese government or military's capabilities.

Such an approach has become increasingly untenable. Since Xi Jinping has made it an explicit goal of the Chinese party-state to integrate various segments of Chinese society in order to advance its national security objectives, the United States has grown more concerned about the security ramifications of the dual-use trade. This was partly reflected in the dramatic increase in the number of Chinese entities sanctioned for, or otherwise labelled as, aiding China's military modernization. Other examples of public scrutiny over Chinese companies vividly demonstrate U.S. anxieties over their independence from Beijing's influence. For instance, in a high-profile hearing in 2023, members of the U.S. Congress ruthlessly questioned TikTok over its ties to the Chinese government. The intense grilling was reminiscent of the Congress's questioning of Huawei in 2011. In each instance, a prominent Chinese technology company was brought under intense scrutiny over its ties with the Chinese party-state, and no answers could seem to assuage fears of potential state influence in the company's operation.

Given the perception of widespread PRC indistinguishability, the United States is no longer giving Chinese entities the benefit of the doubt. Instead, it has pivoted to the presumption of state- and military-affiliation when it comes to restricting the flow of advanced U.S. technology, including advanced computing and related AI technology, to Chinese actors, regardless of end-use, as exemplified by the October 7 export controls. Hence, the empirical findings support my hypotheses that greater perceived civil-military integration (H1) and greater perceived subordination business interests to state objectives (H2) lead to more restrictive U.S. export control policies.

Further Research

In light of the empirical findings, my theoretical argument about how dual-use distinguishability impacts AI competition should be understood with a few caveats. First, the case study reveals the historical boundedness of the effects of distinguishability. Before the United States and China developed a substantial dual-use trade relations, distinguishability was not a major concern to U.S. policymakers. Distinguishability's salience was activated after a sequence of historical events remade U.S. trade policy vis-à-vis China. Distinguishability arose as the principal way for U.S. businesses to continue selling dual-use goods to China without violating the intent of the post-Tiananmen U.S. arms embargo.

Distinguishability is the glue that held together the uneasy interdependence between the United States and China. U.S. technology firms needed the Chinese market to stay competitive vis-à-vis foreign businesses who might be subject to less stringent controls, but the U.S. government was also wary about the dual-use trade's contribution to Chinese military modernization. Facing severe bottlenecks in developing an advanced domestic technology industry, China both depended on foreign technology imports for its technological and military modernization and loathed the vulnerabilities created by these foreign dependencies. The historical idiosyncrasies of the U.S.-China bilateral relations are a reminder that distinguishability may not matter across all contexts. If the military interests of two countries align, distinguishability would be moot because the two would gladly engage in military cooperation, let alone dual-use trade.

Conversely, if two geopolitical rivals have not developed sufficient commercial contacts between them, distinguishability and the associated contention over dual-use technology trade would not be a primary vector of instability. Had the United States and China been less interdependent, a decrease in distinguishability would have been less destabilizing to the bilateral relationship. To be sure, competition may still arise from the uncertainties regarding one's intention with dual-use technologies. But one should expect the mode of competition to shift from forms of weaponised interdependence (e.g., export controls) to self-promotive policies like industrial policy, if countries' dual-use capabilities become less dependent on international exchanges.[280] This is because they will have fewer levers to undercut the others' capabilities geoeconomically, meaning they must boost one's own capabilities in order to compete. In fact, since China had few economic leverages over the U.S. AI industry, it has largely relied on promotive measures such as industrial policies to boost its competitiveness. As the two countries' high-tech industries further decouple, we should expect both countries to prioritise self-strengthening over sabotaging the opponent. This thesis has not explored these promotive measures in detail, leaving out other facets of the AI competition.

Second, since my theory is empirically substantiated by a single case study method, it lacks the external validity to generalize across different dyads of competition. A further weakness stems from the omission of China's perception of the United States. This weakens the portrayal of dual-use distinguishability as a relevant consideration for China, let alone a general feature of modern technology races. This thesis has attempted to establish that Chinese distinguishability matters to the United States, but does U.S. distinguishability matter to the PRC? Does China understand the United States' liberal market capitalism as having sufficient separation between private interests and U.S. strategic objectives? Would it characterise the United States' civilian and military sectors as highly integrated?

Based on my research for this thesis, I will suggest a few propositions for future research. With regards to state-business relations, Marxist ideology fundamentally rejects the separation of political and economic power. The Communist Manifesto famously argues that "[t]he executive

[280] Gehrke 2022

of the modern state is but a committee for managing the common affairs of the whole bourgeoisie."[281] It would be interesting to investigate the extent to which Marxist ideology's rejection of distinguishability has affected China's threat perception and informed its competitive behaviour vis-à-vis the United States. Regarding civil-military integration, evidence suggests that Chinese strategists have long recognised the high degree of integration between the U.S. civilian and defense sectors. In fact, as Elsa Kania has noted, "China's initiatives in military-civil fusion are informed by a close study of and learning from, the U.S. defense industry and American defense innovation ecosystem to an extent that can be striking."[282] Hence, it appears that Chinese thinkers and strategists would be highly cognizant of the blending of private and public sectors, as well as civilian and military sectors, in the United States. Chinese leaders likely perceive these cross-sector integrations as a source of strength and are hence motivated to emulate and pursue their own integration. Filling the gap in understanding the Chinese perspective on AI competition would significantly improve the soundness of my argument.

Third, the relationship between distinguishability, U.S. threat perception, and export controls deserves further elaboration. As discussed in the Theory chapter, distinguishability is conceptualised as a modifier of the security dilemma. However, critics might oppose viewing distinguishability as an intermediate variable. Instead, they might argue that the relationship between distinguishability and export controls is confounded by threat perception. A high threat perception directly causes *both* competitive behaviour and the perception that the opponent's civilian resources are indistinguishable from military assets (see Figure 4). For instance, deep animosity between the United States and China after the Korean War led U.S. policymakers to impose a total embargo on the PRC. They were not willing to distinguish between the civilian and military use—all economic benefits gained from trade were presumed to contribute to China's military power. Similarly, critics could argue that U.S. perception of the "China threat" drives U.S. export controls restrictions, regardless of distinguishability. This criticism appears particularly convincing because the United States and China have also engaged in trade wars affecting broad swathes of their economies, demonstrating that their competition goes beyond dual-use sectors.

[281] Marx and Engels 1848
[282] Kania 2019

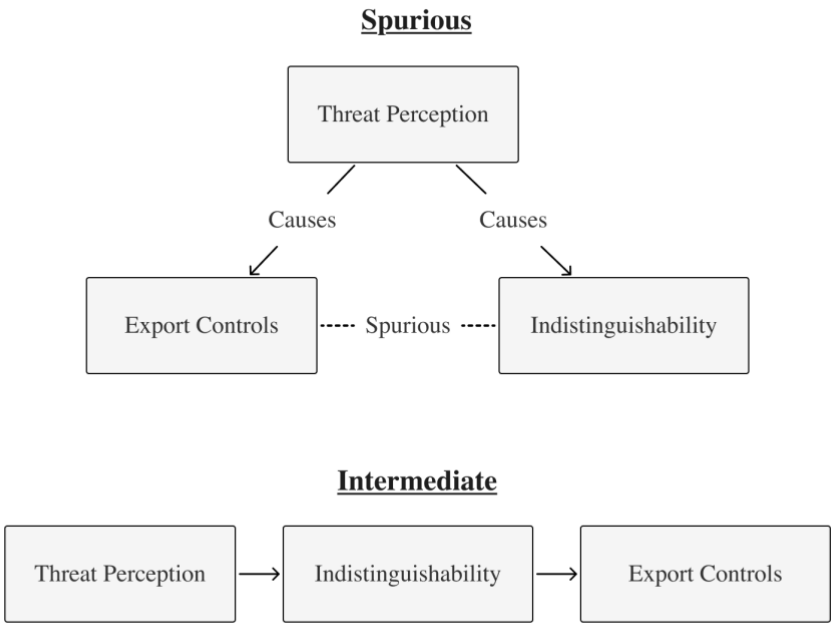

Figure 4. Indistinguishability as either a spurious or intermediate variable

Admittedly, the relationship between these three variables is not easy to delineate, and this thesis's empirical strategy of using a single, within-case analysis has not allowed for a detailed comparative exploration. The surest way to adjudicate between the two is to control for the suspected confounder, i.e., U.S. threat perception towards China. The ideal set up is comparing two periods of U.S.-China relations that share the same level of animosity, but different levels of distinguishability. Across the two periods with the same hostility, if distinguishability matters, the researcher should be able to detect differing levels of export controls depending on the level of distinguishability (See Table 7). However, a note of caution is in order. Empirically, such a scenario might not exist. Theoretically, controlling the confounder requires conceptualising threat perception and distinguishability as separate, autonomous independent variables. Unfortunately, disentangling the two completely would be inconsistent with my philosophical-ontological approach, which views distinguishability as an interpretation rather than objective conditions.

Table 7. Controlling for threat perception to test distinguishability's effect

Threat Perception	Distinguishability	Export Controls
High	High	Less restrictive
	Low	More restrictive

To reconcile the interconnectedness of threat perception and distinguishability, it might be useful to highlight their mutual constitution. U.S. perception of China as a security threat shapes how distinguishability concerns are defined and prioritized. At the same time, observable features of China's political-economic structures, including civil-military fusion and state-business overlap, provide an analytic frame for understanding and constructing the China threat, making the narrative more convincing. This way, indistinguishability is not a post-hoc justification for threat-induced competitive behaviour; it is constitutive of threat perception in the first place. The exact relationship between threat perception and distinguishability would benefit from a more in-depth constructivist exploration.

Fourth, this thesis's embrace of a conventional definition of security has limited its applicability to alternative logics of competition. While it endeavours to provide a more sophisticated understanding of modern security dilemmas, it still largely defines security in military terms: dual-use technology is threatening primarily because it could be militarised. However, constructivist scholars argue that non-military domains of security should be understood on their own terms, rather than solely in relation to their impact on military power.[283] For instance, the geoeconomic competition between the United States and Japan in the 1980s illustrates that even close military allies can become adversarial in non-military domains.[284] This raises a possible counterfactual: if the United States and China had no conflicting military interests, they might still race each other to develop artificial intelligence. The rationale for such a competition could be primarily economic: whoever develops AI the most rapidly could spur domestic economic growth, capitalize on the first-mover advantage, capture greater global market share, and secure lasting economic prosperity. This scenario appears likely considering

[283] Buzan, Wæver, and Wilde 2022
[284] Luttwak 1990

the contentious dynamics around electric vehicles (EVs). Although EVs do not have immediate military applications (except the espionage risks posed by data collected by car sensors), Western nations are nonetheless clashing with China over this industry through tariffs and other regulatory tools.[285] In fact, some scholars have characterised contemporary U.S.-China relations as an inter-capitalist rivalry, stemming from a crisis of overaccumulation resulting in imbalances in the global economy.[286] Future research should explore the non-military drivers of U.S.-China AI competition in greater depth.

[285] S. Kennedy 2024
[286] Hung 2008; 2022

Works Cited

Aghion, Philippe, Benjamin F. Jones, and Charles I. Jones. 2017. “Artificial Intelligence and Economic Growth.” *National Bureau of Economic Research*, NBER working paper series no. w23928, , October.

Alami, Ilias, and Adam D Dixon. 2020. “State Capitalism(s) Redux? Theories, Tensions, Controversies.” *Competition & Change* 24 (1). SAGE Publications Ltd:70–94. https://doi.org/10.1177/1024529419881949.

———. 2023. “Uneven and Combined State Capitalism.” *Environment and Planning A: Economy and Space* 55 (1). SAGE Publications Ltd:72–99. https://doi.org/10.1177/0308518X211037688.

Alden, Edward. 2022. “Washington Raises Stakes in War on Chinese Technology.” *Foreign Policy* (blog). October 11, 2022. https://foreignpolicy.com/2022/10/11/us-china-technology-sanctions-semiconductor-chips-geopolitics-cold-war/.

Alic, John A., Lewis M. Branscomb, Harvey Brooks, Ahston B. Carter, and Gerald L. Epstein. 1992. *Beyond Spinoff: Military and Commercial Technologies in a Changing World*. Harvard Business School Press. http://archive.org/details/beyondspinoffmil0000john.

Allen, Gregory C. 2022. “Choking off China’s Access to the Future of AI,” October. https://www.csis.org/analysis/choking-chinas-access-future-ai.

Almén, Oscar, and Hanna Carlsson. 2025. “The Chinese Communist Party’s Influence over Businesses.” Swedish Defence Research Agency (FOI), Swedish National China Centre (NKK). https://www.ui.se/globalassets/ui.se-eng/publications/other-publications/particeller_nkk_report_2025.pdf.

“Artificial Intelligence Arms Race.” 2024. *Wikipedia*. https://en.wikipedia.org/w/index.php?title=Artificial_intelligence_arms_race&oldid=1245877196.

Bateman, Jon. 2022. “Biden Is Now All-In on Taking Out China.” *Foreign Policy* (blog). October 12, 2022. https://foreignpolicy.com/2022/10/12/biden-china-semiconductor-chips-exports-decouple/.

Beaumier, Guillaume, and Madison Cartwright. 2024. “Cross-Network Weaponization in the Semiconductor Supply Chain.” *International Studies Quarterly* 68 (1):sqae003. https://doi.org/10.1093/isq/sqae003.

Beckley, Michael. 2018. “The Power of Nations: Measuring What Matters.” *International Security* 43 (2):7–44. https://doi.org/10.1162/isec_a_00328.

Bego, Katja. 2024. “Silicon Valley’s National Security Pivot Will Only Accelerate under the New Trump Administration | Chatham House – International Affairs Think Tank.” November 29, 2024. https://www.chathamhouse.org/2024/11/silicon-valleys-national-security-pivot-will-only-accelerate-under-new-trump-administration.

Beraja, Martin, Wenwei Peng, David Y. Yang, and Noam Yuchtman. 2024. “Government as Venture Capitalists in AI.” Working Paper. Working Paper Series. National Bureau of Economic Research. https://doi.org/10.3386/w32701.

Bian, Morris L. 2015. “Explaining Dynamics of Change: Transformation and Evolution of China’s Public Economy Through War, Revolution, and War, 1928-2008.” In *State Capitalism, Institutional Adaptation, and the Chinese Miracle*, edited by Barry Naughton and Kellee S. Tsai. New York, UNITED STATES: Cambridge University Press.

Biever, Celeste. 2024. “China’s ChatGPT: Why China Is Building Its Own AI Chatbots.” *Nature* 629 (8014):977–78. https://doi.org/10.1038/d41586-024-01495-6.

Bitzinger, Richard A. 2021. “China’s Shift from Civil-Military Integration to Military-Civil Fusion.” *Asia Policy* 16 (1):5–24. https://doi.org/10.1353/asp.2021.0001.

Blanchette, Jude. 2019. “Against Atrophy: Party Organisations in Private Firms.” *Made in China Journal* (blog). April 18, 2019. https://madeinchinajournal.com/2019/04/18/against-atrophy-party-organisations-in-private-firms/.

Bode, Ingvild, Cecilia Ducci, and Pak K Lee. 2025. “Narrating and Practising the US–China ‘Tech War.’” *Global Studies Quarterly* 5 (2):ksaf037. https://doi.org/10.1093/isagsq/ksaf037.

Bode, Ingvild, and Hendrik Huelss. 2022. *Autonomous Weapons Systems and International Norms*. Montreal Kingston London Chicago: McGill-Queen’s University Press.

Brandt, Loren, and Eric Thun. 2021. “The Great Dialectic: State versus Market in China.” In *The Oxford Handbook of China Innovation*, edited by Xiaolan Fu, Bruce McKern, and Jin Chen, 0. Oxford University Press. https://doi.org/10.1093/oxfordhb/9780190900533.013.31.

Bremmer, Ian. 2021. “How Big Tech Will Reshape the Global Order.” *Foreign Affairs*, October. https://www.foreignaffairs.com/articles/world/ian-bremmer-big-tech-global-order.

Breuer, Adam, and Alastair Iain Johnston. 2019. “Memes, Narratives and the Emergent US–China Security Dilemma.” *Cambridge Review of International Affairs* 32 (4). Routledge:429–55. https://doi.org/10.1080/09557571.2019.1622083.

Brundage, Carter. 2023. “The US-China Semiconductor Power-Security Dilemma: Decoupling the Security and Power Struggles Through the Theory of Dr. Barry Buzan.” *International Journal* 78 (4). SAGE Publications Ltd:595–613. https://doi.org/10.1177/00207020231213612.

Brynjolfsson, Erik, Daniel Rock, and Chad Syverson. 2017. “Artificial Intelligence and the Modern Productivity Paradox: A Clash of Expectations and Statistics.” w24001. Cambridge, MA: National Bureau of Economic Research. https://doi.org/10.3386/w24001.

Buchanan, Ben. 2020. “The AI Triad and What It Means for National Security Strategy.” Center for Security and Emerging Technology. https://doi.org/10.51593/20200021.

Bulman, David J. 2021. “The Economic Security Dilemma in US-China Relations.” *Asian Perspective* 45 (1). Johns Hopkins University Press:49–73.

Bureau of Industry and Security. n.d. “Lists of Parties of Concern.” U.S. Department of Commerce. Accessed March 18, 2025a. https://www.bis.doc.gov/index.php/policy-guidance/lists-of-parties-of-concern.

———. n.d. “What Is the Background and Purpose of the Entity List?” U.S. Department of Commerce. Accessed May 3, 2025b. https://www.bis.doc.gov/index.php/component/fsj_faqs/faq/105-what-is-the-background-and-purpose-of-the-entity-list.

Buzan, Barry, Ole Wæver, and Jaap de Wilde. 2022. “Security: A New Framework for Analysis.” In *Security*. Lynne Rienner Publishers. https://doi.org/10.1515/9781685853808.

Campbell, Kurt M., and Ely Ratner. 2018. “The China Reckoning.” *Foreign Affairs*, February 13, 2018. https://www.foreignaffairs.com/china/china-reckoning.

Canca, Cansu. 2023. “AI Ethics and Governance in Defence Innovation: Implementing AI Ethics Framework.” Edited by Michael Raska and Richard A. Bitzinger. *The AI Wave in Defence*

Innovation: Assessing Military Artificial Intelligence Strategies, Capabilities, and Trajectories. Abingdon, Oxon; New York, NY: Routledge.

Carothers, Christopher, and Taiyi Sun. 2023. "Bipartisanship on China in a Polarized America." *International Relations*, September. SAGE Publications Ltd, 00471178231201484. https://doi.org/10.1177/00471178231201484.

Casey, Christopher A., and Karen M. Sutter. 2022. "U.S. Export Controls and China." Legislation. Congressional Research Service. https://www.congress.gov/crs-product/IF11627.

Central People's Government of the People's Republic of China. 2000. "Zhonggongzhongyang Guanyu Zhiding Guominjingji He Shehuifazhan Dishi Ge Wunianjihua de Jianyi 中共中央关于制定国民经济和社会发展第十个五年计划的建议." Central People's Government of the People's Republic of China. October 11, 2000. https://www.gov.cn/gongbao/content/2000/content_60538.htm.

———. 2003. "Zhonggongzhongyang Guanyu Wanshan Shehuizhuyi Shichangjingjitizhi Ruogan Wenti de Jueding 中共中央关于完善社会主义市场经济体制若干问题的决定." Central People's Government of the People's Republic of China. October 14, 2003. https://www.gov.cn/gongbao/content/2003/content_62494.htm.

———. 2005. "Guowuyuan Guanyu Guli Zhichi He Yindao Geti Siying Deng Fei Gongyouzhi Jingjifazhan de Ruogan Yijian 国务院关于鼓励支持和引导个体私营等非公有制经济发展的若干意见." Central People's Government of the People's Republic of China. 2005. https://www.gov.cn/zwgk/2005-08/12/content_21691.htm.

———. 2007. "Hujintao Zai Zhonggong Dishiqi Ci Quanguodaibiaodahui Shang de Baogao Quanwen 胡锦涛在中共第十七次全国代表大会上的报告全文." Central People's Government of the People's Republic of China. 2007. https://www.gov.cn/ldhd/2007-10/24/content_785431_9.htm.

———. 2017. "Xinyidai Rengong Zhineng Fazhan Guihuo 新一代人工智能发展规划." Central People's Government of the People's Republic of China. 2017. https://www.gov.cn/zhengce/content/2017-07/20/content_5211996.htm.

Cerny, Michael B, and Rory Truex. 2024. "Under Pressure: Attitudes Towards China Among American Foreign Policy Professionals," December.

Chen, Hao, and Meg Rithmire. 2020. "The Rise of the Investor State: State Capital in the Chinese Economy." *Studies in Comparative International Development* 55 (3). https://doi.org/10.1007/s12116-020-09308-3.

Chen, Xin-zhu J. 2006. "China and the US Trade Embargo, 1950-1972." *American Journal of Chinese Studies* 13 (2). American Association of Chinese Studies:169–86.

Cheng, Dean. 2011. "Chinese Lessons from the Gulf Wars." In *Chinese Lessons from Other Peoples' Wars*, edited by Andrew Scobell, David Lai, and Roy Kamphausen. U.S. Army War College, Strategic Studies Institute. https://apps.dtic.mil/sti/tr/pdf/ADA553490.pdf#page=49.26.

Cheng, Jing, and Jinghan Zeng. 2024. "'Digital Silk Road' as a Slogan Instead of a Grand Strategy." *Journal of Contemporary China* 33 (149). Routledge:823–38. https://doi.org/10.1080/10670564.2023.2222269.

Cheung, Tai Ming. 2013. “5. Building a Dual-Use Economy.” In *Fortifying China: The Struggle to Build a Modern Defense Economy*, 176–234. Cornell University Press. https://doi.org/10.7591/9780801468506-007.

———. 2019. “Keeping Up with the Jundui: Reforming the Chinese Defense Acquisition, Technology, and Ind.” In *Chairman Xi Remakes the PLA: Assessing Chinese Military Reforms*. National Defense University Press. https://ndupress.ndu.edu/Media/News/News-Article-View/Article/1748736/keeping-up-with-the-jundui-reforming-the-chinese-defense-acquisition-technology/https%3A%2F%2Fndupress.ndu.edu%2FMedia%2FNews%2FNews-Article-View%2FArticle%2F1748736%2Fkeeping-up-with-the-jundui-reforming-the-chinese-defense-acquisition-technology%2F.

———. 2022. “CONCLUSIONS: The Prospects and Implications of the Chinese Techno-Security State.” In *Innovate to Dominate*, 273–310. The Rise of the Chinese Techno-Security State. Cornell University Press. https://www.jstor.org/stable/10.7591/j.ctv20pxxmn.13.

———. 2023. “National Strategic Integration: How China Is Building Its Strategic Power.” University of California Institute on Global Conflict and Cooperation, Mercator Institute for China Studies.

“China Boosts State-Led Chip Investment.” 2024. Economist Intelligence Unit. March 13, 2024. https://www.eiu.com/n/china-boosts-state-led-chip-investment/.

“China Electronics Corporation.” 2019. Chinese Defence Universities Tracker. 2019. https://unitracker.aspi.org.au/.

Christensen, Thomas J. 1999. “China, the U.S.-Japan Alliance, and the Security Dilemma in East Asia.” *International Security* 23 (4):49–80. https://doi.org/10.1162/isec.23.4.49.

———. 2002. “The Contemporary Security Dilemma: Deterring a Taiwan Conflict.” *The Washington Quarterly* 25 (4):5–21. https://doi.org/10.1162/016366002760252509.

“Commerce Country Chart.” 2023. U.S. Department of Commerce. https://www.bis.doc.gov/index.php/documents/regulations-docs/federal-register-notices/federal-register-2014/1033-738-supp-1/file.

Coveri, Andrea, Claudio Cozza, and Dario Guarascio. 2024. “Blurring Boundaries: An Analysis of the Digital Platforms-Military Nexus.” *Review of Political Economy*, September. Routledge, 1–32. https://doi.org/10.1080/09538259.2024.2395832.

Dernberger, Robert F. 1999. “The People’s Republic of China at 50: The Economy.” *The China Quarterly*, no. 159. Cambridge University Press:606–15.

“Digital Telephone Switches Manufacturer, Voip Solution, High Reliability Supplier - Hebei Far East Harris Communications Co., Ltd.” n.d. Accessed April 25, 2025. https://www.made-in-china.com/showroom/coryli/.

Ding, Jeffrey. 2021. “The Rise and Fall of Great Technologies and Powers.” Http://purl.org/dc/dcmitype/Text, University of Oxford. https://ora.ox.ac.uk/objects/uuid:d41aba26-e6fa-4c2c-92b0-9e0ec67e4583.

———. 2022. “Dueling Perspectives in AI and U.S.–China Relations: Technonationalism vs. Technoglobalism.” In *The Oxford Handbook of AI Governance*, edited by Justin B Bullock, Baobao Zhang, Yu-Che Chen, Anton Korinek, Valerie M Hudson, Matthew M Young, and Johannes Himmelreich, 881–94. Oxford University Press. https://doi.org/10.1093/oxfordhb/9780197579329.013.53.

Ding, Jeffrey, and Allan Dafoe. 2023. “Engines of Power: Electricity, AI, and General-Purpose, Military Transformations.” *European Journal of International Security*, February. Cambridge University Press, 1–18. https://doi.org/10.1017/eis.2023.1.

DiPippo, Gerard. 2022. “Economic Indicators of Chinese Military Action against Taiwan,” August. https://www.csis.org/analysis/economic-indicators-chinese-military-action-against-taiwan.

Dong Huiming 董慧明. 2019. *Zhongguo Dalu Guofang Keji Gongye de shuibian yu fazhan 中國大陸國防科技工業的蛻變與發展*. Wunan tushu chuban gufen youxian gongsi 五南圖書出版股份有限公司.

Doshi, Rush. 2021. *The Long Game: China’s Grand Strategy to Displace American Order*. New York, NY: OUP USA.

Dou, Eva. 2025. *House of Huawei: Inside the Secret World of China’s Most Powerful Company*. Abacus.

“Dual-Use Export Controls | EUR-Lex.” n.d. Accessed March 17, 2025. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=legissum:4532505.

Eurasia Group. 2023. “Technopolarity.Pdf.” https://www.eurasiagroup.net/files/upload/Technopolarity.pdf.

Evron, Yoram. 2021. “China’s Military-Civil Fusion and Military Procurement.” *Asia Policy* 16 (1). National Bureau of Asian Research (NBR):25–44.

Ezell, Stephen. 2022. “A New Frontier: Sustaining U.S. High-Performance Computing Leadership in an Exascale Era.” https://itif.org/publications/2022/09/12/high-performance-computing-leadership-in-an-exascale-era/.

Farrell, Henry, and Abraham Newman. 2023. *Underground Empire: How America Weaponized the World Economy*. London: Allen Lane.

Farrell, Henry, and Abraham L. Newman. 2019. “Weaponized Interdependence: How Global Economic Networks Shape State Coercion.” *International Security* 44 (1):42–79. https://doi.org/10.1162/isec_a_00351.

Fatima, Samar, Kevin C. Desouza, and Gregory S. Dawson. 2020. “National Strategic Artificial Intelligence Plans: A Multi-Dimensional Analysis.” *Economic Analysis and Policy* 67 (September):178–94. https://doi.org/10.1016/j.eap.2020.07.008.

Fearon, James D. 2011. “Two States, Two Types, Two Actions.” *Security Studies* 20 (3):431–40. https://doi.org/10.1080/09636412.2011.599192.

Fearon, James, and Alexander Wendt. 2002. “Rationalism v. Constructivism: A Skeptical View.” In *Handbook of International Relations*, edited by Walter Carlsnaes, Thomas Risse, and Beth A. Simmons, 52–72. SAGE Publications Ltd. https://www.rochelleterman.com/ir/sites/default/files/Fearon%2Band%2BWendt%252C%2BChapter%2B3.pdf.

Fedasiuk, Ryan, Jennifer Melot, and Ben Murphy. 2021. “Harnessed Lightning: How the Chinese Military Is Adopting Artificial Intelligence.” Center for Security and Emerging Technology. https://cset.georgetown.edu/publication/harnessed-lightning/.

Fergusson, Ian F., and Paul K. Kerr. 2020. “The U.S. Export Control System and the Export Control Reform Initiative.” Legislation. Congressional Research Service. https://www.congress.gov/crs-product/R41916.

Finkelstein, David M. 2010. “The Military Dimensions of U.S. – China Security Cooperation: Retrospective and Future Prospects.” Center for Naval Analyses.

Foot, Rosemary. 1997. “Trading With the Enemy: The USA and the China Trade Embargo.” In *The Practice of Power: US Relations with China since 1949*, edited by Rosemary Foot, 0. Oxford University Press. https://doi.org/10.1093/0198292929.003.0003.

Friedberg, Aaron L. 2022. *Getting China Wrong*. 1st edition. Cambridge, UK Medford, MA, USA: Polity.

Fukuyama, Francis. 1989. “The End of History?” *The National Interest* 16 (Summer 1989):3–18.

Gallagher, Jill C. 2022. “U.S. Restrictions on Huawei Technologies: National Security, Foreign Policy, and Economic Interests.” Congressional Research Service.

Ge, Huimin 葛惠敏. 2021. “Tantao Zhongguo Dalu Junmin Ronghe Fazhan Zhixia Zhi Jundui Jianshe 探討中國大陸軍民融合發展下之軍隊建設 [Exploring Mainland China’s Armed Forces Building under Military-Civil Fusion].” *Kongjun Xueshu Shuangyuekan 空軍學術雙月刊* 683 (August). https://www.mnd.gov.tw/NewUpload/202107/05-%E8%91%9B%E6%83%A0%E6%95%8F-%E6%8E%A2%E8%A8%8E%E4%B8%AD%E5%9C%8B%E5%A4%A7%E9%99%B8%E8%BB%8D%E6%B0%91%E8%9E%8D%E5%90%88%E7%99%BC%E5%B1%95%E4%B8%8B%E4%B9%8B%E8%BB%8D%E9%9A%8A%E5%BB%BA%E8%A8%AD_123700.pdf.

Gehrke, Tobias. 2022. “Geoeconomics : How Great Power Competition Is Transforming the Global Economy.” Dissertation, Ghent University. http://hdl.handle.net/1854/LU-01GK1Z8H71CC0R601KESVZXJPR.

Gentile, Gian, Michael Shurkin, Alexandra T. Evans, Michelle Grisé, Mark Hvizda, and Rebecca Jensen. 2021. “A History of the Third Offset, 2014–2018.” RAND Corporation. https://www.rand.org/pubs/research_reports/RRA454-1.html.

Giorcelli, Michela, and Bo Li. 2021. “Technology Transfer and Early Industrial Development: Evidence from the Sino-Soviet Alliance.” *National Bureau of Economic Research*, November.

Glaser, Charles L. 2010. *Rational Theory of International Politics: The Logic of Competition and Cooperation*. Princeton, UNITED STATES: Princeton University Press. http://ebookcentral.proquest.com/lib/oxford/detail.action?docID=537671.

Haggard, Stephan, and Yasheng Huang. 2008. “The Political Economy of Private Sector Development in China.” In *China’s Great Economic Transformation*, edited by Loren Brandt and Thomas G. Rawski, 337–74. Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9780511754234.011.

Hall, Peter A., David Soskice, Peter A. Hall, and David Soskice, eds. 2001. “An Introduction to Varieties of Capitalism.” In *Varieties of Capitalism: The Institutional Foundations of Comparative Advantage*, 0. Oxford University Press. https://doi.org/10.1093/0199247757.003.0001.

Harper, Jon. 2020. “Defense Innovation Unit Shifts Into Higher Gear.” *National Defense* 104 (795). National Defense Industrial Association:20–21.

Heim, Lennart. 2025. “Understanding the Artificial Intelligence Diffusion Framework: Can Export Controls Create a U.S.-Led Global Artificial Intelligence Ecosystem?” RAND Corporation. https://www.rand.org/pubs/perspectives/PEA3776-1.html.

Hickey, Alan. 2024. “The GPT Dilemma: Foundation Models and the Shadow of Dual-Use.” *arXiv.Org*, July. https://arxiv.org/abs/2407.20442v1.

Hoehn, John R. 2022. “Joint All-Domain Command and Control: Background and Issues for Congress.” Congressional Research Service.

Hoskins, Peter. 2025. “Tencent: US Designates the Firm a Chinese Military Company.” BBC News. January 7, 2025. https://www.bbc.com/news/articles/c9q78wn9g8zo.

House, The White. 2022. “FACT SHEET: CHIPS and Science Act Will Lower Costs, Create Jobs, Strengthen Supply Chains, and Counter China.” The White House. August 9, 2022. https://www.whitehouse.gov/briefing-room/statements-releases/2022/08/09/fact-sheet-chips-and-science-act-will-lower-costs-create-jobs-strengthen-supply-chains-and-counter-china/.

Huang, Chaofeng 黄朝峰, and Junyang 马浚洋 Ma. 2019. “Yitihua de Guojia Zhanlue Tixi He Nengli Goucheng Yu Goujian Yanjiu 一体化的国家战略体系和能力构成与构建研究 [A Study of Unified National Strategic System and Capability Constitution and Construction].” *Xibei Gongye Daxue Xuebao 西北工业大学学报* 4. https://jfzx.nwpu.edu.cn/xbwz/xb_pdf/2019_4/14.pdf.

Hui, Mary. 2024. “Is [Insert Tech Here] the ‘Latest Front’ in US-China Contest?” Substack newsletter. *A/Symmetric* (blog). January 20, 2024. https://theasymmetric.substack.com/p/the-latest-front-in-us-china-competition?utm_medium=email&triggerShare=true.

Hung, Ho-fung. 2008. “Rise of China and the Global Overaccumulation Crisis.” *Review of International Political Economy* 15 (2). Routledge:149–79. https://doi.org/10.1080/09692290701869654.

———. 2022. “Clash of Empires: From ‘Chimerica’ to the ‘New Cold War.’” *Elements in Global China*, March. Cambridge University Press. https://doi.org/10.1017/9781108895897.

“Implementation of Additional Export Controls: Certain Advanced Computing and Semiconductor Manufacturing Items; Supercomputer and Semiconductor End Use; Entity List Modification.” 2022. Federal Register. October 13, 2022. https://www.federalregister.gov/documents/2022/10/13/2022-21658/implementation-of-additional-export-controls-certain-advanced-computing-and-semiconductor.

Institute for Security & Development Policy. 2018. “Made in China 2025: Backgrounder.” Institute for Security & Development Policy. https://isdp.eu/content/uploads/2018/06/Made-in-China-Backgrounder.pdf.

Jervis, Robert. 1978. “Cooperation under the Security Dilemma.” *World Politics* 30 (2):167–214. https://doi.org/10.2307/2009958.

———. 2017. “Perception and Misperception in International Politics: New Edition.” In *Perception and Misperception in International Politics*. Princeton University Press. https://doi.org/10.1515/9781400885114.

Johnson, James. 2021. “The End of Military-Techno *Pax Americana* ? Washington’s Strategic Responses to Chinese AI-Enabled Military Technology.” *The Pacific Review* 34 (3):351–78. https://doi.org/10.1080/09512748.2019.1676299.

———. 2023. “AI-Security Dilemma: Insecurity, Mistrust, and Misperception under the Nuclear Shadow.” In *AI and the Bomb: Nuclear Strategy and Risk in the Digital Age*, edited by James Johnson, 0. Oxford University Press. https://doi.org/10.1093/oso/9780192858184.003.0005.

Johnson, James Samuel. n.d. “The Us-China Military and Defence Relationship during the First Obama Administration 2009-2013: Deteriorating Military Relations in the Asia Pacific, Washington’s Strategic and Military Responses and Security Dilemma Explanations.” Ph.D., England: University of Leicester (United Kingdom). Accessed April 21, 2024. https://www.proquest.com/docview/1913434141?parentSessionId=JbT8MvpsikcOLLP3C50alfHOuA%2Bbk8LJKo5TvdCKCy8%3D&sourcetype=Dissertations%20&%20Theses.

Jones, Sam. 2024. “Germany Orders Ban on Chinese Companies from Its 5G Network.” *Financial Times*, July 11, 2024, sec. German economy. https://www.ft.com/content/aacd77a2-048a-489e-98f8-b9f436e448b6.

Kania, Elsa B. 2019. “In Military-Civil Fusion, China Is Learning Lessons from the United States and Starting to Innovate.” The Strategy Bridge. August 27, 2019. https://thestrategybridge.org/the-bridge/2019/8/27/in-military-civil-fusion-china-is-learning-lessons-from-the-united-states-and-starting-to-innovate.

Kania, Elsa B., and Adam Segal. 2021. “Globalized Innovation and Great Power Competition: The US-China Tech Clash.” In *After Engagement*, edited by Jacques deLisle and Avery Goldstein, 298–329. Dilemmas in U.S.-China Security Relations. Brookings Institution Press. https://www.jstor.org/stable/10.7864/j.ctv11hpt2r.13.

Katzke, Corin, and Gideon Futerman. 2024. “The Manhattan Trap: Why a Race to Artificial Superintelligence Is Self-Defeating.” SSRN Scholarly Paper. Rochester, NY: Social Science Research Network. https://doi.org/10.2139/ssrn.5067833.

Kendall, Paul, and Covell Meyskens. 2024. “Afterlives of the Third Front.” *The China Quarterly* 260 (December):867–71. https://doi.org/10.1017/S0305741024001097.

Kennedy, Andrew B., and Darren J. Lim. 2018. “The Innovation Imperative: Technology and US–China Rivalry in the Twenty-First Century.” *International Affairs* 94 (3):553–72. https://doi.org/10.1093/ia/iiy044.

Kennedy, Paul M. 1989. *The Rise and Fall of the Great Powers: Economic Change and Military Conflict from 1500 to 2000*. New York: Vintage Books.

Kennedy, Scott. 2024. “The Chinese EV Dilemma: Subsidized Yet Striking.” Center for Strategic and International Studies. June 20, 2024. https://www.csis.org/blogs/trustee-china-hand/chinese-ev-dilemma-subsidized-yet-striking.

Kilcrease, Emily, and Michael Frazer. 2023. “Sanctions by the Numbers: SDN, CMIC, and Entity List Designations on China.” Center for a New American Security. March 2, 2023. https://www.cnas.org/publications/reports/sanctions-by-the-numbers-sdn-cmic-and-entity-list-designations-on-china.

Kot, Chun Hey (Brian), and Owen Au. 2025. “Panama Port Deal Puts Hong Kong Businesses at a Crossroads.” *The Diplomat* (blog). March 28, 2025. https://thediplomat.com/2025/03/panama-port-deal-puts-hong-kong-businesses-at-a-crossroads/.

Krafft, P. M., Meg Young, Michael Katell, Karen Huang, and Ghislain Bugingo. 2020. “Defining AI in Policy versus Practice.” In *Proceedings of the AAAI/ACM Conference on AI, Ethics, and Society*, 72–78. New York NY USA: ACM. https://doi.org/10.1145/3375627.3375835.

Lafferty, Brian. 2019. “Civil-Military Integrations and PLA Reforms.” In *Chairman Xi Remakes the PLA: Assessing Chinese Military Reforms*. National Defense University Press. https://ndupress.ndu.edu/Media/News/News-Article-View/Article/1748777/civil-military-

integrations-and-pla-reforms/https%3A%2F%2Fndupress.ndu.edu%2FMedia%2FNews%2FNews-Article-View%2FArticle%2F1748777%2Fcivil-military-integrations-and-pla-reforms%2F.

Lardy, Nicholas R. 1987. "Economic Recovery and the 1st Five-Year Plan." In *The Cambridge History of China*, edited by Roderick MacFarquhar and John K. Fairbank, 1st ed., 144–83. Cambridge University Press. https://doi.org/10.1017/CHOL9780521243360.004.

———. 2001. *Integrating China into the Global Economy*. Blue Ridge Summit, UNITED STATES: Brookings Institution Press. http://ebookcentral.proquest.com/lib/oxford/detail.action?docID=3004327.

———. 2014. *Markets Over Mao: The Rise of Private Business in China*. Washington, UNITED STATES: Peterson Institute for International Economics. http://ebookcentral.proquest.com/lib/oxford/detail.action?docID=3385726.

Larsen, Benjamin. 2019. "Drafting China's National AI Team for Governance." *DigiChina* (blog). November 18, 2019. https://digichina.stanford.edu/work/drafting-chinas-national-ai-team-for-governance/.

Lee, Jane, Stephen Nellis, and Jane Lee. 2022. "Explainer: What Is 'FDPR' and Why Is the U.S. Using It to Cripple China's Tech Sector?" *Reuters*, October 8, 2022, sec. Technology. https://www.reuters.com/technology/what-is-fdpr-why-is-us-using-it-cripple-chinas-tech-sector-2022-10-07/.

Liff, Adam P., and G. John Ikenberry. 2014. "Racing toward Tragedy? China's Rise, Military Competition in the Asia Pacific, and the Security Dilemma." *International Security* 39 (2). The MIT Press:52–91.

Lim, Darren J., and Victor Ferguson. 2019. "Conscious Decoupling: The Technology Security Dilemma." SSRN Scholarly Paper. Rochester, NY. https://papers.ssrn.com/abstract=3484171.

Lin, Lauren Yu-Hsin, and Curtis J. Milhaupt. 2021. "Party Building or Noisy Signaling? The Contours of Political Conformity in Chinese Corporate Governance." *The Journal of Legal Studies* 50 (1). The University of Chicago Press:187–217. https://doi.org/10.1086/713189.

Lin, Liza, and Alexander Ward. 2025. "AI Chip Curbs Trigger Rare Public Fight: Tech Giants vs. China Hawks." *Wall Street Journal*, January 9, 2025, sec. Politics. https://www.wsj.com/politics/policy/ai-chip-curbs-trigger-rare-public-fight-tech-giants-vs-china-hawks-3aebbd9b.

"Lt. Gen. Jack Shanahan Media Briefing on A.I.-Related Initiatives within the Department Of." n.d. U.S. Department of Defense. Accessed November 19, 2024. https://www.defense.gov/News/Transcripts/Transcript/Article/1949362/lt-gen-jack-shanahan-media-briefing-on-ai-related-initiatives-within-the-depart/https%3A%2F%2Fwww.defense.gov%2FNews%2FTranscripts%2FTranscript%2FArticle%2F1949362%2Flt-gen-jack-shanahan-media-briefing-on-ai-related-initiatives-within-the-depart%2F.

Luce, Matthew. 2012. "A Model Company: CETC Celebrates 10 Years of Civil-Military Integration." Jamestown Foundation. February 21, 2012. https://jamestown.org/program/a-model-company-cetc-celebrates-10-years-of-civil-military-integration/.

Lupovici, Amir. 2021. “The Dual-Use Security Dilemma and the Social Construction of Insecurity.” *Contemporary Security Policy* 42 (3). Routledge:257–85. https://doi.org/10.1080/13523260.2020.1866845.

Lushenko, Paul, and Keith Carter. 2024. “A New Military-Industrial Complex: How Tech Bros Are Hyping AI’s Role in War.” *Bulletin of the Atomic Scientists* (blog). October 7, 2024. https://thebulletin.org/2024/10/a-new-military-industrial-complex-how-tech-bros-are-hyping-ais-role-in-war/.

Luttwak, Edward N. 1990. “From Geopolitics to Geo-Economics: Logic of Conflict, Grammar of Commerce.” *The National Interest*, no. 20. Center for the National Interest:17–23.

Markelius, Alva, Connor Wright, Joahna Kuiper, Natalie Delille, and Yu-Ting Kuo. 2024. “The Mechanisms of AI Hype and Its Planetary and Social Costs.” *AI and Ethics* 4 (3):727–42. https://doi.org/10.1007/s43681-024-00461-2.

Marsh, Jenni. n.d. “The Rise and Fall of a Belt and Road Billionaire.” CNN. Accessed April 15, 2025. https://www.cnn.com/interactive/2018/12/asia/patrick-ho-ye-jianming-cefc-trial-intl/.

Marx, Karl, and Frederick Engels. 1848. “Communist Manifesto.” Marxists Internet Archive. February 1848. https://www.marxists.org/archive/marx/works/1848/communist-manifesto/ch01.htm.

Mastanduno, Michael. 1985. “Strategies of Economic Containment: U.S. Trade Relations with the Soviet Union.” *World Politics* 37 (4). Cambridge University Press:503–31. https://doi.org/10.2307/2010342.

McCourt, David M. 2022. “Knowledge Communities in US Foreign Policy Making: The American China Field and the End of Engagement with the PRC.” *Security Studies* 31 (4). Routledge:593–633. https://doi.org/10.1080/09636412.2022.2133629.

McNally, Christopher A. 2011. “China’s Changing Guanxi Capitalism: Private Entrepreneurs between Leninist Control and Relentless Accumulation.” *Business & Politics* 13 (2). Cambridge University Press:1–29. https://doi.org/10.2202/1469-3569.1339.

Mearsheimer, John J. 2014. *The Tragedy of Great Power Politics*. Updated edition. The Norton Series in World Politics. New York ; Norton.

Meijer, Hugo. 2016. *Trading with the Enemy: The Making of US Export Control Policy Toward the People’s Republic of China*. Oxford University Press.

Mickle, Tripp, Ana Swanson, Meaghan Tobin, and Cade Metz. 2025. “Washington Takes Aim at DeepSeek and Its American Chip Supplier, Nvidia.” *The New York Times*, April 16, 2025, sec. Technology. https://www.nytimes.com/2025/04/16/technology/nvidia-deepseek-china-ai-trump.html.

Mueller, Joris, Jaya Wen, and Cheryl Wu. 2023. “The Party and the Firm,” December. https://www.hbs.edu/ris/Publication%20Files/2023.12.06%20The_Party_and_the_Firm_5d1d06fd-dcb6-44e5-8edb-4db24d7186c8.pdf.

National Security Commission on Artificial Intelligence. 2021. “Final Report.” National Security Commission on Artificial Intelligence. https://assets.foleon.com/eu-central-1/de-uploads-7e3kk3/48187/nscai_full_report_digital.04d6b124173c.pdf.

Naughton, Barry. 1988. “The Third Front: Defence Industrialization in the Chinese Interior.” *The China Quarterly* 115 (September):351–86. https://doi.org/10.1017/S030574100002748X.

———. 2020. “2. Grand Steerage.” In *2. Grand Steerage*, 51–81. Stanford University Press. https://doi.org/10.1515/9781503612235-006.

———. 2024. “The ‘Third Front’ after Sixty Years.” *The China Quarterly* 260 (December):925–31. https://doi.org/10.1017/S0305741024001243.

Naughton, Barry, and Briana Boland. 2023. “The Reshaping of China’s State Capitalist System.”

Naughton, Barry J. 2018. *The Chinese Economy: Adaptation and Growth*. Second edition. Cambridge, Massachusetts London, England: MIT Press.

Nölke, Andreas, Tobias Ten Brink, Christian May, and Simone Claar. 2019. *State-Permeated Capitalism in Large Emerging Economies*. 1st Edition. Ripe Series in Global Political Economy. New York: Routledge.

Nouwens, Meia, Maria Shagina, and Erik Green. 2025. “China’s Use of Export Controls.” IISS. February 27, 2025. https://www.iiss.org/online-analysis/charting-china/2025/02/chinas-use-of-export-controls/.

“OECD’s Live Repository of AI Strategies & Policies.” n.d. Accessed March 15, 2025. https://oecd.ai/en/dashboards.

Olcott, Eleanor, and Zijing Wu. 2025. “How Jack Ma’s Pivot to AI Rehabilitated Alibaba.” *Financial Times*, March 17, 2025, sec. The Big Read. https://www.ft.com/content/df2bccee-1730-402f-bb92-9d743018324f.

O’Shaughnessy, Matt. 2022. “One of the Biggest Problems in Regulating AI Is Agreeing on a Definition.” Carnegie Endowment for International Peace. October 6, 2022. https://carnegieendowment.org/posts/2022/10/one-of-the-biggest-problems-in-regulating-ai-is-agreeing-on-a-definition?lang=en.

Palmer, Alex W. 2023. “‘An Act of War’: Inside America’s Silicon Blockade Against China.” *The New York Times*, July 12, 2023, sec. Magazine. https://www.nytimes.com/2023/07/12/magazine/semiconductor-chips-us-china.html.

Pan, Frank, and Ivy Tan. 2024. “China Published Implementing Regulations under the Export Control Law.” Global Sanctions and Export Controls Blog. November 7, 2024. https://sanctionsnews.bakermckenzie.com/china-published-implementing-regulations-under-the-export-control-law/.

Pardo, Ramon Pacheco. 2014. “Guided by Identities? A Constructivist Approach to Sino-American Relations.” *Estudos Internacionais* 2 (1):39–60.

Paul Triolo. 2024. “Legacy Chip Overcapacity in China: Myth and Reality.” *Center for Strategic and International Studies* (blog). April 30, 2024. https://www.csis.org/blogs/trustee-china-hand/legacy-chip-overcapacity-china-myth-and-reality.

Pearson, Margaret M., Meg Rithmire, and Kellee S. Tsai. 2022. “China’s Party-State Capitalism and International Backlash: From Interdependence to Insecurity.” *International Security* 47 (2):135–76. https://doi.org/10.1162/isec_a_00447.

Puscas, Ioana. 2023. “AI and International Security.” Geneva: UNIDIR.

Raska, Michael, and Richard A. Bitzinger, eds. 2023. *The AI Wave in Defence Innovation*. Routledge. https://learning.oreilly.com/library/view/the-ai-wave/9781000875010/.

Rasser, Martijn, and Kevin Wolf. 2023. “The Right Time For Chip Export Controls.” *Lawfare*, January. Lawfare. https://www.lawfaremedia.org/article/right-time-chip-export-controls.

Roberts, Huw, Josh Cowls, Jessica Morley, Mariarosaria Taddeo, Vincent Wang, and Luciano Floridi. 2021. “The Chinese Approach to Artificial Intelligence: An Analysis of Policy, Ethics, and Regulation.” *AI & SOCIETY* 36 (1):59–77. https://doi.org/10.1007/s00146-020-00992-2.

Rogers, Mike, and Dutch Ruppersberger. 2012. “Investigative Report on the U.S. National Security Issues Posed by Chinese Telecommunications Companies Huawei and ZTE.”

Permanent Select Committee on Intelligence, U.S. House of Representatives. https://intelligence.house.gov/sites/intelligence.house.gov/files/documents/huawei-zte%20investigative%20report%20(final).pdf#page=29.72.

Rotolo, Daniele, Diana Hicks, and Ben R. Martin. 2015. "What Is an Emerging Technology?" *Research Policy* 44 (10):1827–43. https://doi.org/10.1016/j.respol.2015.06.006.

Russell, Stuart, and Peter Norvig. 2016. *Artificial Intelligence: A Modern Approach, Global Edition*. 3rd edition. Boston Columbus Indianapolis New York San Francisco Upper Saddle River Amsterdam Cape Town Dubai London Madrid Milan Munich Paris Montreal Toronto Delhi Mexico City Sao Paulo Sydney Hong Kong Seoul Singapore Taipei Tokyo: Pearson.

Sarkin, Jeremy Julian, and Saba Sotoudehfar. 2024. "Artificial Intelligence and Arms Races in the Middle East: The Evolution of Technology and Its Implications for Regional and International Security." *Defense & Security Analysis* 40 (1). Routledge:97–119. https://doi.org/10.1080/14751798.2024.2302699.

Scharre, Paul. 2021. "Debunking the AI Arms Race Theory." *Texas National Security Review*, June. https://tnsr.org/2021/06/debunking-the-ai-arms-race-theory/.

———. 2024. "The Perilous Coming Age of AI Warfare." *Foreign Affairs*, February 29, 2024. https://www.foreignaffairs.com/ukraine/perilous-coming-age-ai-warfare.

Schumacher, Andreas. 2024. "China's Mature Semiconductor Overcapacity: Does It Exist and Does It Matter?" *Center for Strategic and International Studies* (blog). November 19, 2024. https://www.csis.org/analysis/chinas-mature-semiconductor-overcapacity-does-it-exist-and-does-it-matter.

Sevastopulo, Demetri, and Edward White. 2024. "China's Hesai to Be Removed from US Defence Department Blacklist." *Financial Times*, August 13, 2024, sec. US-China relations. https://www.ft.com/content/97dff7c2-33e9-4729-a059-968e308cac49.

Sheehan, Matt. 2024. "Tracing the Roots of China's AI Regulations." Carnegie Endowment for International Peace. 2024. https://carnegieendowment.org/research/2024/02/tracing-the-roots-of-chinas-ai-regulations?lang=en.

Shen, Hong. 2019. "China's Tech-Giants: Baidu, Alibaba, Tencent." In *Digital Asia*, edited by Christian Echle, Katharina Naumann, and Megha Sarmah. Singapore: Konrad-Adenauer-Stiftung. https://www.kas.de/en/web/politikdialog-asien/single-title/-/content/chinas-tech-giganten-baidu-alibaba-tencent.

Shepardson, David. 2022. "U.S. Commerce Secretary: Competing with China Not 'Easy.'" *Reuters*, November 30, 2022, sec. World. https://www.reuters.com/world/commerce-secretary-tout-us-strategy-counter-china-2022-11-30/.

Sherman, Justin. 2019. "Essay: Reframing the U.S.- China AI 'Arms Race.'" New America.

Simon, Herbert A. 1976. "From Substantive to Procedural Rationality." In *25 Years of Economic Theory: Retrospect and Prospect*, edited by T. J. Kastelein, S. K. Kuipers, W. A. Nijenhuis, and G. R. Wagenaar, 65–86. Boston, MA: Springer US. https://doi.org/10.1007/978-1-4613-4367-7_6.

State Council Information Office. 2004. "China's National Defense in 2004." https://www.andrewerickson.com/wp-content/uploads/2019/07/China-Defense-White-Paper_2004_English-Chinese_Annotated.pdf#page=9.11.

———. 2019. "China's National Defense in the New Era." July 2019. https://www.gov.cn/zhengce/2019-07/24/content_5414325.htm.

Stevenson, Alexandra. 2025. “China’s Leader Embraces Business, Even Jack Ma. But Will It Be Enough?” *The New York Times*, February 17, 2025, sec. Business. https://www.nytimes.com/2025/02/17/business/china-xi-jinping-jack-ma.html.

Stone, Alex. 2021. “Military-Civil Fusion Terminology: A Reference Guide.” China Aerospace Studies Institute.

Stone, Alex, and Peter Wood. 2020. “China’s Military-Civil Fusion Strategy: A View from Chinese Strategists.” China Aerospace Studies Institute. https://www.airuniversity.af.edu/Portals/10/CASI/documents/Research/Other-Topics/2020-06-15%20CASI_China_Military_Civil_Fusion_Strategy.pdf.

Sun, Li 孙力, and Ang 王莺 Wang. 2018. “Junmin Ronghe Zhanlue de Lishi Yanjin Ji Neizai Luoji 军民融合战略的历史演进及内在逻辑 [The Historical Evolution and Internal Logic of Military-Civil Fusion Strategy].” *Zhonguo Pudong Ganbu Xueyuan Xuebao 中国浦东干部学院学报* 12 (2). https://oversea-cnki-net.ezproxy-prd.bodleian.ox.ac.uk/KCMS/detail/detail.aspx?dbcode=CJFD&dbname=CJFDLAST2018&filename=ZPDG201802006&uniplatform=OVERSEA&v=gKNcFP8-SvVc94GtmKD-IJIKYwBIjLhmCJ_ik1s6wKDljqY5EjnkLHSSyccc7bSU.

———. 2019. *Xinshidai Junmin Ronghe Fazhan Zhanlue Yanjiu 新时代军民融合发展战略研究 [A Study of New Era Military-Civil Fusion Development Strategy]*. Beijing: Renmin chubanshe.

SuperCLUE. n.d. “Zhongwen Damoxing Zonghexing Ceping Jizhun 中文大模型综合性测评基准.” SuperCLUE. Accessed May 3, 2025. https://gradio.app/.

The White House. 2024. “Memorandum on Advancing the United States’ Leadership in Artificial Intelligence; Harnessing Artificial Intelligence to Fulfill National Security Objectives; and Fostering the Safety, Security, and Trustworthiness of Artificial Intelligence.” October 24, 2024. https://www.whitehouse.gov/briefing-room/presidential-actions/2024/10/24/memorandum-on-advancing-the-united-states-leadership-in-artificial-intelligence-harnessing-artificial-intelligence-to-fulfill-national-security-objectives-and-fostering-the-safety-security/.

Tran, Jessica. 2018. “Security Dilemma in U.S.-China Relations: A Non-Traditional Security Studies Perspective.” *Master’s Theses*, May. https://repository.usfca.edu/thes/1070.

Tsang, Steve, and Olivia Cheung. 2024a. *The Political Thought of Xi Jinping*. Oxford, UNITED STATES: Oxford University Press, Incorporated. http://ebookcentral.proquest.com/lib/oxford/detail.action?docID=7372768.

———. 2024b. “Xi Jinping’s Approach to Acquire Strategic Technology from the West.” *East Asia* 41 (4):301–23. https://doi.org/10.1007/s12140-024-09431-1.

U.S. Department of Commerce. 2007. “Revisions and Clarification of Export and Reexport Controls for the People’s Republic of China (PRC); New Authorization Validated End-User; Revision of Import Certificate and PRC End-User Statement Requirements.” Federal Register. June 19, 2007. https://www.federalregister.gov/documents/2007/06/19/E7-11588/revisions-and-clarification-of-export-and-reexport-controls-for-the-peoples-republic-of-china-prc.

———. 2016. “Russian Sanctions: Addition of Certain Entities to the Entity List.” Federal Register. September 7, 2016. https://www.federalregister.gov/documents/2016/09/07/2016-21431/russian-sanctions-addition-of-certain-entities-to-the-entity-list.

———. 2019. “Addition of Entities to the Entity List.” Federal Register. May 21, 2019. https://www.federalregister.gov/documents/2019/05/21/2019-10616/addition-of-entities-to-the-entity-list.

———. 2022. “Commerce Implements New Export Controls on Advanced Computing and Semiconductor Manufacturing Items to the People’s Republic of China (PRC).” Bureau of Industry and Security, U.S. Department of Commerce. https://www.bis.doc.gov/index.php/documents/about-bis/newsroom/press-releases/3158-2022-10-07-bis-press-release-advanced-computing-and-semiconductor-manufacturing-controls-final/file.

———. 2023. “Implementation of Additional Export Controls: Certain Advanced Computing Items; Supercomputer and Semiconductor End Use; Updates and Corrections.” Federal Register. October 25, 2023. https://www.federalregister.gov/documents/2023/10/25/2023-23055/implementation-of-additional-export-controls-certain-advanced-computing-items-supercomputer-and.

Van Rythoven, Eric. 2020. “The Securitization Dilemma.” *Journal of Global Security Studies* 5 (3):478–93. https://doi.org/10.1093/jogss/ogz028.

Vaynman, Jane, and Tristan A. Volpe. 2023a. “Dual Use Deception: How Technology Shapes Cooperation in International Relations.” *International Organization* 77 (3):599–632. https://doi.org/10.1017/S0020818323000140.

———. 2023b. “Dual Use Deception: How Technology Shapes Cooperation in International Relations.” *International Organization* 77 (3):599–632. https://doi.org/10.1017/S0020818323000140.

Walt, Stephen M. 1985. “Alliance Formation and the Balance of World Power.” *International Security* 9 (4). The MIT Press:3–43. https://doi.org/10.2307/2538540.

Watling, Jack. 2023. “Supporting Command and Control for Land Forces on a Data-Rich Battlefield.” *Royal United Services Institute*.

Wei, Lingling. 2023. “China’s New Way to Control Its Biggest Companies: Golden Shares.” *Wall Street Journal*, March 8, 2023, sec. World. https://www.wsj.com/articles/xi-jinpings-subtle-strategy-to-control-chinas-biggest-companies-ad001a63.

Wendt, Alexander. 1992. “Anarchy Is What States Make of It: The Social Construction of Power Politics.” *International Organization* 46 (2). [The MIT Press, Cambridge University Press, International Organization Foundation]:391–425.

Woods, Dwayne. 2024. “The Silicon Sword Hanging Over China’s Head.” *Journal of Chinese Political Science*, March. https://doi.org/10.1007/s11366-024-09883-5.

Wu, Mark. 2016. “The ‘China, Inc.’ Challenge to Global Trade Governance.” *Harvard International Law Journal* 57.

Xu Ning 许宁. 2024. “hesai meiguo weiquan chenggong, zhong wei xiaofang, mei guofangbu zhengming zhong qi ‘shejun’ weihe kunnan chong chong? 禾赛美国‘维权’成功，中微效仿，美国防部证明中企‘涉军’为何困难重重？[Hesai successfully defended its rights in the United States, and AMEC followed suit. Why is it so difficult for U.S. Department of Defense to prove Chinese companies’ military involvement?].” *Voice of*

America, August 25, 2024. https://www.voachinese.com/a/pentagon-chinese-military-company-list-20240824/7755818.html.

Ye, Josh. 2023. "Beijing Takes 'golden Share' in a Tencent Subsidiary, Records Show." *Reuters*, October 19, 2023, sec. China. https://www.reuters.com/world/china/beijing-takes-golden-share-tencent-subsidiary-records-show-2023-10-19/.

Zhang, Lin, and Tu Lan. 2023. "The New Whole State System: Reinventing the Chinese State to Promote Innovation." *Environment and Planning A* 55 (1). SAGE Publications Ltd:201–21. https://doi.org/10.1177/0308518X221088294.

Zhong, Raymond, and Alexandra Stevenson. 2021. "Jack Ma Shows Why China's Tycoons Keep Quiet." *The New York Times*, April 22, 2021, sec. Technology. https://www.nytimes.com/2021/04/22/technology/jack-ma-alibaba-tycoons.html.

Zhou, Taomo, and Cuifen Weng. 2024. "Soldiering in the Special Zone: The People's Liberation Army Engineering Corps in Shenzhen." *The China Quarterly* 260 (December):906–24. https://doi.org/10.1017/S0305741024000900.

Zhu, Julie, Fanny Potkin, Eduardo Baptista, Michael Martina, and Julie Zhu. 2023. "Insight: China Quietly Recruits Overseas Chip Talent as US Tightens Curbs." *Reuters*, August 24, 2023, sec. Technology. https://www.reuters.com/technology/china-quietly-recruits-overseas-chip-talent-us-tightens-curbs-2023-08-24/.

Appendix A

Geoeconomic Distinguishability

Dual-use indistinguishability may prompt one state to enact competitive policies, but it takes at least two states to spiral into an AI competition. What propagates a vicious action-reaction cycle, I argue, is a second layer of uncertainty caused by the unique character of AI competition. The imperative of dual-use technological development moves the locus of competition to geoeconomics. If dual-use indistinguishability prompts states to resort to taking the first geoeconomic actions to increase their relative technological capability, the geoeconomic distinguishability—the ability to differentiate between legitimate and predatory geoeconomic acts—affects the likelihood of a downward spiral. If these geoeconomic actions evoke fear and suspicion by another state, it might fuel a destabilising cycle of securitisation. This means that even if State A pursue geoeconomic measures exclusively to increase its own security, State B might still interpret them as threatening. It might in turn devise geoeconomic measures to balance against State A, which ultimately reduce State A's security. Hence, a technology competition caused by a dual-use security dilemma involves the perception and misperception of two variables: dual-use distinguishability and geoeconomic distinguishability.

Having characterised another state's possession of dual-use technology, a state must make a second decision: given its characterisation of the threat level posed by the technology, how should it respond? Balance of threat theory suggests that State A will balance against State B's dual-use technology if it determines that the technology poses a military threat.[287] The goal of balancing is to achieve technological parity or even superiority vis-à-vis an adversary by increasing one's own capabilities and/or undercutting an adversary's capabilities. In the realm of technology competition, balancing acts mainly take the form of geoeconomic measures because they affect a state's technological capabilities.

[287] Walt 1985

One might ask: if State A treats State B's dual-use technology as a military threat, shouldn't State A balance against State B by directly building up military armaments, rather than seeking to improve relative technological capabilities? Boosting military capabilities is certainly an option for State A, but it is only a short-term solution. Over the long term, State A's inability to improve its relative technological capabilities will undermine its relative military capabilities in the long run. Technology's compounding effect on military capability is especially prominent if it is general purpose, meaning that it will affect military effectiveness through broad, delayed channels shaped by indirect productivity spillovers.[288] State A must therefore compete at the level of technology in order to balance against State B's techno-security threat. Here, the international norms environment may also affect state's calculus. In a liberal international order that strongly favours free trade, states that unilaterally restrict trade without presenting an unambiguously legitimate rationale may receive a punishment for norm violation. Even if it suspects that State B is exploiting dual-use trade for military advantage, State A has an incentive to avoid overacting or the appearance of overaction. Reacting to another state's technological development that is plausibly peaceful via arms buildup would appear disproportionate and escalatory, which could incur reputational costs to the extent that international norms punish aggressive behaviour.

To improve its balance of technological capabilities, a state can pursue geoeconomic measures grouped along two dimensions. The *inward-outward* dimension corresponds to the internal and external sources of economic power. Inward measures affect national assets, whereas outward measures impact the structure of international economic flows affairs through avenues such as international trade and investment rules or industrial partnerships with allies.[289] The *protective-promotive* dimension differentiates between measures aiming to protect existing capabilities from transfer to foreign powers and measures aiming to foster new capabilities.[290] For example, U.S. semiconductor export controls against China would be inward-protective because they inhibit the transfer of U.S. technology to China. It is also an outward-protective policy because the Foreign Direct Product Rule—which extends U.S. export controls to foreign-

[288] Ding and Dafoe 2023
[289] Gehrke 2022
[290] Gehrke 2022

made items containing U.S. components—grants the export controls a degree of extraterritoriality.[291] By contrast, the U.S. CHIPS and Science Act of 2022 would constitute an inward-promotive policy because it aims to bolster American semiconductor research, development, and production.[292]

The interpretation of these geoeconomic measures can be highly contentious and ambiguous. The burgeoning literature on weaponised interdependence demonstrates how globalisation of economic flows generates (negative) security externalities that can spur a sense of insecurity among interdependent states.[293]Although export controls are be viewed as a protective measure to prevent the leakage of one's technology, they can also be construed as a means to undercut another state's development of capabilities through denying it access to crucial inputs for technological developments. Another example is talent recruitment – which China uses to combat the "brain drain" of science and technology talents, but could be construed as an aggressive measure to take advantage of openness and facilitate technology transfer.[294] Hence, while its *protective* intention connotes defensive purposes, protective measures can be *offensive* in nature, implemented to pre-emptively undermine an adversary's technological development.[295]

While promotive policies may sound innocuous, they too can be regarded as malicious if a state's promotion of capabilities come at the expense of another state. Industrial policies, for instance, can be perceived as predatory if they create and export overcapacities to other states, damaging the latter's domestic industries. This is why China's recent plan to ramp up production capacity for less advanced, legacy chips has raised considerable concerns in Washington, despite lingering uncertainties over whether the Chinese government really intends to flood the global market, or it merely wanted more plants to cover the surging domestic demands.[296] Furthermore, the receiving state could use the shield of plausible deniability to frame the sender state's geoeconomic actions as unwarranted. For instance, the targeted state could argue that it plans to

[291] Lee, Nellis, and Lee 2022
[292] House 2022
[293] Farrell and Newman 2019; 2023
[294] Zhu et al. 2023
[295] Woods 2024
[296] Paul Triolo 2024; Schumacher 2024

use the technology for economic development and criticise the sender state for hindering legitimate technology uses. The ambiguities around how states interpret geoeconomic measures resemble the offense-defense distinguishability in the classic security dilemma literature.[297]

[297] Jervis 1978

Appendix B

Data Collection and Labelling Procedure for Entity List Analysis

1. **Data Collection**: Downloaded the complete Entity List data from *Supplement No. 4 to Part 744* of the Federal Register, available in HTML format from the Electronic Code of Federal Regulations (eCFR) website. (URL: https://www.ecfr.gov/current/title-15/subtitle-B/chapter-VII/subchapter-C/part-744/appendix-Supplement%20No.%204%20to%20Part%20744)
2. **Data Cleaning**: Imported the HTML data into R and converted it into a structured data frame. Removed the final five rows, which contained footnote explanations unrelated to listed entities. Created a `first_date` column by parsing the date information from the "Federal Register citation" column using regular expressions and date conversion functions in R. Extracted the Federal Register URLs embedded in the "Federal Register citation" column to create a separate `URL` column for each entity.
3. **Web Scraping**: Developed a Python script to automate scraping of the corresponding Federal Register pages. Captured the specific text that documents the justification for each entity's addition to the Entity List. Appended the scraped justification text to the R data frame.
4. **Text Labeling Using OpenAI**: In R, used the OpenAI API with the GPT-3.5-turbo model to generate labels for a shortened version of each scraped justification. The prompt instructed the model to output:
    - A justification category
    - A confidence score (on a 1–100 scale)
    - A one-sentence rationale
5. **Robustness Check**: Repeated the labeling process using a slightly different prompt to cross-check outputs. This step was taken to identify inconsistencies or ambiguous cases and to strengthen the robustness of the final labeling. Manually reviewed all entries that returned low confidence scores or discrepancies between the two labeling attempts. Made final adjudications based on human judgment to ensure data reliability.

Appendix C

Modes of Civil-Military Technological Interactions

Table 8. Modes of Civil-Military Interactions
Source: Alic et al. 1992, 64-75.

Mode	Description	Example
Direct product conversion (spinoff)	Military product developed at government expense finds commercial application	Microwave oven
Defense procurement pull and commercial "learning"	Government purchases create enough market demand to sustain innovation of high-risk, cost-intensive technologies	Supercomputers
Concurrent development of civil and military applications	Parallel development of both military and civil applications of a new technology (from the same prototype)	Jet engines, jet transports
Shared infrastructure for defence programs and emerging commercial industry	Government shoulders the cost of building the public infrastructure required for both civilian and defence applications.	Civilian uses of nuclear technology (e.g., radiology)), satellite communications (e.g., gov paid for the development of launch vehicles, facilities, and

		services), computer languages/standards
Development of engineering techniques and tools to meet government needs		NASTRAN (NASA Structural Analysis, developed for firms contracting with NASA)
Dual-use technology developed from defense agency support	Defence agencies fund basic research in universities and laboratories in a wide range of subjects of potential military interests	AI
Reverse spinoff ("spin-on") from civil to military	Technologies developed entirely in the commercial sector are used or adapted for use by defence	CMOS circuits (developed initially by Japan for electronic wristwatches but used in military applications)
Forced diffusion through demonstration programs	Military-funded technology demonstrations stimulate service branches' demand for technology and incentivize commercial industry to sell to government	