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Game-Theoretic Analysis of the Escalating Dynamics of the Chip War Between the US and China

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Moritz Franke, MA
E-Mail: Moritz.Franke@munich-business-school.de

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Abstract

This thesis analyses the US-China “Chip War” as a strategic interaction in which semiconductor-related industrial and trade policies are used to shape dependencies, alter relative industrial capabilities, and improve future bargaining positions. It asks how both states have used such policies under conditions of uncertainty and commitment problems, and how these dynamics have shaped the course and outcomes of their semiconductor rivalry since the mid-2010s. To answer this question, the thesis combines an empirical reconstruction of the rivalry with a game-theoretic analysis across three phases.

The empirical analysis shows sustained Chinese catch-up under continued U.S. leadership. China narrowed the economic and innovative gap across the semiconductor value chain but did not displace the United States from its leading position. At the same time, both sides remained vulnerable through mutual control of the other’s strategic chokepoints. Moreover, an analysis of interactions during the Chip War is conducted. On this basis, the thesis models the Chip War as a dynamic bargaining process. The first phase is driven by uncertainty and preventive incentives, the second by asymmetric information and commitment problems, and the third by brinkmanship under rising systemic risk and uncertainty about resolve. The thesis argues that the escalation of the Chip War is best understood as a phased escalation driven by changing information, mutual vulnerability, and bargaining failure.

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kU and kC *Costs of Escalation*

〖dw〗_t *Declaration of War*

〖rC〗_S *Strong Resilience of C*

〖rC〗_T *Resilience Type of C*

〖rC〗_W *Weak Resilience of C*

a_t *Acceptance Variable*

C *China, China, China*

d *Costs of Decoupling for U/C*

f *Decision to stand firm by U/C*

g *C's Retained Value Share*

i *Investitionshöhe*

I_t *Investment Decision*

M_t *Capabilities in t*

p *C's Likelihood to Overcome U's Restrictions, Restriction Intensity (Model 3)*

p_i *Probability for C to invest*

p_p *Probability for U not to restrict*

p_s *Probability for signal revelation*

p_S *Probability for Sufficiently Informative Signal*

PRC *People's Republic of China*

q *Likelihood of C to be of Strong Resilience*

r *Retaliatory Escalation Risk chosen by C*

R(p) *Resilience of U/C*

rU *Cost of Industrial Warfare for U*

s_t *Signal*

t *Zeitperiode*

U *USA, USA, USA*

US *United States*

v_C *Value of C retaining Strategic Industrial Position*

w_U *Payoff for Industrial War*

x_AT *Acceptable Share of Payoffs depending on Type*

x_t *Proposal share to C*

δ *Discounting Factor*

Δ *Shift in Relative Industrial Capabilities*

θ *Prior Belief of U about C's Resilience*

φ *Conflict Efficiency Factor*

1. Introduction

Over the last two decades, the relationship between China and the USA has increasingly developed into a broad strategic rivalry that extends beyond conventional trade disputes. Rather than being confined to isolated disagreements over tariffs or market access, the interaction between the two countries comprises disputes about economic power, technological leadership, military capability, and international order (State Council of the PRC, 2017). In 2015, both governments defined their relationship and interaction as one of comparatively stable cooperation where most differences could be managed through communication and negotiation (State Council of the PRC, 2015b; White House, 2015). Almost ten years later, the US describes its relationship to China as one of strategic competition that requires proactive management to avoid escalation into conflict (US Department of State, 2024). Consequently, it aims to strengthen its own strategic position for the interaction with China (US Department of State, 2022) in order to decrease dependency and reliance on the People's Republic.

Conversely, the Chinese framing of this shift has been more ambivalent in its official formulation. While the People's Republic of China (PRC) defines the preferred bilateral relationship in cooperative terms such as respectful, cooperative, and mutually beneficial (State Council of the PRC, 2023), it increasingly portrays actual U.S. policy toward China as being driven by a logic of strategic competition and long-term containment (Ministry of Foreign Affairs of the PRC, 2024). Official statements describe disagreements with the US as politically motivated attempts to constrain China's development and strategic position, by increasing tensions in the domains of trade, technology, and national security to hinder its economic and technological development.

Technological development and innovation are treated by both countries as a source of advantage to strengthen the national strategic position (White House, 2015; State Council of the PRC, 2015a). Both serve as a tool to promote military development as well as economic performance (Department of Defence of the U.S., 2023), therefore, becoming indispensable for an increasingly confrontational interaction in which China is seeking to assert itself against the US (State Council of the PRC, 2018), while the Americans are trying to defend their technological and geopolitical dominance (Department of State of the U.S., 2023). In the eyes of both governments, technological leadership enables increases in productivity and innovation capacity, which shape the development of industrial and military capabilities and affect the long-term distribution of power between states. Competition over advanced technology is therefore understood as a competition over future economic strength, strategic autonomy, and geopolitical influence. Within the broader technological competition between both countries, semiconductors therefore occupy a vital position, as they constitute a foundational input for a wide range of downstream industries and capabilities (SIA, 2021b). Semiconductors, or more colloquially “chips”, are key components to all kinds of electronic devices and components. They are integrated circuits that allow processing, storage, and transmission of data and electronic signals in larger electronic devices (SIA, 2021b). Thus, they enable the transfer of electronic information, which is essential for the functionality of electronic devices (Beaumier & Cartwright, 2024). This functionality makes them indispensable for every electronic device, no matter the intended end-consumer. From consumer goods like smartphones, computers, and cars to military application devices like satellites, drones, and missiles, every device relies on the respective performance capability of semiconductors (Hamdani & Belfencha, 2024).

The economic significance of the global semiconductor industry, therefore, cannot be adequately captured by market size alone but must also be assessed in terms of its contribution to downstream value creation and the breadth of industries it supports. The global sales value of semiconductors amounted to $628 billion in 2024 (World Semiconductor Trade Statistics, 2026), with an average growth rate of 7.2% between 2015 and 2024. Yet as an upstream input, semiconductors enable much larger downstream markets, like, for example, the global car market with $2.9 trillion of revenue or the worldwide IT market of $5.26 trillion in 2024 (Gartner, 2024). Notably, the revenue of the IT market grew by only 7.5% in that year (Gartner, 2024), while the sales of semiconductors increased by 19.7% (World Semiconductor Trade Statistics, 2026). To further investigate the downstream value of semiconductors, the OECD (2025) conducted an input-output analysis of the value added by semiconductors. It showed that semiconductors account for 8% of the value added in the information and communication technology sector, while another intermediate product, like primary energy, only contributed 2%. This indicates that a meaningful share of the value embodied in downstream digital products depends on semiconductors as inputs. Furthermore, the downstream value-creation extends to the labour market, where for every single job in the US semiconductor industry, an additional 5.7 jobs on average were supported in the wider US economy across more than 300 downstream economic sectors (SIA, 2021b).

Since semiconductors underpin such a wide range of economically and strategically valuable capabilities, it is not surprising that both governments have a strong focus on developing a strong and resilient semiconductor industry. In the US, the government highlighted the importance of semiconductor capabilities across multiple presidencies, as they affect national security interests, continued U.S. technological and economic leadership, as well as many aspects of everyday life (Executive Office of the POTUS, 2024). The Chinese government on the other hand classified semiconductors, or integrated circuits (IC), as the core enabling technology for the information technology industry, thereby being a strategically significant industry for its economic development and national security (Central Committee of the CPC, 2016). Semiconductors, therefore, meaningfully shape the broader U.S.–China technology rivalry, since access to and control over them affects not only any given industrial sector, but the entire spectrum of relevant dimensions in the geopolitical contest (Beaumier & Cartwright, 2024). This includes capabilities such as artificial intelligence, supercomputing, a broad range of advanced electronic and digital technologies, as well as defense and other dual-use systems from which both economies and militaries derive value (Beaumier & Cartwright, 2024).

The strategic relevance and broad applicability of semiconductors create incentives for each country to foster and protect its domestic semiconductor industry through political measures like investments, legislation, or tax exemptions. This strategic relevance potentially makes restriction and state intervention attractive for an adversary that wants to deny access to semiconductors and thus military power and future technological developments. Once industrial and trade policies are used to extend a state's capabilities and its available actions to choose from, the interaction no longer follows the logic of ordinary market competition but becomes one of strategic bargaining.

Bargaining situations are generally characterised by a framework of uncertainty towards the true resolve, expectations, and capabilities of an opponent that aims to optimise its strategic situation. States can strategically leverage this mutual uncertainty to influence their adversary's belief about their capabilities to their own advantage. They can also strengthen their own respective bargaining position by applying industrial and trade policies to improve their relative industrial capabilities and independence. A continuous shift of industrial power, however, goes hand in hand with a change of the framework conditions for trade, as trade flows between both countries and third-party countries, regulations, and therefore, outcomes and related payoffs change. An opposing state has an incentive to anticipate and counteract a shift in relative industrial capabilities to avoid a deteriorated bargaining position in the future. Such a situation where incentives arise to preventively or pre-emptively act to secure one's own bargaining position is defined as a commitment problem, and it is a key mechanism used for the explanation of escalation between states.

The escalatory confrontation between the United States and China, as well as the economic, technological, and military impact of the control over semiconductors has therefore led to this interaction being described as the "Chip War" (Hamdani & Belfencha, 2024; Kim & Rho, 2024). Hence, the Chip War is not merely a conflict over technological leadership, but a strategic interaction in which semiconductor-related industrial and trade policies are used to shape dependencies, relative industrial capabilities, and future bargaining positions. To investigate the mechanisms behind this unfolding escalation, this work therefore aims to analyse how the United States and China have used semiconductor industrial and trade policies as strategic instruments in a rivalry shaped by uncertainty and commitment problems and how these dynamics have influenced the course and outcomes of their bilateral semiconductor conflict since the mid-2010s.

This thesis approaches the Chip War as a strategic interaction between two rational states whose policies are shaped by expectations about the opponent's capabilities, resolve, and future bargaining position. Rather than treating semiconductor policy merely as an instrument of industrial development or economic competition, it analyses how industrial and trade measures can be used strategically to shape dependencies, alter relative industrial capabilities, and influence the distribution of future semiconductor-related rents. The underlying core argument advanced in this work is that the escalation of the Chip War is best understood as the result of bargaining under uncertainty and commitment problems.

By combining game-theoretic reasoning with an empirical reconstruction of the semiconductor rivalry, this work contributes to the literature in two ways. First, it shifts the analytical focus from the static question of why the United States and China compete over semiconductors to the dynamic question of how this confrontation escalated across distinct strategic phases. Second, it adapts concepts originally developed for the analysis of military conflict to a form of geo-economic confrontation in which restrictions, industrial policy, and control over chokepoints shape bargaining positions and escalation dynamics without amounting to direct armed conflict. Third, it provides a structured empirical foundation for the formal analysis by reconstructing the industrial development of the U.S. and Chinese semiconductor sectors, their respective strategic chokepoints, and the political escalation of the Chip War.

The remainder of this work proceeds in four steps. Chapter 2 develops the theoretical foundations by introducing the rational-actor perspective, strategic interdependence, game-theoretic modelling, bargaining, asymmetric information, commitment problems, and brinkmanship as relevant analytical concepts. Chapter 3 then reconstructs the empirical and strategic context of the US–China semiconductor rivalry by examining the development of both industries, their strategic chokepoints, and the political escalation of the Chip War. Building on these foundations, Chapter 4 models the confrontation as a dynamic strategic game across three successive phases of escalation. The conclusion summarises the main findings and reflects on their implications for understanding the strategic logic of the Chip War.

2. Literature Review and Theoretical Foundations

This literature review develops the theoretical foundations for the analysis of the Chip War. It first elaborates on the rational-actor perspective and strategic interdependence in international politics. It then introduces the concept of structural frameworks of strategic games and elaborates on game-theoretic modelling by discussing their core elements, bargaining, uncertainty, private information, and the representation of strategic interaction. Finally, it reviews game-theoretic explanations for the occurrence of war and thereby establishes the analytical framework for the formal models of escalation developed for the later game-theoretical analysis.

2.1. Rationality in Game theory and International Politics

To explain why game theory can be applied to the analysis of international politics, it is first necessary to clarify how rationality is understood in both fields.

2.1.1. Rationality in Game Theory

In the field of game theory, rationality comprises the idea of consistent actions and decision-making under given constraints and conditions. Bound to a given set of preferences and expectations, a player is continuously going to follow the respective action or set of actions, so-called strategy, which are going to maximise future payoffs. Preferences between the actions are consistent and transitive, thus ensuring consistent decision-making. Furthermore, rationality demands that the player act according to the other player's expected preferences, types, and actions. This practice of best response implemented by both players then creates a stable equilibrium that no player has incentives to deviate from. Within the guarding rails of the respective model and its assumptions, rationality in game theory leads to optimised decision-making for the player. However, the degree to which this idea of rationality can be applied to real-life scenarios is widely discussed and questioned in academic literature.

Simon (1955) notes that humankind is neither capable of computing the information of complex, multi-dimensional problems nor able to process such decisions, due to information and time constraints. The limits of rationality are therefore determined by the (human) players themselves. Human nature and its environment also lead inevitably to bounded rationality through conflicting goals and aspirations, the costly search for alternative actions, imperfect learning, and environmental instability (Selten, 2001). Human biases like loss aversion, diminishing sensitivity, and reference dependence also create distortion of rationality by affecting the evaluation of outcomes, alternatives, and probabilities (Tversky & Kahneman, 1992). Under realistic constraints, rationality applied by humans turns into a mindset that, contingent on the respective model constraints, can be used to varying degrees for decision-making. Nevertheless, this mindset can still be applied to analytical frameworks (Selten, 2001).

2.1.2. Rational State & Structural Framework of International Politics

The analysis of rational state behaviour in international politics must begin with the structural conditions under which states interact. No country on the world stage has the unequivocal authority or power to enforce an international order, and while there are countries capable of imposing their will onto others, the reason for them successfully doing so is better explained with coercion and deterrence, which create new incentives for individual action. In this context, the anarchy prevailing in the international order may not be seen as a denial of order, but as the defining structural framework of international politics within which different patterns of interaction and interests may emerge and occur, due to dynamic evaluations of expectations and preferences (Waltz, 1979).

The concepts of realism and neorealism provide two approaches for how the agency of states within such an anarchical framework may be conceived. The former concept highlights states as actors striving for power, the ability to influence the actions and expectations of other actors to serve one's own interests. Other's power together with the human nature of individual actors within the state, therefore, poses a constraint (Morgenthau, 1948). The latter focuses on states as functionally similar units, constrained by their own capabilities and the surrounding anarchic structure, which strive for survival and relative gains within their respective system (Waltz, 1979). What both approaches share is the notion that states can be treated as action-oriented actors that are guided by interests and strategic calculation (Fearon, 1995; Powell, 2002). In the context of international politics this notion is described as rational state behaviour. Rationality does not refer to psychological processes or normative standards of reasonableness, but to an analytical abstraction that describes states as actors that pursue their interests in a consistent goal-oriented manner, given their expectations and beliefs about the expectations and beliefs of other states in the international environment (Fearon, 1995; Keohane, 1986). The given anarchic framework of international politics demands a methodology for explaining state behaviour in incentive-driven patterns, and despite divergent perspectives on how interests are being formed or how they are constrained, both classical realism and neorealism share the assumption of states being rational actors.

One question that must arise when the rationality of states is being concluded is how states can be rational when human individuals, who operate them, only have bounded rationality with all its implications (Jervis, 1979). Waltz (1979) argues that the understanding of states as unitary actors is not a dismissal of domestic politics, but a deliberate abstraction to explain patterns of international outcome. By claiming that the observable behaviour of states can be explained as if from purpose-driven choice, the rational-state models can explain the observable patterns of state behaviour, which often display strategic consistency despite being generated by bounded, fragmented, and politically contested decision-making processes (Keohane, 1986). Putnam (1988) provides an additional approach to answering this question by recognizing that international politics operate on two levels simultaneously, on the international and the domestic. Domestic politics do not directly influence the outcome on the international stage, but they constrain the number of acceptable outcomes, as all outcomes of international negotiation must go through a process of ratification domestically. This ratification requires the aggregation of preferences, so-called coalition-building, and demands that the state leadership consider domestic expectations and beliefs in their strategic calculus. Evolutionary models, which iteratively analyse how strategies spread, persist, or disappear based on their performance, show how collectives achieve rational outcomes through selection and adaptation mechanisms (Farkas, 1996).

Consequently, states can be treated as rational actors, because as selection pressures operate externally through the international system (Waltz, 1979) and internally through domestic politics and state structure (Farkas, 1996), collective decision-making processes adapt behaviour systematically to incentives and constraints over time. Thus, producing outcomes that approximate rational choice despite bounded individual cognition (Farkas, 1996; Fearon, 1995; Powell, 2002).

2.1.3. Strategic Interdependence in International Politics

Once states are treated as rational actors, their behaviour in international politics cannot be understood as a series of isolated choices, but must be analysed as inherently interdependent. The consequences of any given action are not determined solely by a state's own decision, but by how other states respond to it (Waltz, 1979)Out of this logic arises the idea of strategic interdependence. A state's rational action must consider the external environment where its counterparts are likewise purposive and responsive (Schelling, The strategy of conflict: Prospectus for a reorientation of game theory, 1958). This makes anticipation and mutual adjustment central features of political decision-making, as not only are states' actions interdependent, but also the resulting payoffs (Snidal, 1985). In a competitive framework this means that one state's pursuit of relative power and advantage is conditional on anticipated expectations and counteractions of other states (Schelling, The strategy of conflict: Prospectus for a reorientation of game theory, 1958).

If outcomes in international politics are generated through strategic interaction, they cannot be understood solely as the aggregation of observable actions. Schelling (1958) emphasizes that strategic outcomes are analytically characterized by the degree to which actors arrive at shared expectations on actions. This expectation convergence requires mutual recognition of anticipated behaviour or belief about another state (Jervis, 1979). Beliefs about other states lead to expectations, therefore outcomes are dependent on the degree of belief alignment. Belief and expectation alignment can occur through unspoken communication by relying on specific properties of a given situation, like the framework conditions, precedent, simplicity, or symmetry (Schelling, The strategy of conflict: Prospectus for a reorientation of game theory, 1958). On the other hand, Jervis (1979) notes that one of the biggest sources for belief misalignment is the discrepancy between one state's belief of another and this other state's self-image. Beliefs are highly dependent on perceptions; therefore, a high degree of belief-alignment to obtain a favourable strategic outcome requires alignment between one's self-image and one's perception (Axelrod & Hamilton, 1981). Perception is not simply perceived unfiltered but is affected by already existing beliefs and images. In international relations such existing beliefs are under constant development as they are sourced from continuous assessment and resource-intensive observation of others' capabilities and intentions (Kaplow & Gartzke, 2021).

Continuous assessment of other states' capabilities and intentions is only one side of the coin of forming beliefs about other states. The flip side consists of uncertainty about capabilities and intentions that cannot be observed. Uncertainty is not simply the absence of information, but depends both on the characteristics of the state being assessed and on the strategic environment in which the assessment takes place (Kaplow & Gartzke, 2021). Intentions and expectations, for example, are intersubjective and inferred, and therefore not directly observable (Wohlforth, 2012). In addition, states have incentives to purposefully misrepresent their private information to hinder assessment by others (Fearon, 1995). As a result, even sustained and rational assessment processes cannot eliminate uncertainty, leaving expectations about other states' future behaviour inherently provisional and incomplete.

The dependence of outcomes on expectation formation, rather than on observable actions alone, leads to interdetermination in international politics. Similar material conditions can give rise to different outcomes depending on how states form beliefs about each other's intentions and resolve. As a result, international interaction cannot be understood solely through structural constraints or preference descriptions but requires an analytical framework capable of modelling how strategies, expectations, and responses co-evolve.

2.1.4. Game Theory as an Analytical Framework for International Politics

If international politics is characterized by rational, action-oriented states whose outcomes are generated through strategic interdependence, then an analytical framework is required that can explicitly account for interactive decision-making under anticipated responses. As shown above, states do not evaluate policies solely on the basis of their immediate effects, but in light of expected counteractions, belief formation, and adjustment processes. Political outcomes therefore emerge not from isolated choices, but from the strategic interaction of purposive actors whose payoffs depend on one another's behaviour.

Game theory provides a formal analytical language precisely for such settings. It is designed to analyse situations in which actors choose strategies under the expectation that others are simultaneously engaging in similar forward-looking calculations. Rather than focusing on single decisions, game-theoretic analysis examines how patterns of interaction arise when actors form beliefs about others' preferences, capabilities, and likely responses, and select actions accordingly. This makes game theory particularly suitable for the study of international politics, where enforcement is decentralized, commitments are intrinsic, and strategic anticipation is unavoidable.

Importantly, the application of game theory does not require the assumption of perfect information or fully optimized outcomes. As established in the preceding sections, rationality serves as an analytical abstraction that structures decision-making under constraints, while strategic interaction is fundamentally shaped by uncertainty and incomplete information. Game-theoretic frameworks are therefore well suited to capture how rational state behaviour can lead to miscoordination, escalation, or inefficient outcomes, not despite, but because of strategic calculation. This methodological logic forms the basis for the subsequent discussion of uncertainty, private information, and commitment problems in game-theoretic models of international conflict.

2.2. Game-Theoretic Abstraction of the Chip War

To introduce the unfamiliar reader to the concepts discussed in this thesis, the Appendix chapter 1) introduces core elements, concepts, and frameworks, which will prove helpful for the understanding of later discussions.

Structural Framework for the Chip War

The escalation between the US and China in the semiconductor industry can only be presented in an analytically comprehensible manner if the game-theoretical framework has been adequately classified beforehand. The observable policies and counter policies between both countries do not happen simultaneously. Political moves are usually followed by a response and continuing adjustments. This pattern of sequential moves takes place over multiple years with different phases of escalation intensity. The time-structural dimensions for the game theoretic model are therefore classified as sequential and dynamic.

In terms of the informational dimensions, both countries generally know about the direction as well as the measures taken by their adversary. However, the degree to which the political direction of measures allows conclusions about the set of possible actions and their payoffs, is not high. Political actions and payoffs are highly uncertain ex ante, as the implementation is dependent on third parties, like companies, regional public offices, and others who are not under direct control of political decision-makers. In addition, capabilities like technological frontiers, substitution capacities, and the ability to scale under the respective constraints are not fully known, as publicly available data is limited (OECD, 2025a). Overall, political actions of both countries are only partially observable, as the political announcement alone allows little conclusion about its operational bite. The effectiveness is determined by the implementation, which comprises rule interpretations, regional differences, or individual exceptions. Certain licensing policies also contribute to unobservability, as outsiders cannot fully observe what licensing process will be accepted or denied by respective authorities. In conclusion, the escalation is most consistently captured as a sequential, dynamic game with incomplete and imperfect information, where observable policy moves provide noisy signals about capabilities and political resolve.

Implications for the Illustration of the Chip War as a Strategic Game

To model the interaction of the Chip War as a strategic game, the core elements of the interaction between the US and China must be specified. To formalize the interaction between China and the US and to abstract from complexity, the bargaining scenario analysed assumes that only the US and China receive payoffs from semiconductors and that there are no third parties with independent interests involved in the conflict.

Players in this interaction are only the US and China, and their actions range from moves that improve their own position, like investments or structural support for the domestic industry, to actions that deteriorate the position of their adversary by excluding the adversary's companies from the domestic market through sanctions or limiting access to bottleneck resources and technologies. The structural framework of the interaction between the two countries has already been defined as a sequential, dynamic game with incomplete and imperfect information. Therefore, the interaction takes place under uncertainty due to the limited observability of situations, preferences, and the action space.

The value function for both countries comprises present and future value created through the semiconductor industry. The present value is not only captured by the revenue created within the economy through the sale of semiconductors, but also comprises indirect revenue created downstream, along the supply chain. The expected future value of semiconductors is created through future developments of the industry as well as technological advances in downstream sectors like Artificial Intelligence, military technologies, Information Technologies, and their corresponding hardware (Kim & Rho, 2024). This value component also includes the subjective value of capabilities, which are enabled through the capabilities of the semiconductor industry. To illustrate this point, one may consider the implications of superior military capabilities. A leading position in the semiconductor industry could result in the development of advanced weapons and systems, which would create military advantages. The value, which is thereby created, depends on the respective situation a country finds itself in and the goals that are defined for the respective military encounter. Overall, the value of semiconductors, therefore, may be summarized as the value of semiconductor-related rents, which capture all the discussed aspects.

Bargaining in the Chip War, therefore, describes the strategic interaction through which both states seek to shape the terms of market access, access to critical inputs, industrial development, and thereby, future semiconductor-related rents in their favour. Both countries start from a basis of cooperation, which is preferred to restrictive confrontation, as confrontation and potential techno-economic decoupling, where both economies and value chain completely decouple from one another, are generally costlier than any bargaining solution.

Despite a bargaining solution being feasible and preferred to conflict, both countries might face incentives to escalate the situation into a broader conflict (Fearon, 1995). While this insight might appear counterintuitive while assuming that all actors are rational, it opens the discussion about what conditions create incentives to escalate and what frameworks lead to bargaining failure. Consequently, the analysis of the escalation of the Chip War under the game-theoretic assumption of rationality among players requires the investigation of an incentive constellation that favours bargaining failure and thus leads to escalation.

2.3. Game-theoretic Explanations for Conflicts and Escalations

The framework of rational states, which suggests that actions are generally incentive-driven, leads to the question of why wars occur in the first place. Apart from the humanistic view, where wars are unwanted because they create destruction and suffering, there is also the rationalist notion that wars are unwanted as they are resource-intensive and create uncertainty for the states participating (Powell, 2006). Instead of fighting, there usually exists an incentive for states to bargain, as the bargaining range for their interests widens the larger the potential costs and risks of fighting the conflict become (Fearon, 1995). However, there are still conditions that lead to states having incentives to fight and to prefer conflict as an alternative to bargaining.

These conditions are generally a consequence of the uncertainty states face regarding others' intentions and capabilities. Imperfect observability of other states' commitment and their actions creates an incentive for self-help and assuming the worst-case (Schelling, 1966). Thus, a perception of ongoing threat by others can only be diminished by self-action (Simon, 1955). Promises and agreements are also no alternative to self-help, as they remain unenforceable without an outside authority that can credibly threaten reprisal for failing to comply with the settlement (Powell, 2006).

This logic culminates in the security dilemma. Measures adopted to increase one's own security, like capability-building, defensive postures, or precautionary restrictions, can be interpreted by the opponent as preparation for coercion (Schelling, 1958). Under such uncertainty, each side's attempt to reduce vulnerability induces countermeasures that appear equally defensive from its own perspective, while increasing the perceived threat for the counterpart. Thereby, creating a self-reinforcing spiral of escalation (Schelling, 1966). Even where both sides would benefit from halting an escalatory spiral, reassurance is rarely costless or immediately credible, as such a motive requires verifiable evidence about intentions that exceeds mere communication (Schelling, 1958). Additionally, the risk of misinterpretation and false alarms, which can push actors toward rapid retaliation or preemption even when neither side seeks general war, further compounds this problem (Jervis, 2015). However, escalation pressure alone does not imply war if actors can still identify and credibly implement a settlement that both prefer to fighting.

While the security dilemma provides an explanation for how escalations emerge and develop over time, it fails to be a consistent explanation for the occurrence of war. As stated above, states have incentives to attain mutually beneficial bargains. A holistic explanation for the occurrence of war, therefore, not only needs to deliver an explanation of how escalation occurs, but also why bargaining for peaceful solutions fails. Fearon (1995) contributed three core mechanisms that explained the failure of bargaining. The first mechanism focuses on the role of private information about intent, relative capabilities, and resolve, as well as incentives to misrepresent such information. The second highlights commitment problems where the participating parties are unable to arrange a settlement that both would prefer to war, as at least one of them has incentives not to comply with the conditions in the long term. The third argument brings up the indivisibilities of certain bargaining objects and the problem that usually only one party is able to obtain an indivisible object. An example of that could be the appointment of a successor to the throne.

For the analysis of the chip war, both the mechanisms for bargaining failure and the mechanisms behind the development of an escalation have to be investigated. The former mechanisms relevant for the Chip War comprise asymmetric information and commitment problems simultaneously, as the US and China face uncertainty about the power and resolve of their adversaries, as well as uncertainty about the shift in industrial power. The latter mechanism must explain how escalation unfolds, and what conditions determine the outcome of a confrontation.

2.3.1. Private Information and Uncertainty

Building on the premise that rational states generally prefer negotiated settlements to costly conflict, the question arises of how private information and uncertainty can obstruct bargaining to make conflict a rationalisable outcome. In this context, war and conflict should not be viewed as outcomes outside the logic of negotiation. Although both occur when negotiations fail to reach an agreement, the ensuing conflict is often a prerequisite for a successfully negotiated agreement later on. Conflicts, therefore, can function as a mechanism that reveals information and reduces belief disagreement, so that an agreement can be reached (Smith & Stam, 2004). Consequently, conflicts of any kind must be analysed as part of the bargaining process rather than as a separate alternative (Wagner, 2000). Ramsay (2017) identified three different types of private information that can create rational incentives for conflict, namely intent, resolve, and capabilities. The uncertainty about these types of private information leads to different kinds of conflict where different mechanisms to converge beliefs are at workTo illustrate the escalating nature of the conflict between the United States and China in game-theoretic terms, it is necessary to investigate the type of uncertainty that may cause bargaining failure and thereby contribute to conflict between the two countries. Moreover, depending on the type of underlying uncertainty, different mechanisms for de-escalation apply to the conflict.

Uncertainty About Intent

Intent is best explained by an analogy of a burglar entering a house at night. In this scenario, the house owner wakes up to a noise. Well-armed with a gun, she sees herself confronted with a burglar on the staircase, who is equally equipped as her. Both understand the precarity of the situation, and neither one of them intends to use their gun at first. However, the uncertainty about the counterpart's intention generates significant risk for both. Any one of them could expect the other one to shoot first and proactively shoot as an act of preemptive self-defence. However, without the uncertainty about each other's intentions, none of them would shoot (Schelling, 1958). In such a setting, the central difficulty is that reassurance through communication alone is often insufficient. It requires verifiable evidence that the feared action is not underway, for example, by taking out the gun's magazine or putting it down entirely. Intent-uncertainty is mitigated when actors can credibly demonstrate a non-aggressive posture through reciprocal and observable steps, since any de-escalatory bargain must make compliance observable, verifiable, and provable through costly action (Powell, 2004).

Uncertainty about Resolve

Uncertainty about resolve describes a setting in which an actor is unable to credibly estimate how costly conflict will be for an opponent and how willing it is to bear these costs rather than conceding. This type of private information is also commonly formalised as the “cost of war” parameter, since each side’s private cost shapes whether a given offer will be accepted or rejected (Fey & Ramsay, 2011). In bargaining terms, this uncertainty concerns the opponent’s acceptance threshold. The acceptance threshold is the minimum concession that makes settlement preferable to continued conflict for that opponent (Ramsay, 2017). Since an opponent is unable to observe this, it may know that a bargaining range exists in principle but still be unable to locate the opponent’s acceptance threshold with precision. Consequently, settlement offers must be chosen under an inherent risk of rejection (Fey & Ramsay, 2011). Since the terms an actor receives depend on how resolved it is believed to be, it has incentives to represent itself as more willing to fight than it truly is (Banks, 1990). This incentive prevents truthful disclosure, thus, offers cannot be conditioned on reliably known resolve, and as a result, even well-structured bargaining can retain a positive probability of breakdown and costly conflict. Powell (2006) explained resolving uncertainty with an example from the beginning of World War II and Germany’s resolve to attack Poland and Britain’s resolve to defend Poland militarily. While Germany was or pretended to be of high resolve, it anticipated that Britain’s resolve was low, due to observed episodes of prior accommodation. This shifted expectations about Britain’s acceptance threshold and thereby made more demanding terms feasible. In this logic, bargaining then failed because the settlement Germany expected Britain to accept was inconsistent with Britain’s actual willingness to stand firm. When Britain’s true willingness to fight implied a higher acceptance threshold than Germany anticipated, the demands Germany deemed negotiable were instead rejected, and the bargaining range that existed in principle could not be translated into a settlement. The incentive for starting a war was therefore given, because both countries expected their adversary to be of low resolve, and neither side had been able to meet the other’s acceptance threshold. As the disagreement over Britain’s true resolve could not be resolved without incurring the costs of testing it, the only available option to reduce that uncertainty was through costly confrontation.

A reduction of resolve uncertainty, therefore, requires a costly screening process that separates low-resolve from high-resolveur that is difficult to manipulate (Ramsay, 2017). Usually, this requires a sequence of offers, rejections, and continued confrontation in which the proposer updates beliefs about the opponent's resolve after each rejection and then adjusts subsequent offers (Powell, 2004). Actors that are of high resolve or low-cost type are willing to persist longer, while low-resolve or high-cost types tend to accept worse terms and settle earlier. Continued fighting and rejected offers therefore generate information that forces belief updating and narrows the set of plausible resolve types until a settlement becomes acceptable to both sides.

Uncertainty about Capabilities

When each side is uncertain about the other's true strength, technological frontier, or ability to sustain competition, proposed bargains become difficult to agree upon. The reason for this is that disagreement about the distribution of power also suggests disagreement about the expected outcome of the conflict resolution (Fearon, 1995). A settlement, on the other hand, requires both parties not to have an incentive to choose conflict over a bargaining settlement, and this is given when the proposed division of payoff exceeds each side's expected value of conflict. (Wagner, 2000). The expected value of conflict, however, is underlying uncertainty from multiple sources. Capabilities may be publicly or secretly observed, but they rarely serve as a completely reliable proxy for the probability of winning and therefore the value one party can draw from winning the conflict. Power shifts and investments in capabilities also create uncertainty about the value of conflict, as they change the expected distribution of power and shift the prospects of succeeding over time (Bell & Johnson, 2015). If both sides manage to agree about their relative power and exceed each other's expected value of conflict with a bargaining settlement, then they can reach an agreement without fighting.

Fearon (1995) illustrates capability uncertainty with the war between Russia and Japan in 1904. During this conflict, both countries were expanding their power in Northeast Asia. While Japan expanded its sphere of influence to Korea, Russia increased its presence in Manchuria. Diverging assessments of relative military power and the Russian belief to dictate the conditions of an agreement from a position of strength prevented a settlement between the two countries, so that the conflict escalated in February 1904. Asymmetric information on the capabilities of Japanese intelligence services and the fighting ability of the relatively untested Japanese army led the Russian leadership to believe that their own military power would be sufficient to achieve success in this conflict, yet the Japanese army was able to overpower the Russians within fifteen months.

In this situation, bargaining failed because both sides were convinced that the outcome of the conflict would meet their expectations. The Russians' conviction that they would resolve the conflict quickly and successfully in their favour, led to two bargaining positions which did not overlap on any important issues and made an acceptable settlement for both parties intangible. Proxies for capabilities, like army size or experience, together with failed observation of the power shift, defined the assessment and belief for victory and thus, forced a situation where information revelation from costly interaction was necessary to converge both assessments of military capabilities (Wagner, 2000).

The semiconductor rivalry features two of the described uncertainty types (See Table 1). Uncertainty about intent does not exist, as both governments publicly declared their intention to be the leading force behind developments in the semiconductor industry (State Council of the PRC, 2014; White House, 2015). On the other hand, uncertainty about the other’s capabilities exists on both sides, as data about industrial developments is limited (OECD, 2025a). Uncertainty of resolve becomes relevant towards the final phase of the investigated interaction between the US and China when both sides aim to enforce concessions from the other.

Table 1

Overview of Uncertainty Types

Type of Uncertainty	Object of Uncertainty	Mechanism behind the Conflict Incentive	Mechanism of Belief Convergence
Intent	Intentions about Actions	Value of Worst Case with Intervention > Value of Worst Case without Intervention	Verifiable Reassurance & Observable Restraint
Resolve	Willingness to bear costs	Pretended resolve > Actual resolve	Costly screening & Belief Updating through endurance
Capability	Relative Strength & Ability to impose will	Expected Value of Conflict > Value of Bargaining Outcome	Information revelation through performance and costly interaction

2.3.2. Commitment Problems in Dynamic Strategic Interaction

Beyond bargaining failure caused by private information and incentives to misrepresent, another rationalist mechanism through which war may occur is the commitment problem. Conflict can arise not because states are unable to identify a mutually preferable settlement, but because they are unable to credibly commit to uphold such a settlement once shifts in bargaining power or incentives alter the terms of future interaction. While bargaining failure due to private information does not lead to continuous violation and renegotiation of a settlement (Wolford, Reiter, & Carrubba, 2011), bargaining under commitment problems remains vulnerable to later revision and renegotiation (Powell, 2006). Commitment problems, therefore, do not describe an unlimited residual category, but a limited set of mechanisms through which otherwise feasible bargains become unenforceable over time (Powell, 2006).

The most prominent mechanisms of such kind include preventive war to counteract anticipated future shifts in power before they materialize (Fearon, 1995; Powell, 2006), pre-emptive action to enjoy a first-mover advantage (Fearon, 1995), bargaining over issues which change relative bargaining power between the adversaries (Fearon, 1995; Powell, 2006), as well as lacking ability to commit to accepted settlements (Fey, Meirowitz, & Ramsay, 2013). Among these different commitment-related mechanisms, the two most relevant for the present analysis are the preventive-war logic and bargaining over issues changing the relative bargaining power. In the chip war, the commitment problem arises from anticipated shifts in the distribution of industrial power. In this context, industrial power comprises the performance and self-reliance of the respective semiconductor industry. As an industry becomes more powerful, the stronger and more independent it becomes from outer influence and dependencies.

Preventive war occurs despite existing settlements that both sides prefer to costly escalation, before and after the shift of power (Powell, 2006). The underlying problem is the inability of the rising state to credibly commit to the current settlement, as its improved future position might incentivise demanding more than it is currently entitled to. New demands would open negotiation again and could lead to situations where war is considered a rationally viable option or settlements deteriorate notably for the other state (Bell & Johnson, 2015). To prevent this development, a relatively declining state has the option or even an incentive to confront its adversary in the present rather than in the future when its relative position and thereby its expected payoffs have deteriorated (Wolford, Reiter, & Carrubba, 2011). However, the basis for considering such a preventive strike does not stem from an observed shift in relative power, but always evolves from the expectation of a future shift in power which has not yet materialised (Bell & Johnson, 2015). Preventive war can therefore be described as an opportunistic consideration of state leaders, because it is only attractive as long as the shift in the distribution of power is not decisively completed (Krainin, 2017).

Furthermore, the logic of preventive action is not constrained to abrupt large shifts in power. Slow but persistent changes in power can also undermine commitment and cause war (Krainin, 2017). In case such a shift stems from endogenous action like an investment in capabilities, however, the logic becomes more complex. A fully transparent capability accumulation does not lead to preventive war, as any development will be deterred by an adversary observing the capability build-up. Preventive incentives, therefore, primarily emerge under uncertainty about the extent of an occurring relative shift (Debs & Monteiro, Known Unknowns: Power Shifts, Uncertainty, and War, 2014).

A historical illustration of this commitment problem logic is provided by the Iraqi invasion of Kuwait in 1990. By taking control of Kuwaiti oil reserves and strengthening its relative position to Saudi Arabia, Iraq threatened to acquire immediate resource wealth, which would later translate into greater military and political influence. Krainin (2017) argues that the underlying concern which led to US intervention and the beginning of the Gulf War in 1990 was neither that Iraq had already produced an immediate hegemonic transition, nor that a sudden large shift in power had already occurred. The concern revolved around the prospect that Iraqi control over additional oil wealth would eventually translate into greater economic, military, and political power. Thus, it erodes the future US bargaining position when negotiating with the Iraqis on matters regarding oil and regional influence. To prevent such a situation, the US had to intervene in the region and preemptively attack the Iraqi positions.

This case illustrates how commitment problems and preventive action arise from the expectation of a long-term deterioration in bargaining leverage rather than from the anticipation of direct future attack. The relevance of commitment problems for the semiconductor rivalry between the USA and China lies in a similar logic. The central issue is not the prospect of immediate techno-economic decoupling, where both industries decouple completely from each other's markets, intermediate products, raw materials, and technology. Instead, the expectation of continued shifts in technological and industrial capabilities increases the difficulty of sustaining existing patterns of interdependence between both countries and their semiconductor industries. Measures of capability accumulation for greater strategic autonomy, coercive leverage, or resilience against external pressure may be interpreted by the adversary as altering the future distribution of relative power. Therefore, the commitment problem provides a valuable lens for understanding why Chinese investment in its semiconductor industry may generate incentives for preventive action, such as restrictions and countermeasures, even in the absence of direct military escalation or full decoupling.

2.3.3. Brinkmanship and Risk Manipulation

Asymmetric information and commitment problems both provide explanations for how wars arise. Bargaining failure, as well as the inability to credibly commit to a bargained settlement, create incentives that make war a viable option for a rational actor. However, they do not provide insight into how a confrontation unfolds once it has been triggered, and neither side is willing to back down. At this point, the strategic problem shifts from explaining the occurrence of war to analysing escalation as a bargaining process under rising shared risk (Powell, 1988). Before any confrontation escalates into full-scale war, each adversary seeks to coerce the other into making concessions or taking actions that shift the bargaining outcome in the coercer's favour. The success of such a coercive confrontation depends less on direct force, but on the use of power to hurt the interests of the adversary in order to influence its decision-making (Schelling, 1966).

Brinkmanship describes such a coercive strategy in which a state seeks to influence its adversary not by deliberately threatening catastrophe, but by deliberately creating a recognisable risk of escalation and thus coercing it into action. The logic of this strategy lies in exposing both sides to a shared danger whose continuation becomes increasingly costly. By leaving room for further threats and escalation, the initiator aims to make quitting the escalation attractive, while expected costs to maintain the confrontation are being increased to induce retreat from the adversary (Powell, 1987). However, whether the catastrophe occurs or not is beyond the initiator's control (Nalebuff, 1986), the potential consequence of the occurrence of the catastrophe must be considered by the initiator (Powell, 2015).

Brinkmanship, therefore, remains a bargaining process where risk is deliberately manipulated to increase coercion, rather than a continuous development of increased escalation risk alone (Powell, 1987). While increasing the coercive power towards one's adversary, an actor also must consider the potential risk of a catastrophic outcome. This trade-off makes brinkmanship not only a contest of resolve, where the resolve to withstand imposed pressure determines the outcome, but a strategic consideration between the effectiveness of coercion and the consequences of systemic escalation (Powell, 2015). The course of confrontation is therefore shaped by expectations about the adversary's resolve and by the extent to which additional coercive measures intensify the risk that events spiral out of control. Manipulating both to an extent that the other is unwilling to bear denotes the ending condition to an escalation if the initiator is unwilling to bear the risk (Powell, 2015), or the beginning of a catastrophe.

Powell (2015) explains this logic aligned with the Cuban Missile Crisis. The confrontation between the USA and the Soviet Union was not primarily shaped by which country could exert more military pressure on the other, but by the extent of escalatory risk in the form of nuclear escalation with which the United States was ready to react to the stationed rockets in Cuba. In this case, the Soviet Union was unwilling to bear the risk of a nuclear war with the US and retreated.

This logic also becomes relevant for the semiconductor rivalry between the USA and China. Once confrontation is defined by how far each side is willing to intensify coercive pressure under rising systemic risk, framing the interaction between both countries as a brinkmanship game provides the theoretical lens through which the final phase of the chip war can be analysed. In such a setting, stronger restrictive or retaliatory measures may increase bargaining leverage, but simultaneously raise the danger of broader and less controllable techno-economic decoupling. Applying this logic, therefore, provides insights into what incentives and considerations both countries acted and defended their individual interests.

2.3.4. Classification of Bargaining Dynamics During the Chip War

For the broader analysis of the chip war, two types of asymmetric information, together with commitment problems, are indispensable to illustrate the bargaining failure between the US and China. Throughout the chip war, both countries have proactively expanded their technological and economic capabilities through financial investments and structural support for their semiconductor industries (Congress of the US, 2022). Due to those efforts, both industries' industrial power arguably increased in absolute terms through technological and economic development of the industries. However, the relative development of industrial power is not directly observable and can only be approximated through a set of proxies for economic and innovative development and through comparison between the two countries.

Such proxies include sales volumes of the industries, dependencies on foreign inputs, or innovation indicators like patents, forward citations, and R&D intensity. Since these proxies are imperfect and subject to time lags in the availability of data, both countries face a degree of uncertainty about capabilities, which makes observation of the extent of the relative power shift more difficult. This uncertainty, combined with the American observation of increased efforts and accelerated developments in the Chinese semiconductor industry (Congress of the US, 2022; White House, 2015), creates a framework in which commitment problems may arise and misrepresentation of information may be incentivised. Consequently, the direct contest between both countries for superiority in the semiconductor industry together with the US interest in defending its leading position, creates a situation in which the US potentially has an incentive to impose preventive restrictions on the Chinese semiconductor industry, in order to preserve its advantageous position.

As the course of the Chip War will show, the interaction between the US and China leads to an escalation in which each side is willing to intensify coercive pressure despite the rising risk of wider economic and technological fallout. In its final stage, the Chip War can therefore be framed as a brinkmanship game in which the outcome is determined by the resolve of both countries. Accordingly, resolve uncertainty also becomes relevant for the analysis of the chip war.

A game-theoretic analysis of causes for bargaining failure usually focuses only on one of the discussed mechanisms (Wolford, Reiter, & Carrubba, 2011). Through isolation of other aspects, strategic games become more representable and allow better insights into how the discussed mechanism leads to bargaining failure. While Fearon (1995) argues that separation can serve as an analytical starting point, he highlights that mechanisms are not empirically independent from each other. Analysing asymmetric information and commitment problems together, therefore, captures not only the respective mechanisms, but also elaborates how they interact and potentially intensify certain incentives for escalation. (Debs & Monteiro, Known Unknowns: Power Shifts, Uncertainty, and War, 2014). For the analysis of the chip war, the simultaneous analysis of asymmetric information and commitment problems allows us to explain how US restrictions can be understood as preventive actions under uncertainty, and how the continuous revelation of information affects the incentive for preventive restriction and escalation.

The final requirement for modelling the interaction of the US and China as a strategic game is to analyse the interaction between both countries and the information underlying the decision-making during the interaction. Thus, the sequence of moves, the relevant uncertainties, and the informational conditions under which both sides act can be represented formally and, in a manner, most suitable for the representation of the Chip War.

3. The Empirical & Strategic Context of the US-China Semiconductor Rivalry

This section provides the empirical and strategic context necessary to analyse the semiconductor rivalry as a strategic game. For this purpose, it identifies and analyses the direction of the relative development of industrial power, strategic vulnerabilities of both countries, and the political interaction that shaped the escalatory development of both countries' relationship.

The development of industrial power comprises the development of industrial performance and the self-reliance of an industry. Therefore, the shift in this dimension is investigated through analysis of data reflecting economic and innovative capability development through proxies and analysis of strategic vulnerabilities and dependencies of the respective value chains. Latter are being discussed through the analysis of data on dependencies and the coercive pressure enabled through them.

Strategic vulnerabilities are analysed through industry reports, which cover weaknesses in both countries value chains, and through the analysis of economic data.

Finally, the main political actions through which the rivalry escalated into the Chip War are being reconstructed to obtain an insight into how specific events and decisions enabled escalatory developments.

3.1. Relative Development of Industrial Power

This section is divided into three parts: the analysis of economic and innovative development data, the analysis of vulnerabilities and dependencies along the value chain, and a discussion about the implications for the relative power shift. Both sub-chapter divisions discussing data are introduced with a methodology section about the data collection.

3.1.1. Economic and Innovative Development of the Chip Industries

Methodology of Data Collection for Economic Data

The data collected for the analysis of economic development relies on the annual revenue of publicly listed semiconductor companies, which are listed on the stock exchanges of both countries. Semiconductor companies have been identified with the screener tool from Moomoo (2024), which allowed filtering for publicly listed companies in the "semiconductor" and the "semiconductor equipment & materials" industry from the US and China. The lists of companies, therefore, comprise all companies that are publicly listed on one of the country's stock exchanges. The US list, therefore, also includes companies headquartered in France, Israel, Japan, the Netherlands, South Korea, Singapore, and Taiwan. As fiscal years of US companies can start and end mid-year, companies that presented their annual financial statements between January and the end of June were allocated to the prior year for the analysis, since a financial statement published in, for example, February 2024 covers ten months of revenue from 2023. Another criterion to filter for companies is the lower revenue constraint of revenue within a fiscal year. Companies had to achieve at least once revenue worth one billion Chinese Yuan to be considered mature enough to be accepted to the industry list. Moreover, at least 25% of the revenue has to be verifiably attributable to sales of semiconductors. The latter constraint filtered a considerable number of companies from the Moomoo industry lists, as photovoltaic companies are also commonly listed. The reason for this is similar processes in the primary stages of manufacturing, which allow photovoltaic companies to produce parts that can also be considered for semiconductor production.

Consequently, the presented data does not comprise revenue data of privately held companies like YMTC or Huawei in China, which have a significant impact on the development of their respective semiconductor industries (OECD, 2019). Companies that produce semiconductors only for their own products, like Apple are also not included, as semiconductors do not directly contribute to the company's revenue (Apple, 2025).

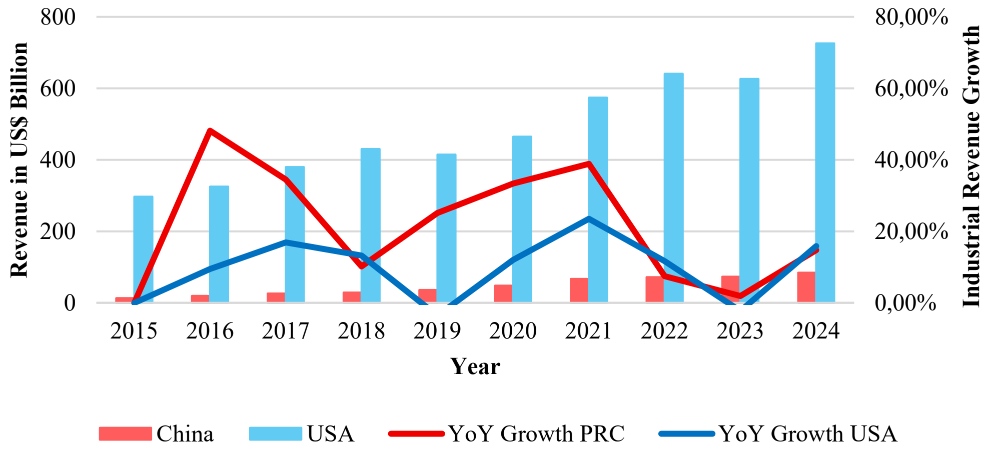
While the acceptance constraint for companies has been defined in Chinese Yuan, the data is presented in US dollars throughout the entire empirical analysis. In order to apply a common standard for exchange rates between the US Dollar, the Chinese Yuan, and other currencies in which revenues were reported, the value of revenues has been standardized with annual exchange rates from XE (2025) according to the exchange rates available on the 31st of December of the respective year at 17:00 UTC.

Economic Development of the Semiconductor Industries during the Chip War

China grew considerably faster from a lower initial base, but the US nevertheless remained larger throughout the entire period and retained its absolute lead in all four value-chain segments. Both industries were almost continuously growing within the time period of the Chip War, except for the US industry, which was shrinking in 2019 and 2023 by respectively -3,57% and -2,24%. At the aggregate level, the data therefore does not indicate a reversal of the two industries' positions, but a narrowing of the economic gap. Figure 2 illustrates this development by relative comparison of the two industries as well as their value chain segments. While in 2015 the US industry was 22,5 times larger than the Chinese, this multiple reduced to 8,6 over the following nine years. This pattern is also visible across the individual value-chain segments (See Figure 3). The chip design segment comprises firms whose main business activity lies in the design of semiconductors or in electronic design automation (EDA) software.

Figure 1

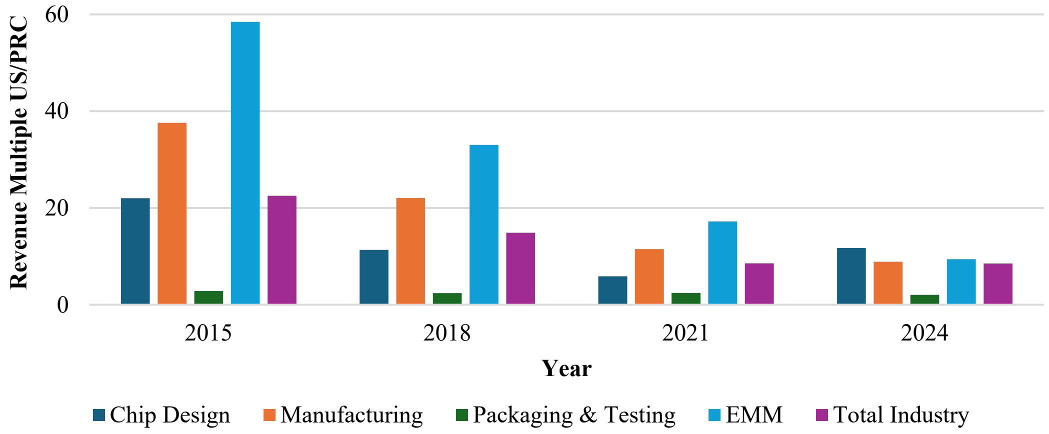
Revenue Development of the Semiconductor Industries



Data derived from Moomoo (2024), anlysed and summarised by the author

Figure 2

Relative Revenue Comparison by Industry Segment

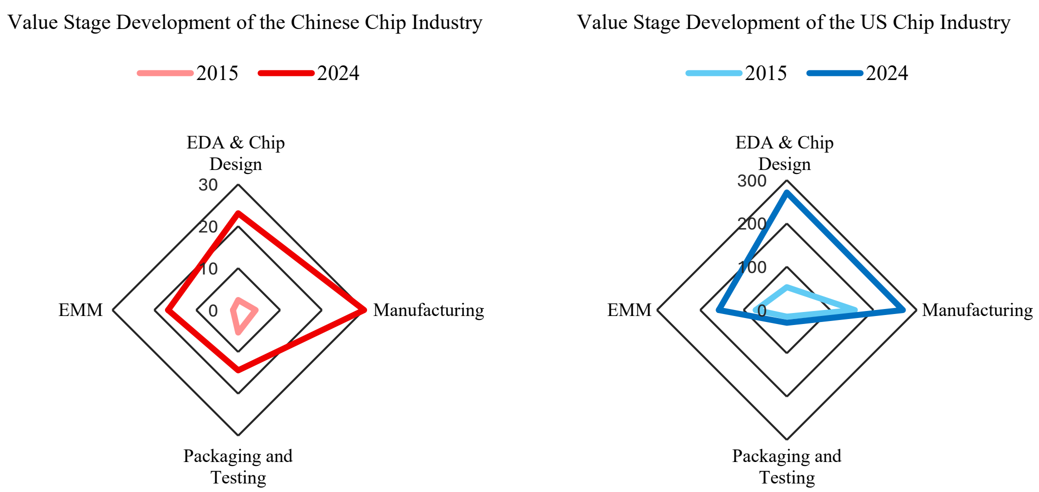


Data derived from Moomoo (2024), categorised, analysed and summarised by the author

The manufacturing segment addresses firms engaged in semiconductor fabrication, including foundries and integrated device manufacturers. Firms whose main business activity consists of the assembly, packaging, and testing of semiconductor devices after production are classified as packaging and testing (P&T) companies. Companies providing equipment, machinery, and materials as production inputs are included in the equipment, machinery, and materials segment (EMM).

Figure 3

Value Stage Development by Industry Segment



Data derived from Moomoo (2024), categorised, analysed and summarised by the author

Both industries recorded particularly strong revenue growth in the chip design segment of 865% for the Chinese and 415% for the US industry, leading to an average annual growth rate of 28,64% and 19,96% respectively. At the same time, China also expanded strongly in the equipment, machinery, and materials segment with an average annual growth rate of 33,63%, indicating China's efforts to develop its formerly weakest segment along the value chain.

In the segment with the smallest absolute and relative gap between the countries, the packaging and testing segment, the development of both countries occurred relatively in parallel. Nevertheless, China is also catching up in this domain, as the US segment remains only roughly twice as large in 2024, while being almost three times as large in 2015. The manufacturing segment remains among the biggest segments for both industries in absolute numbers in 2024, but while the US industry only grew by 71%, the Chinese industry grew by 620% in this segment in the investigated timeframe (See Table 2) The economic evidence, therefore, suggests that Chinese industrial expansion during the chip war was broad-based across the value chain, yet uneven in magnitude and still insufficient to displace the US from its leading economic position in any of the four segments. Nevertheless, the economic data suggest the success of some of the self-defined goals from policies from the beginning of the chip war (State Council of the PRC, 2014; 2015a), as they were able to substantially grow their domestic semiconductor industry and strengthen self-sufficiency.

Methodology of Data Collection for Innovative Data

The innovative capabilities of both semiconductor industries are analysed through data from three different sources, with a focus on different aspects of the industries' innovativeness. The first source for innovation data is the World Intellectual Property Organisation (WIPO), which provides internationally comparable patent statistics and Patent Cooperation Treaty (PCT) filing data that can be used to trace the volume and cross-border orientation of inventive activity. The data from the WIPO (2024) is retrieved from the WIPO Intellectual Property Statistics Data Center. The used patent data was accessed through the selection of the options "4a – Patent publication by technology" as the indicator, report type "Total count by filling office", and the timeframe 2015-2024. The Intellectual Property Offices selected then represent the countries in which the patents have been filed. For China as a country, the offices from China, Hong Kong, and Macau have been selected. The last filter concerns the patents' field of technology for which "8 – Semiconductors" is selected.

The next set of patent data, which is being analysed, has been retrieved from Lens (2025). This patent database features not only the number of patent applications sorted by national Intellectual Property office, but also provides structured information on citation counts and patent family size, thereby allowing not only the volume of inventive activity but also aspects of the technological impact and international breadth of patent protection to be assessed. The data has been collected by leveraging the Structured Search tool of the website. Semiconductor-related patents were extracted through the CPC code H01L. Cooperative Patent Classification (CPC) codes are a standardized, hierarchical system used by patent offices worldwide to classify patent documents according to their specific technical subject matter (Lens, 2025). Other filters applied include the document type "Patent Application" while excluding "Limited Patents", the Filing Date of the application ranging from the 1st of January to the 31st of December for each year, and the Jurisdiction, of "United States" or "China", "Hong Kong", and "Macau" for China. Moreover, the results are grouped by "Simple Families", which leads to only one search result per patent family or innovation. "Limited Patents" are excluded as they comprise types of patents that are subject to limitations or restrictions on the scope of protection, and can therefore not fulfill the same standard as other patents covered in the database (Lens, 2025).

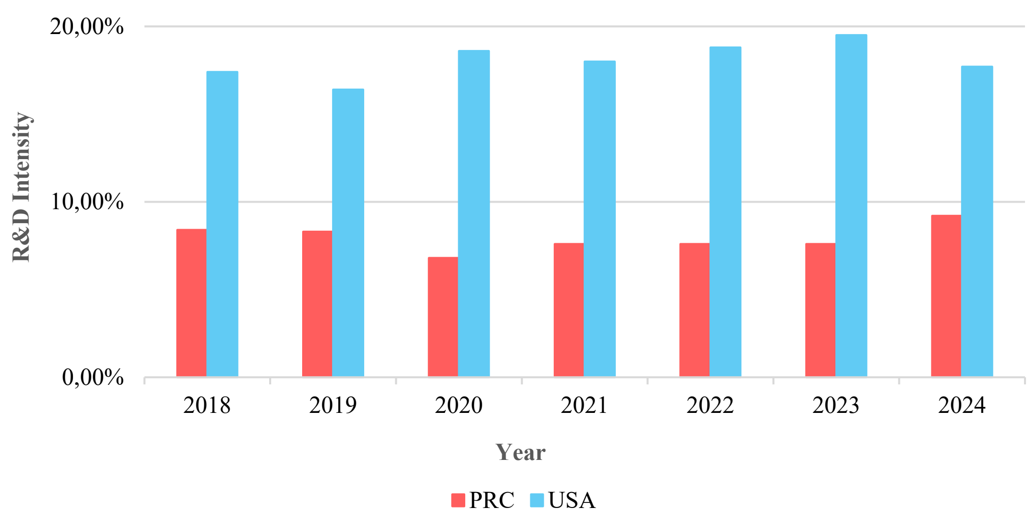
The final dataset used to assess the innovative efforts of both industries covers the R&D intensity of the semiconductor sectors in the United States and China. These data were retrieved from the annual Factbook published by the Semiconductor Industry Association between 2019 and 2025, with each edition reporting the R&D intensity of the preceding year for semiconductor companies grouped by country (SIA, 2019, 2020, 2021, 2022, 2023, 2024, 2025). The firms included in this statistic are semiconductor companies that ranked among the world's two thousand companies with the highest R&D intensity in the respective year. As such, the dataset provides an additional indicator of the extent to which both industries commit financial resources to innovative activity.

Innovative Development of the Semiconductor Industries During the Chip War

The innovation data show a similarly broad pattern of Chinese catch-up for the innovative capabilities in the semiconductor industry. For the evaluation of innovative capabilities, three dimensions have been investigated, namely the innovation effort, innovative activity, and the innovation quality. The indicator for innovation effort is the R&D intensity of leading semiconductor firms in both (SIA, 2022). Figure 4 shows that both countries leading semiconductor companies invested a significant share of their annual revenue into Research and Development (R&D), however, while US companies invested between 16.4% and 19.5% into R&D, Chinese leading semiconductor companies only invested between 6.8% and 9.2% on average. These numbers indicate sustaining financial commitment to technological development in both industries and highlight the US efforts to remain a leading innovator in the semiconductor industry. In terms of innovative activity, patent publications by filing office and Patent Cooperation Treaty (PCT) filings indicate that China expanded far more dynamically between 2015 and 2024 and narrowed the gap substantially, even though patent counts are better interpreted as a measure of inventive activity rather than as a direct measure of technological quality. Semiconductor patent data of the WIPO (2025) suggests that China overtook the US in innovative activity in 2018 and has remained in the leading position ever since.

Figure 4

R&D Intensity of Leading National Semiconductor Companies

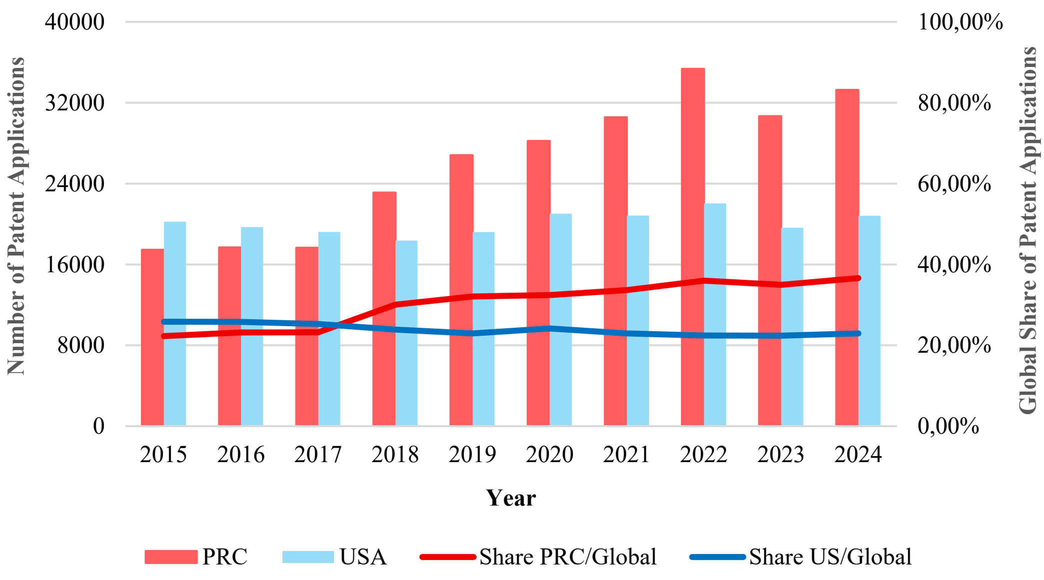


R&D Intensity from 2018-2024, data provided by SIA

Figure 5 showcases this development and the rising Chinese share of global innovation activity in the semiconductor technology segment. The global share of patent applications initiated in the intellectual property office of the US remained consistently between above 22% and 26%, however, with a declining trend, which is mostly caused by the growing number of patent applications from China. This development is also observable in Patent Cooperation Treaties (PCT). PCT filings are international patent applications filed under the Patent Cooperation Treaty, which allows applicants to seek patent protection in multiple countries through a single filing procedure (WIPO, 2026). Figure 5 shows that the relative share of all global PCT filings shifted towards China while the US share decreased over the nine investigated years. The only metrics of innovation activity where the US could extend its lead over China is the simple patent family size, which refers to the number of patent documents that belong to the same invention family based on a common priority document. This metric indicates the number of jurisdictions across which patent protections have been applied for and therefore shows in how many countries a patent has been filed for application. Conclusively, primary patents that have been filed for application in the US seek patent protection across a wider range of jurisdictions and countries. (See figure 5)

Figure 5

Semiconductor Patent Application Data



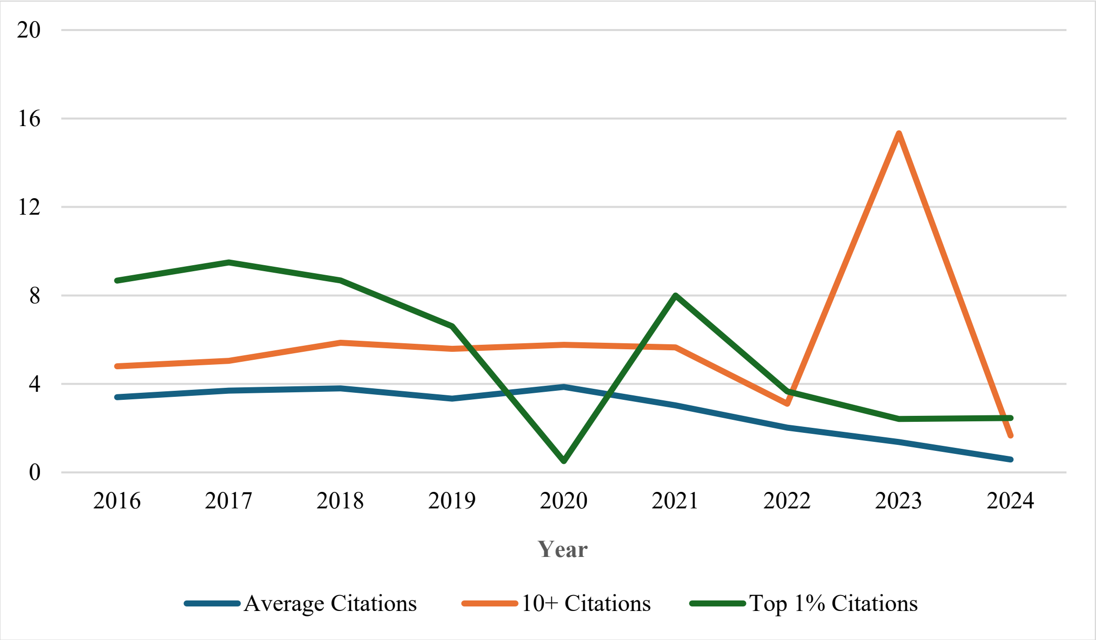
Data derived from WIPO (2025) and contextualised by the author

While the Chinese semiconductor industry overtook the US in innovative activity, a more differentiated picture emerges once innovative impact is investigated. Average forward citations, the number of highly cited patents, and the average of the top 1% most cited semiconductor patents show that the United States retained a clear lead in innovation impact throughout the period (See Figure 4, Figure 5, Table 3, and Table 4). The relative comparison of innovation impact metrics in Figure 6 also highlights the US dominance, especially in high-impact metrics representing high-impact patents. In metrics like the average citations of the top 1% most cited patents or the number of patents cited ten or more times (10+), the US was able to outperform China relatively consistently, with few exceptions. While the patent impact figures of recent years suggest a decreasing relative advantage for the US, it must be considered that newer patent data remains less informative, since newer patents have had less time to accumulate forward citations.

Overall, innovation data points to strong innovation efforts by both semiconductor industries; however, the US has the edge over China on financial commitment in R&D. As far as inventive activity is concerned, the Chinese semiconductor industry caught up and overtook the US in the number of semiconductor-related patent applications. But the US remains protecting its patents across a wider range of jurisdictions as the average family size of US patents remains higher than of the Chinese(See Table 3). US patents also outperform Chinese ones in terms of inventive impact, but the quality gap is slowly narrowing. It can therefore be concluded that, similarly to the results of the economic analysis, the Chinese semiconductor industry is steadily narrowing the US lead.

Figure 6

Relative Citation Impact



Data derived from Lens (2025), analysed and contextualised by the author

Discussion over the Development of Relative Industrial Capabilities

The economic and innovation data suggest strong growth in industrial capabilities over the course of the Chip War for both industries. Across both dimensions, China was able to narrow the capability gap, but without achieving a reversal of relative industrial positions in any meaningful domain. In absolute terms, China's semiconductor-related revenue still faces significant gaps compared to the US across all segments of the value chain. However, it was able to even out weaknesses, like its equipment, machinery, and materials segments. Overall, China grew faster than the US but started from a significantly smaller base. Therefore, the data suggests sustained Chinese catch-up with the United States, and this insight also arises when investigating innovative capabilities. China overtook the US in inventive activity and narrowed the gap in innovative impact on the US. This does not imply that China is close to changing its relative industrial position to the US, but that the direction of relative industrial development runs in China's favour.

3.1.2. Strategic Chokepoints and Leverage Within the Strategic Rivalry

Methodology of Data Collection for the Chokepoint Analysis

For the analysis of strategic chokepoints along the value chain of both industries, vulnerabilities were identified through an assessment of each country's relative position within the semiconductor value chain. Following the work of the OECD (2025a, 2025b), a chokepoint is treated as strategically relevant where high concentration and low substitutability of inputs or capabilities allow disruptions to impose disproportionate costs on downstream production. The same OECD analysis identifies highly specialised foreign equipment and advanced manufacturing capabilities as a major chokepoint for the Chinese semiconductor industry, while material dependencies and concentration risks within the value chain constitute a potential vulnerability for the US semiconductor industry. Chinese vulnerabilities are therefore examined through selected qualitative sources on technological bottlenecks in semiconductor manufacturing equipment and advanced production capabilities, whereas US vulnerabilities are assessed through the OECD's value-chain analysis (2025a). Latter analysis is complemented with an analysis on the degree of the US' dependency on upstream materials, namely Gallium, Germanium, and other Rare Earths. The data is derived from the US Geological Survey, which monitored the mined amounts of those metals and the relative dependency on imports of these raw materials. The data was accessed on its website (US Geological Survey, 2026) by selecting the year (period) of the annual reports and accessing the data for the three materials, respectively. As every report covered the information of the previous year and reports were only available from 2020, the analysed timeframe covers the period of 2019 up to 2024 for the analysis of the US dependency on upstream materials. Data for production amounts has been derived from reports two years in the future, as reports still estimated production amounts of prior years. The relative share of dependency on China covers the average relative dependency over the preceding three years.

Chokepoints of the Chinese Value Chain

Despite a significant growth rate of 1259 % between 2015 and 2024 in its EMM value chain segment, the Chinese semiconductor industry remains structurally dependent on foreign semiconductor manufacturing equipment. Chinese firms hold less than 2% market share across almost all manufacturing equipment sub-sectors and have localized less than 8% of their roughly US$ 14 billion annual domestic demand for such equipment in 2020 (CSET, 2021). Lithography technology, which is used to create circuit patterns onto semiconductor wafers, determines how large the smallest units of electric circuits are on a chip. It directly influences how many electric circuits fit on a chip and, therefore, how high the performance can become. In 2019, China's lithography segment generated only US$ 33 million in revenue and accounted for just 0.2% of the global market, while companies from the leading countries, the USA, the Netherlands, and Japan, accounted for 80-95% of the market share for different types of this technology (CSET, 2021). This technological bottleneck creates a strategic dependency for China, as the control over highly advanced lithography remains concentrated across those countries with tight ties to the US (Kleinhans & Lee, 2024). Moreover, China is not able to close the technological gap between its own photolithography tools and state-of-the-art tools. An analysis of CSET (2021) highlighted that China is approximately ten years behind in the development of such tools. Although it is able to consistently narrow this time gap, it remains far behind the high-end development of this technology. Kleinhans and Lee (2024) argue that domestic substitution of high-end manufacturing equipment requires more than strengthening Chinese producers alone through financial investments. The ability to close the gap rather depends on the development of a wider ecosystem of highly specialized components, subsystems, and auxiliary materials (CSET, 2021). However, in these sectors, foreign suppliers, especially from Europe, continue to dominate

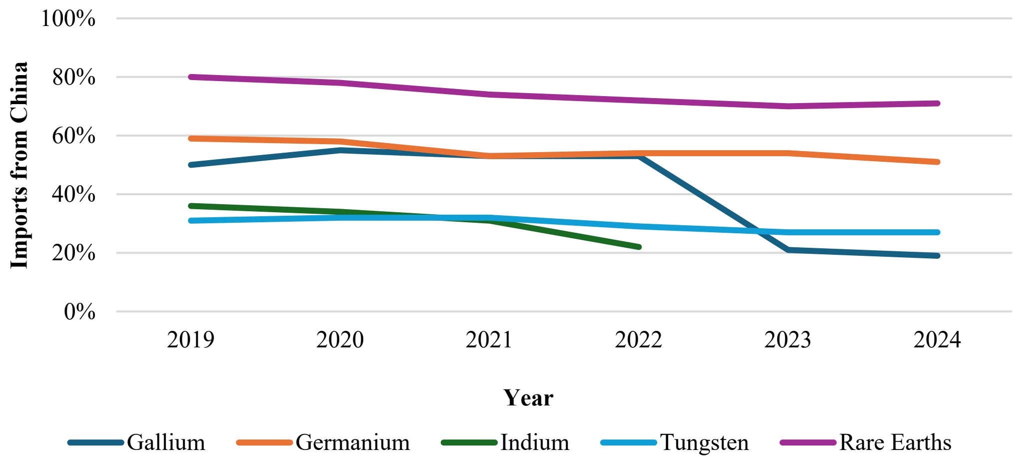
(Kleinhans & Lee, 2024). As a result, China is neither able to produce the most advanced process nodes with a node size of 5nm or smaller, nor able to substitute the underlying technology (OECD, 2025a).

Chokepoints of the US Value Chain

In contrast to China's dependence on advanced manufacturing equipment, the comparison of the United States' and China's economic and innovative data shows that the US does not suffer from a comparable structural vulnerability across any of the four value-chain stages. Instead, the US semiconductor industry's relevant vulnerability lies further upstream in its dependence on externally sourced critical raw materials (CSIS, 2024; OECD, 2025a). In a response to a US Trade Representative, the Semiconductor Industry Association (2026) listed Gallium, Germanium, Indium, Tungsten, and a group of rare earth elements, including elements like Cerium, Dysprosium, Terbium, Neodymium, among others, as essential elements for semiconductor production. The US Geological Survey (2025) publishes annual reports covering production and import information about said minerals and metals. Notably, the US has only very limited domestic sourcing for these metals, while China is the largest producer for all of them. Therefore, access to these upstream inputs depends heavily on imports. Figure 7 shows the strong position China has built in global sourcing for those key raw materials.

Figure 7

US Critical Raw Materials Import Dependency on China



Data derived from US Geological Survey (2026), analysed and contextualised by the author

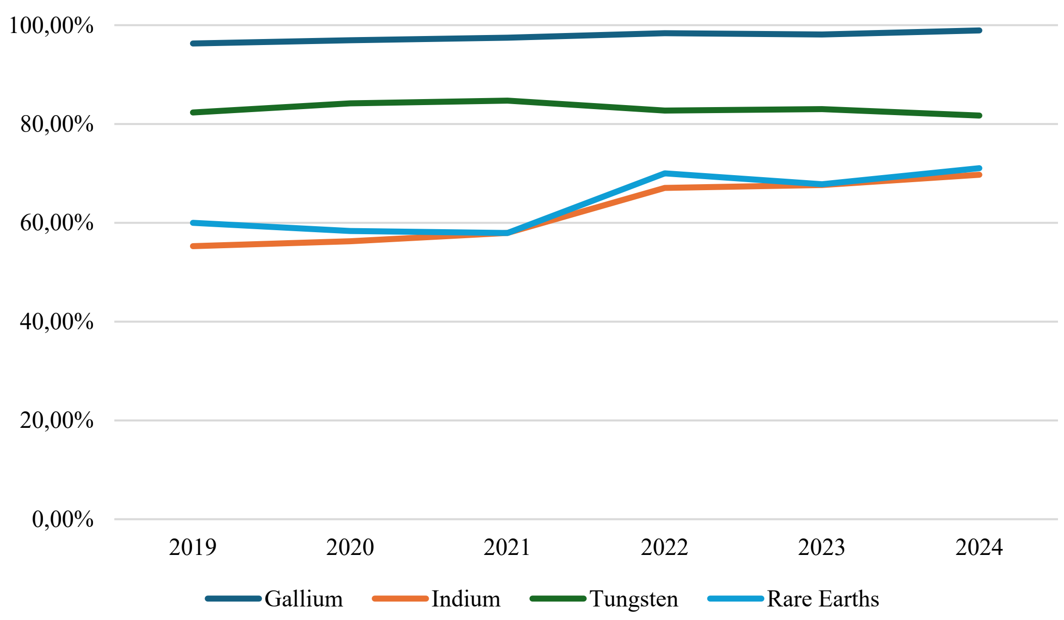
With shares of relative global production being around 60% at least for rare earths and Indium, over 80% for Tungsten, and over 95% for the sourcing of Gallium, the US cannot fully avoid reliance on Chinese supply and its access to valuable inputs for the semiconductor industry.

For accessing Germanium, the US also has to rely on imports from China. The relative share of global production is unknown as most countries do not publicly report germanium production; however, the reports from the US Geological Survey on Germanium stress that China remains the country with the largest production and export quantity for Germanium (US Geological Survey, 2024).

Figure 7 highlights the high degree of the US dependency on metals from China. The US was able to reduce its dependency across all metals and specifically Gallium from above 50% to below 20%. However, within the timeframe of 2019 and 2024, the US was only able to reduce the dependence on germanium and rare earths by approximately 10% within five years. The dependence on Indium has been reduced to such an extent that the share was too small to be mentioned in the reports (US Geological Survey, 2026)

Figure 8

Global Share of Rare Metal Sourcing PRC



Data derived from US Geological Survey (2026), analysed and contextualised by the author

Overall, the US semiconductor industry remains exposed to China in parts of the upstream materials base. Germanium and rare earths represent the most persistent dependencies, while gallium and indium show that partial diversification is possible. At the same time, the data suggests that substitution remains difficult, as China continues to dominate global production in several semiconductor-related metals.

Relative Vulnerability Through Chokepoints

The comparison of both countries' biggest vulnerabilities shows that they differ not only in location on the value chain but also in strategic character. China's dependence on foreign semiconductor manufacturing equipment, especially lithography, primarily constrains its ability to move into the most advanced segments of semiconductor production, therefore affecting its high-end production capabilities. On the other hand, the US vulnerability comes from a dependence on critical raw materials, which are mostly sourced by China. If access to those critical inputs were to be denied, a broad range of production would be affected along the entire value chain. In relative terms, China's chokepoint is therefore more limited on the high-end segment of the value chain, whereas the US chokepoint has the potential to disrupt larger parts of semiconductor production. Following the OECD framework (2025a, 2025b), both dependencies qualify as strategically relevant chokepoints, as they combine a high concentration of foreign control over critical inputs with low substitutability. Thus, allowing disruptions to impose disproportionate costs on downstream production. However, since the US vulnerability affects a broader upstream input base, it constitutes the strategically more severe chokepoint in the bilateral rivalry.

3.1.3. Discussion Over the Relative Shift in Industrial Power

The data on economic and innovative development show that the semiconductor industries of both countries expanded significantly over the course of the chip war. At the same time, the countries committed to efforts to reduce the dependencies between one another and thus increased self-sufficiency. Consequently, both countries' industrial power increased in absolute terms over the investigated time period, as both the performance and the self-sufficiency of their domestic industry could be increased. To investigate the relative shift in power, the developments have to be compared to one another and qualitatively assessed.

The results of the previous sections suggest a clear tendency. Economically, the Chinese semiconductor industry expanded at a far higher rate across all value-chain segments, even though the United States remained ahead in absolute revenue and preserved its leading position in every stage of the value chain. A similar pattern emerges for the innovative development. While China overtook the US in patenting activity and reduced the relative gap in several patent quality-related indicators, the US commits financially more to R&D and retained its advantage in high-impact dimensions. The development of self-sufficiency reinforces this broader pattern. Both countries were able to reduce dependencies on critical inputs that they can access only through one another and thereby strengthened the autonomy of their supply chains.

Overall, China is not close to challenging the leading industrial position of the US, but the simultaneous increase in industrial performance and in domestic self-sufficiency suggests a relative improvement of China's industrial position relative to the US. Consequently, this development can be understood as a gradual narrowing of the gap of industrial power in favour of the Chinese semiconductor industry.

3.2. Political Initiatives Driving the US-China Semiconductor Rivalry

Analysing the escalation between China and the US requires abstracting the reality of both countries' interactions. In doing so, one observes three distinct phases over the course of the last ten years. The first phase is characterised by capacity building and substantial investment efforts on the part of China, marking the beginning of the shift in the balance of power between the two countries regarding their semiconductor capacity. The US, aware of these developments, intends to defend its technological leadership by responding with a series of measures to weaken the Chinese development progress thereby initiating this escalation. The second phase comprises significant political and financial investments into their own industrial development on both sides, as well as a growing escalation through mutual actions of restriction, market exclusion, and efforts to hinder technology transfers. The restrictive escalation, at this point in time, is still limited to individual companies and their efforts to obtain advantageous market positions. These changes occur in the third phase, when the adversaries begin targeting strategic and structural weaknesses of their opponents' efforts, to cause high opportunity costs that affect the entire industry. At the peak of the escalation, both countries agreed to a temporary ceasefire, which stopped the escalatory development; however, it still allowed restrictive measures against individual entities, as seen in phase two.

These phases are not merely chronological stages but reflect qualitatively different modes of strategic interaction between the US and China. As escalation progresses, policy measures are imposing to an increasing degree irreversible costs on the adversary's future payoff from semiconductor-related rents, and thus, reveal information about each state's willingness to incur and endure economic and political costs to serve their own national interest. By tracing these shifts and both states' resolve, the empirical foundation of the escalation between the US and China can be established for future analysis.

The analysis of these phases is conducted by focusing on policies and initiatives that are directly addressed to the semiconductor industries. Other types of broad policies like general tariffs, were therefore excluded from the analysis, as they are not directly aimed at bolstering or, in this case, impeding the other country's semiconductor industry.

3.2.1. Phase 1: Capability and Restriction Build-up

The first phase of the Chip War is characterised by initial efforts aimed at capability build-up by the Chinese government. With the "Outline for Advancing the Development of the National IC Industry" the PRC set ambitious goals for China to establish a leading semiconductor industry in all areas of the integrated circuit (IC) supply chain by 2030. Besides self-sufficiency goals like serving 70% of its national semiconductor demand by domestic production, the guideline, as well as the "Made in China 2025" strategy, outlined measures like investment funds, subsidies, and tech acquisition efforts to achieve these high-set goals (State Council of the PRC, 2014; 2015a).

Financial support for this strategy was provided through the National IC Investment Fund, also known as "big fund". This "government guidance investment fund" is a tool of equity investment developed by the Chinese government to overcome the risks associated with local government financing. In short, it is a private equity fund in which Chinese government institutions act as the limited partner, which provides the funds, while private equity firms operate as the general partner, which invests the funds (Lan & Topp, 2024). The big fund collected in its first round around 140 billion

Chinese Yuan in 2014, which equaled approximately 2.25 billion US Dollars at the time (XE, 2025). The money provided was then invested over the next 5 years until 2019, which denoted the end of the “big fund’s” first phase (Lan & Topp, 2024).

In later years, China repeatedly confirmed the goals set in its early legislature (DigiChina, 2017), but did not implement a system of tax subsidies and incentives to support its semiconductor industry. Tech acquisition efforts, however, were implemented, and they initiated the first conflicts with the US.

During the initial phase of China’s capability build-up, the US did not structurally impede the Chinese development; however, a first attempt of a Chinese investment fund to acquire Aixtron’s US business was eventually stopped by the US government under President Obama due to national security concerns (US Department of Treasury, 2016). In a report to the president which followed this incident, the President’s Council of Advisors on Science and Technology (2017) highlighted China’s offensive approach to becoming a leading power in the global semiconductor value chain and the potential risks connected to this. The report, furthermore, highlighted the urgency for US investment in its own semiconductor industry and the requirement for proactively counteracting Chinese policy measures.

In the further course, the US blocked two more Chinese acquisition attempts for the companies Lattice Semiconductor and Qualcomm for national security concerns (Congress of the US, 2018; US House of Representatives, 2018). To extend the US government’s rights to defend its industry from foreign takeovers, the US strengthened its technology protection legislation with the Foreign Investment Risk Review Modernization Act and the Export Control Reform Act in 2018. Former Act extended the government‘s ability to scrutinize investments in sensitive industries, including the semiconductor industry (US House of Representatives, 2018). The latter enabled the US government to block the export of sensitive technologies like chips (Congress of the US, 2018)

This first phase of the Chip War (See Table 5), therefore, comprises major efforts of the Chinese government to support its semiconductor industry, while the US focuses on the protection of its technologies’ intellectual property. The phase is therefore characterised by mostly instructive policies which aim to set focus or to define strategies for future policies. The phase transition to the second phase was initiated in

2019 when the US put Huawei Technologies and its affiliates on its entity list due to concerns regarding national security and foreign policy interests (Federal Register of the US, 2019a). Huawei and its subsidiary HiSilicon have been critical players in the development of a strong and self-sufficient semiconductor industry in China (Grimes & Du, 2022). The main consequences for companies on the entity list include licensing requirements for the export or in-country transfer of specified items from or to those companies (Bureau of Industry and Security, 2020). The listing, therefore, restricted Huawei's access to critical U.S. technologies and components, including chips and related technologies, and thereby marked the beginning of a more direct and targeted approach to impede the technological development of leading Chinese semiconductor-linked firms (Federal Register of the US, 2019a).

3.2.2. Phase 2: US Restriction Regime vs Chinese Strategic Development

The second phase of the Chip War is characterised by efforts from both countries to further develop their semiconductor industries and protect them from perceived threats. However, in doing so, both countries pursue different strategies. While the US maintains its level of deterrence efforts by continuously restricting Chinese semiconductor companies and important downstream industries, the Chinese government responds mostly with structural reforms to obtain tools for retaliation. The second phase transitions into the third, after the US increases the escalation level another time, by directly aiming at the chokepoints of China's semiconductor value chain, instead of only targeting single companies (See Table 6 for comparison).

At the beginning of phase 2, China reinforces its financial commitment to its semiconductor industry. By initiating the second phase of the National IC Investment Fund, the government manages to raise another US$35 billion in funding for its chip industry for the next five years until 2024 (SIA, 2021b). Moreover, it implements a core element of its national semiconductor industry strategy, which it has formulated in its "Outline for Advancing the Development of the National IC Industry". With the introduction of the "Promoting the Integrated Circuit and Software Industries" act, the Chinese government implemented a set of policies to structurally support its entire industrial base.

The act comprised diverse tax incentives like loss carry-forwards, tax reduction, and even tax exemptions for multiple years (SIA, 2021b). The tax benefits grew in favourability with rising technological complexity, leading to tax exemptions for up to ten years for the best ICs manufacturers or projects producing chips with node sizes ≤28 nm.Besides tax incentives, the set of policies also included policies regarding R&D, trade, talent, intellectual property, and market application, which aimed at directing funds and talent towards high-priority projects and consolidating fragmented industry players into an industrial network. Thus, long-term innovation-led growth was meant to be created (State Council of the PRC, 2020).

Within the first two years of the second phase, the US continued its restrictive approach against the Chinese semiconductor industry. With multiple rounds of semiconductor company additions to its entity list in 2019 (Federal Register of the US, 2019b; Federal Register of the US, 2019c) and a complete export ban to Huawei Technologies and its global subsidiaries, the US aimed to defend its national security and foreign policy interests (Federal Register of the US, 2019a). As a reaction, China introduced a set of policies, which would enable retaliation with similar tools that the US applied. China introduced new rules for an "Unreliable Entity List", which enable the government to penalize or restrict foreign companies that were deemed to act against Chinese interests by cutting off supplies, for example (Ministry of Commerce of the PRC, 2020). The updated Export Control law provided the legal basis for restricting exports of sensitive materials, technologies, and services for national security or foreign policy reasons (National People's Congress of the PRC, 2020). Finally, the Anti-Foreign Sanctions Law enabled the government to impose sanctions on entities involved in implementing measures discriminating against Chinese entities (Communist Party Member Network, 2021). Through this legislation, the Chinese government was enabled to retaliate against US measures it deemed to be "unfair". However, it refused to apply the tools it created for itself until the end of phase 2 of the Chip War.

During this second phase, the US government under President Biden published the 100-day supply chain review. This report discussed vulnerabilities and supply chain risks that have been exposed during the COVID-19 pandemic. It identified semiconductors as a critical vulnerability in the US supply chain and recommended cooperation with allies, strengthening of production and innovation capabilities, as well as the enforcement of international trade rules, in order to overcome its vulnerabilities (White House, 2021).

This agenda was implemented over the course of the second phase of the Chip War. With the CHIPS and Science Act of 2022, the US government established its own support and incentivisation program for its domestic semiconductor industry. The Act comprised US$39 billion in government loans and tax credits, US$11 billion in R&D programs, US$2 billion for the development of a network of research centres for the commercialisation of defence-related semiconductor technologies, and US$200 million for the development of the semiconductor workforce (US Studies Centre, 2022). Moreover, the CHIPS and Science Act established policies and developed strategies with US Institutions like the National Institute of Standards and Technology (NIST) or Manufacturing USA, among others, to increase national resilience in the semiconductor value chain, expand capabilities, create a talent pipeline, and achieve supply chain sovereignty. A key requirement for all measures implemented, however, was to sever ties with Chinese institutions and proxies to increase independence, especially from the People's Republic (Congress of the US, 2022).

Over the residual course of the second phase of the Chip War, the US therefore continued its restrictive efforts with multiple rounds of Chinese company additions to its entity lists between 2020 and early 2023. Thereby, the US did not only target important semiconductor companies like SMIC, the leading semiconductor manufacturer in the Chinese value chain (Federal Register of the US, 2020b), but also important downstream industries for the development of high-end chips like the supercomputer industry or the AI industry (Federal Register of the US, 2021, 2022a).

The end of the second phase was initiated when the US implemented another initiative from the 100-day supply chain review. In early 2023, the US agreed on a trilateral agreement with the Netherlands and Japan, which would introduce licensing requirements on exports of high-end semiconductor manufacturing equipment (Congress of the US, 2023). Through cooperation with the governments of these two countries, the US increased the difficulty for the Chinese semiconductor industry to access high-end semiconductor manufacturing equipment, which is only produced in the Netherlands and Japan (CSET, 2021).

Through this political move, the US increased the degree of escalation in the Chip War. Rather than targeting individual companies, this US measure was aimed at the bottleneck in China's semiconductor supply chain, thereby impeding its entire high-end development sector (CSIS, 2024). Three months later, China initiated its first restrictive political measure against the US semiconductor industry by banning products from Micron, the second-largest US-based chip manufacturer, from its critical infrastructure.

This development marked the end of the second phase of the Chip War, where restrictive measures were mostly conducted by the US to deter the development of the Chinese semiconductor industry through restrictions on a company-level. The next level of escalation would comprise restrictive attacks against chokepoints of both industries through targeted limitation of access to critical inputs on both sides.

3.2.3. Phase 3: High Stake Escalation on Rare Earths and Technologies

The third phase of the Chip War is characterised by an interaction between both countries that only focuses on restricting the adversary. Strategically, this is the most unidimensional phase, as both countries only increase restrictive pressure through measures targeting the strategic chokepoints of their adversary's semiconductor industry. While the US aims to deter Chinese development through measures restricting access to advanced semiconductor manufacturing equipment, advanced computing items, and related production capabilities, China responds by tightening control over critical upstream inputs and by selectively restricting foreign firms and exports of strategically relevant materials. A temporary ceasefire agreement in late 2025 will put a halt to this escalation spiral. Both sides suspend selected restrictive measures for one year, while the broader structure of export controls, entity-based restrictions, and industrial policies remains in place.

US policy in the third phase relied on a set of complementary measures comprising additions to the entity list, foreign direct product controls, end-use controls, verified end-user authorization, and export controls. In 2023, the US implemented verified end-user authorisation for the Chinese subsidiaries of two South Korean semiconductor companies (Federal Register of the US, 2023a). Thereby, China's ability to circumvent US restrictions through third-country companies should be limited. Towards the end of the same year, the US implemented broad export controls that further tightened Chinese access to advanced computing chips, semiconductor manufacturing equipment, and related technologies (Federal Register of the US, 2023c). Complementary to this, end-use controls have been implemented for the US to oversee the use of high-end semiconductor-related exports (Federal Register of the US, 2023b).

This oversight and control regime was expanded in the next year when the US introduced foreign direct product controls (Federal Register of the US, 2024b). Foreign direct product controls made items produced outside the US related to high-end semiconductors and their equipment also subject to the previously introduced export legislation. Further expansion of this comprised outbound investment rules, which limited US capital flows into the Chinese semiconductor industry (Federal Register of the US, 2024a). Eventually, entity list additions comprised three rounds of additions targeting the PRC's broad semiconductor industry, its high-end chip production, and its semiconductor manufacturing equipment production (Federal Register, 2024c, 2025a, 2025b). Notably, in late 2024, the US restricted access to semiconductor-related input and equipment to over one hundred different Chinese semiconductor companies in addition, thereby restricting the industry broadly.

The PRC's policy in the third phase was not as multi-layered as the US measures. Besides the initiation of the third phase of the National IC Investment Fund, which collected 344 billion Chinese Yuan, equalling over US$47 billion (XE, 2024), for the next 14 years (State Council of the PRC, 2024a), Chinese policy focused on measures like export controls on critical raw materials and related dual-use items. In 2023, China imposed export controls on gallium- and germanium-related items, which subjected the export of strategically relevant upstream materials to prior licensing requirements (Ministry of Commerce, 2023a). These restrictions were the Chinese response to the initial trilateral restriction on high-end semiconductor manufacturing equipment from the US, Japan, and the Netherlands (Congress of the US, 2023). China further expanded its control regime by introducing export controls on graphite-related items (Ministry of Commerce of the PRC, 2023b) and strengthened restrictions on dual-use exports to the United States to further limit the US access to vital semiconductor inputs (State Council of the PRC, 2024c). Those export controls were reinforced two more times in 2024 and 2025.

The first reinforcement prohibited exports of dual-use items to US military end users. The publication stated that critical semiconductor inputs like gallium or germanium going to the US would generally not be approved, and imposed stricter end-use review for graphite-related exports to the US (Ministry of Commerce of the PRC, 2024). The second reinforcement comprised the extension of export controls on rare earths like terbium, dysprosium, lutetium, scandium, and yttrium. These rare earth metals were among the raw materials on which the US was most heavily dependent (see Figure 7).

The latter restriction of rare earths followed a ruling that had been imposed one week prior. The US imposed a trade policy that would treat a company as if it were subject to the end-user controls of companies on its entity list, if it was owned 50% or more, directly or indirectly, individually or in the aggregate, by one or more listed entities on the entity list (Federal Register of the US, 2025c).

Against this background of high mutual restriction, President Trump and President Xi met in Kuala Lumpur to contain the most recent escalation between the two countries. While both government leaders also discussed other matters of mutual interest, they agreed to a limited ceasefire under which both sides suspended selected restrictive measures for one year. On the US side, this concerned the 50% Affiliates Rule for end-user controls, while China suspended the related restrictions on rare-earth exports (Ministry of Commerce, 2025c; White House, 2025). Notably, both sides deviate in the results of the talks. While the Trump White House claims that effectively all export controls implemented for critical semiconductor inputs have been suspended (White House, 2025), the Chinese government only speaks about the latest rare earth export controls implemented before the meeting (Ministry of Commerce, 2025c). A publication of the European Parliament (2025) confirms the Chinese version of the meeting's outcome. However, the terms of this agreement may not only be seen through the lens of semiconductor-related issues, as the meeting comprised a multitude of issues.

Overall, the course of the Chip War has shown that the escalatory development unfolded in a context of sustained Chinese catch-up under continued US leadership. Economically and innovatively, China narrowed the gap across the semiconductor value chain, but without overturning the United States' leading position in any decisive domain. At the same time, both industries remained constrained by distinct strategic chokepoints. China remains dependent on advanced semiconductor manufacturing equipment, while the US remains dependent on Chinese-controlled upstream raw materials. However, both countries were able to reduce their respective dependencies over the course of the Chip War. The political reconstruction of the rivalry further showed an escalation from long-term capability-building and protective measures to direct restrictions on firms and, ultimately, to attacks on the central chokepoints of the opposing value chain.

Taken together, these findings indicate that the relative shift in industrial power ran in China's favour, but under persistent US dominance, and that this shift unfolded in a strategically vulnerable and increasingly confrontational setting. For the game-theoretic analysis of the Chip War, this implies that the strategic interaction must be modelled not as a simple reversal of power, but as a dynamic bargaining process under uncertainty, in which anticipated shifts in relative capabilities, preventive incentives, and later reciprocal coercion jointly shape the logic of escalation.

4. Game-Theoretic Analysis of the Chip War

The empirical analysis has shown that the escalation of the Chip War unfolded under conditions of shifting relative industrial capabilities, mutual strategic vulnerability, and increasingly direct attacks on the central chokepoints of the opposing semiconductor value chain. To analyse the strategic logic of this escalation more systematically, the interaction between the US and China is abstracted from empirical complexity and modelled as a dynamic strategic game. Within the applied framework, both states are treated as rational actors that bargain over semiconductor-related rents. Such rents must be understood as the present and future economic, technological, and strategic value generated through semiconductor capabilities in the semiconductor industry, as well as all downstream industries. Bargaining failure, however, may arise where uncertainty about capabilities and resolve interacts with commitment problems created by anticipated shifts in relative industrial power.

Against the background of the investigated interaction between the countries and the empirical observations of both semiconductor industries, the following chapter analyses the escalation through three successive strategic phases. In the first phase, the interaction is shaped by uncertainty about China's capability build-up and the incentives for preventive restriction thereby created for the US. In the second phase, the confrontation intensifies by taking the form of bargaining under asymmetric information and shifting power, where industrial warfare describes repeated rounds of restrictive escalation below the threshold of military conflict that shape the distribution of payoffs by imposing costs on the opponent and thereby shifting the expected allocation of semiconductor-related rents. As this interaction increasingly reveals the direction and strategic significance of the underlying capability shift, the central strategic problem changes in the third phase from bargaining under capability uncertainty to brinkmanship under rising systemic risk, in which uncertainty about resolve becomes more important than uncertainty about relative industrial strength.

Analytical Framework and Bargaining Logic

In formal approaches to conflict, bargaining begins from the premise that fighting is costly and therefore inefficient. Therefore, rational actors should have incentives to prefer some negotiated settlement to costly confrontation (Fearon, 1995). The central analytical puzzle is therefore not why conflict may appear attractive, but why actors fail to locate or sustain an agreement that both would prefer to the costs of fighting.

To represent this problem formally, the object of dispute is commonly modelled as a divisible issue space on a continuous interval, such as $x \in [0,1]$ where x denotes a share of the contested good rather than a literal monetary amount. If no settlement is reached, actors resort to conflict as an outside option, which is typically represented as a costly lottery over outcomes (Fearon, 1995). Because payoffs are expressed as utility over outcomes rather than as raw cash values, a term with multiple variables also only comprises value components (e.g. $-c$, a negative utility value component, which resembles costs). Depending on the offered share of the contested good, a player may choose to accept a proposal. The minimum settlement value which an actor is willing to accept is therefore defined as the reservation price and any offer underbidding the value of it leaves a player better off choosing the costly outside option of conflict instead. Each actor therefore compares a proposed settlement to its reservation value, that is, the expected payoff it associates with conflict (Fearon, 1995). The range within which proposed outcomes satisfy both reservation values is defined as bargaining range (Fearon, 1995).

As long as confrontation is costly, a bargaining range exists in which both sides prefer settlement to escalation (Fearon, 1995). Bargaining breakdown occurs when actors are unable to locate a mutually acceptable settlement within the bargaining range. This may happen when private information obscures the opponent's acceptance threshold and therefore prevents actors from identifying which offer is likely to be accepted, or when a mutually preferable settlement cannot be sustained because anticipated shifts in power alter future incentives and thereby erode credible commitment (Fearon, 1995; Powell, 2006).

In the context of the Chip War, the bargaining logic applies to the distribution of semiconductor-related rents. The bargaining range comprises the possible distributions of semiconductor-related rents that both states prefer to costly restrictive escalation. Therefore, a state's reservation value corresponds to the payoff it expects from the outside option of industrial warfare. Proposals represent concrete offers over the distribution of these rents or the conditions under which they are realised. Those conditions could be revenues generated through the semiconductor industry and its downstream industries or policies from both countries which will affect the value creation of the industries. Thus, such proposals are only accepted if they at least satisfy the opponent's reservation value.

4.1. Phase 1: The Condition for Preventive Industrial War

The first phase of the chip war is characterised by the emergence of preventive restrictions by the US. Due to Chinese investments in their semiconductor industry, the US faces the strategic dilemma of a potential future shift in relative industrial power. At this stage, the US still has the opportunity to preventively restrict and thus deter its rival's capability build-up.

To formalise this strategic setting, the phase 1 model is derived from Debs and Monteiro (2014), as it captures how a deterring state may respond to an anticipated shift in power when the rival's militarization decision is only imperfectly observable. The model illustrates a scenario where a player can make a costly investment in military capabilities whose effects materialize later, while the opponent observes an imperfect signal of this investment and can choose between a preventive strike and a peaceful settlement. In the semiconductor context, this model is used to analyse how preventive industrial restriction can arise before the future redistribution of semiconductor-related rents has been fully revealed.

The interaction, therefore, links preventive action to the commitment problem created by shifting capabilities under uncertainty. The commitment problem arises as both countries are not able to credibly commit to any agreements for the future, due to the relative shift in power. The information problem arises due to the ambiguous signal of the investment decision of the rising power, in this case, China. Within the chip war framework, the US is the deterring state, and China is the target state, as it is the US which targets China with a first round of restrictions in phase 1, while China invests in its capabilities (see table phase 1). Instead of developing and deriving value from military capabilities, the countries derive value from semiconductor-related rents and the framework conditions in which the semiconductor industries operate. The analogue of the decision to militarize is C's decision whether to invest in its semiconductor capabilities, which is imperfectly observable to U and therefore generates an ambiguous signal. A preventive "attack" in this setting is modelled as restrictions that are designed to limit the expected payoff of C's capability build-up before it fully materializes. Escalation therefore arises in order to prevent a shift in the future distribution of rents.

4.1.1. Model of Phase 1

The game is played over two periods and formalizes a setting in which an initially ambiguous signal about C's capability investment is resolved over time. Within the basic framework, C decides whether to undertake an investment in semiconductor capabilities, and U decides whether to launch a preventive restriction against C's semiconductor industry under uncertainty about whether the investment occurred. C's industrial investment decision is costly with i > 0 in period t and produces a yield in the next period t + 1, conditional on U not striking preventively. U does not perfectly observe the investment being made and therefore are uncertain whether it should restrict C. Accordingly, uncertainty in period t concerns whether the investment was undertaken rather than whether an observed investment later proves successful. The investment decision $I_t \in \{0,1\}$, where $I_t = 1$ indicates investment, becomes publicly observable only in period $t+1$. C knows about its decision in period t, while U observes it in period $t+1$. In period t, U therefore must evaluate whether C invested based on a received signal s_t under imperfect information. If C does not invest $I_t = 0$, U observes the ambiguous signal s_t = 0. If C invests I_t = 1, the received signal is unambiguous s_t = 1 with probability $p_s \in [0,1]$, and remains ambiguous s_t = 0 with probability $1 - p_s$. Accordingly, a signal s_t = 1 represents unambiguous detection of investment by U, while s_t = 0 represents an ambiguous signal that is consistent with either no investment in capabilities (I_t = 0) or an undetected investment (I_t = 1). If $p_s = 1$, the signal perfectly reveals whether an investment occurred, and no information problem arises.

After U receives the signal, it decides whether to "declare industrial war" ($dw_t = 1$) or makes a settlement offer x_t ($dw_t = 0$). If $dw_t = 0$, U chooses not to preventively restrict C and offers it a division of the pie of all future semiconductor-related technology rents, while maintaining the option to escalate if the offer is rejected. If U declares industrial war ($dw_t = 1$), no offer is made to C.

Figure 9

Game Tree of Phase 1 – Period t

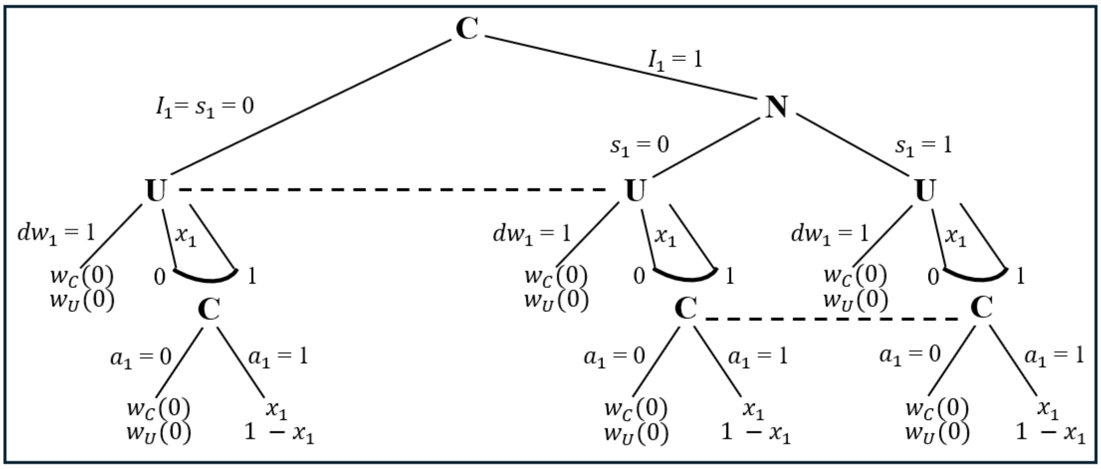


Illustration developed by the author

The respective payoffs of industrial war for U and C are defined as $w_U(M_t)$ and $w_C(M_t)$, where $M_t \in \{0,1\}$ denotes the industrial capability state that results from whether C has undertaken the investment. If instead, U offers proposal $x_t \in [0,1]$ ($dw_t = 0$) to C, which denotes a set of payoffs and conditions that determine the extent of future semiconductor rents for C. U keeps the share $1 - x_t$ for itself, if C accepts the offer. The acceptance condition for such an offer is that it provides C at least as much value as a declaration of industrial war, which is denoted by:

$x_t \geq w_C(M_t)$

When C accepts the offer ($a_t = 1$), C and U respectively receive their payoffs x_t and $1 - x_t$. If not ($a_t = 0$), U initiates industrial war and preventive sanctioning. Industrial war is defined to be inefficient for any $I_t \in \{0,1\}$, therefore

$$w_U(0) + w_C(M_t) < 1$$

In the second period $t + 1$, the true capability state of C's semiconductor industry becomes observable for U. At that point, both countries can assess the resulting capability state of C's semiconductor industry. In this period, however, no further investment occurs. As the effects from the prior investment are observable at this point, U has the option to declare industrial war ($dw_{t+1} = 1$) on the basis of C's now-observable capability state, or to again offer a share x_{t+1} to C ($dw_{t+1} = 0$). C then must accept the proposal x_{t+1} (a_{t+1} = 1) or reject it (a_{t+1} = 0), with the consequence of U starting restriction.

Overall, the model captures a strategic setting in which costly capability investment, delayed information, and the inefficiency of preventive escalation jointly shape the conditions under which restrictive escalation may arise. To identify when such an outcome becomes rational, the incentive conditions governing both C's investment decision and U's choice between peaceful settlement and preventive restriction must be derived.

Figure 10

Game Tree of Phase 1 – Period t+1

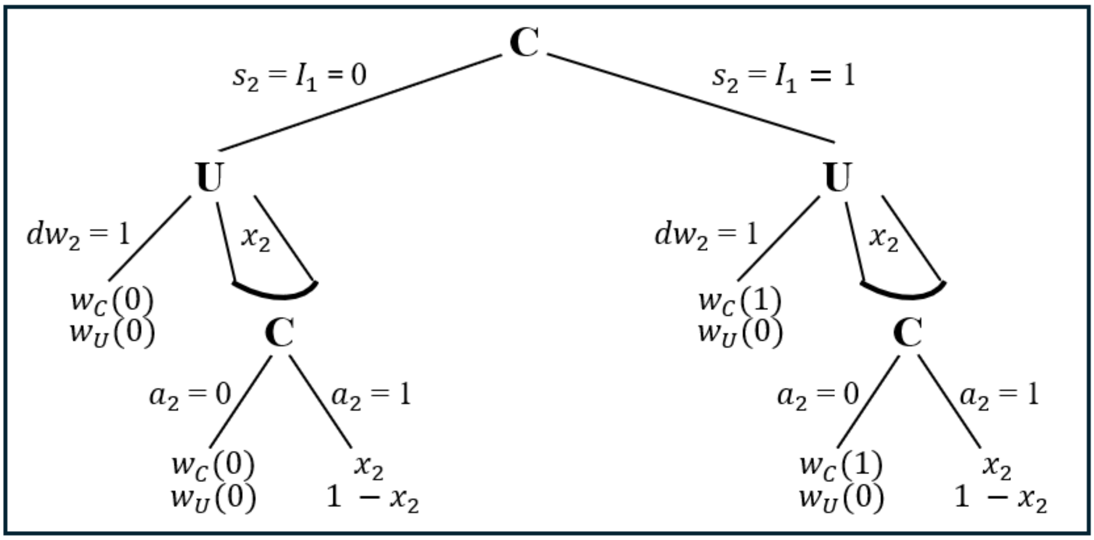


Illustration developed by the author

4.1.2. Model Conditions and Equilibria

If U declares industrial war, nation n ∈ $\{C, U\}$ receives a payoff $w_n(M_t) \geq 0$ where M_t represents the state of semiconductor-related industrial capabilities. M_t = 1, if C has undertaken the investment in the prior period t. Consequently, the industrial war payoff after a successful investment exceeds the payoff after a failed investment. This is denoted by:

$$w_C(1) > w_C(0)$$

Since industrial war is assumed to be inefficient for any $M_t \in \{0,1\}$, it implies that $w_C(M_t) < 1$. Consequently, industrial war destroys a strictly positive share of the available surplus:

$$1 - w_U(0) - w_C(0)$$

This is defined as the cost of preventive restriction. Furthermore, countries discount future payoffs by a discounting factor δ ∈ (0,1). As the payoff from an investment occurs in $t + 1$, this discounting factor must be considered for capturing the surplus of the capability value, this is denoted by:

$$\delta[w_C(1) - w_C(0)]$$

This surplus must be bigger than the investment i C has committed to at the beginning of the first phase t in order for the investment to be considered rational. Consequently, an incentive for C to invest is only given if:

$$\delta[w_C(1) - w_C(0)] \geq i$$

For U to have an incentive to restrict C, the effect of industrial investment must be greater than the cost of preventive restriction, as this implies that U would incur a greater loss from allowing the future capability shift to materialise than from bearing the immediate cost of preventive restriction. This is given when:

$$\delta[w_C(1) - w_C(0)] > 1 - w_U(0) - w_C(0)$$

However, U faces uncertainty about the outcome of C's investment. Preventive restriction in period t, therefore, additionally depends on whether the signal observed by U leaves enough uncertainty for preventive restriction to become rational. Therefore, if the effect of industrial investment is greater than the cost of preventive restriction and greater than the cost of investment, then, under an ambiguous signal $s_t = 0$, a signal is sufficiently informative for peace to prevail if:

$$(1 - p_s)\delta[w_C(1) - w_C(0)] \leq i$$

If this condition holds, the expected effect of industrial investment is smaller than the investment. Therefore, U refuses to restrict. However, if the expected effect is greater than the investment, then the signal remains too uninformative to sustain deterrence in pure strategies, so the interaction moves into the mixed-equilibrium case.

For this case, two additional probabilities must be defined. p_p is denoted as the probability for U not to restrict C and peace prevailing after an ambiguous signal, and p_i is defined as the probability for C to invest. Both $p_p, p_S \in (0,1)$, when the ambiguous signal is not sufficiently informative (Debs & Monteiro, 2016). The first condition that must be defined for peace to prevail must capture that C is indifferent whether to invest or not invest under given p_p. This is given when:

$$(1-\delta)w_C(0) = -i + (1-\delta)w_C(0) + p_p(1-p_s)\delta[w_C(1) - w_C(0)]$$

The left-hand side captures C's payoff if it decides against an investment, while the right-hand side captures the cost of investment, the baseline payoff C receives regardless of the signal outcome, and eventually the expected surplus if peace prevails and the investment materializes. Solving this equation for p_p:

$$p_p = \frac{i}{(1-p_s)\delta[w_C(1) - w_C(0)]}$$

The second condition states that, after the ambiguous signal, U is exactly indifferent between immediate restriction and peaceful settlement under the investment likelihood p_i. Therefore, the condition is defined as:

$$w_U(0) + \delta\big(1 - w_C(0)\big) = (1+\delta)\big(1 - w_C(0)\big) - \frac{p_i(1-p_s)}{1-p_i p_s}\delta[w_C(1) - w_C(0)]$$

The left-hand side comprises U's value when C did not invest in its capabilities. The right-hand side therefore shows U's value when C invests with its baseline value deducted by the expected surplus of C in case of a successful investment. The probability determining the expected value is U's posterior belief that C invested after an ambiguous signal. By applying Bayes' rule, after observing an s_t = 0, the probability of an investment by C is:

$$P(I = 1 \mid s_t = 0) = \frac{p_i(1-p_s)}{1-p_i p_s}$$

The resulting probability p_i for C investing, thus is captured by:

$$p_i = \frac{1}{p_s + (1-p_s)\dfrac{\delta[w_C(1) - w_C(0)]}{1 - w_C(0) - w_U(0)}}$$

Overall, these conditions create three different cases in period t. First, C might not have an incentive to invest if the cost of its investment does not match the potential surplus it receives. Therefore, no investment occurs, and U has no incentive to restrict C. The second case also leads to restriction being unattractive, even if C has an incentive to invest. In case the effect of industrial investment is smaller than the cost of preventive restriction, U does not have an incentive to restrict C. Only if C's investment is rational and the anticipated capability shift is sufficiently large to make prevention attractive for U, preventive restriction becomes relevant. In this last case, the remaining decisive variable is the informativeness of the signal observed by U. If the signal is sufficiently informative, deterrence prevails. If it is not, the interaction moves into the mixed-equilibrium case defined by p_i and p_p.

The mixed-equilibrium case comprises two sub-cases where U's strategic response depends on the signal s_t it observes. First C invests with probability p_i in its industrial capabilities. If the resulting signal is unambiguous $s_t = 1$, U restricts immediately, as the investment is revealed with sufficient certainty. If, on the other hand, the signal remains ambiguous $s_t = 0$, U refrains from restricting C with the probability p_p.

In case no restriction occurs, up to this point, U offers C a share of future semiconductor-related rents x_t, which is accepted in case it does not undercut the minimum share C should receive due to its existing semiconductor industrial capabilities $x_{t+1} \geq w_C(M_{t+1})$. In the second period, this is also the only mechanism that can lead to industrial war, as no further investment occurs, the capability implications of the prior investment become observable, the information problem of period t is resolved, and the game is designed as a 2-period game. Therefore, U must offer the share $x_{t+1} \geq w_C(1)$ in case C invested in period t, as war remains inefficient.

4.1.3 Relevant Equilibrium Path & Real-World Interpretation for Phase 1

In the relevant equilibrium path for phase one, C decides to invest and U decides to restrict, as the first declaration of war is defined as the transition criterion for transition into phase two. Since U must stay on the equilibrium path while restricting C, it is determined that the relevant game path remains in the first period t only, as U cannot rationalise restricting C in the second phase of this game after the capability shift occurred.

C’s investment decision, as well as U’s preventive restriction, must be rationalisable in principle. Therefore, C must assess the effect of industrial investment to be greater than the cost of its industrial investment. Statements from both government, and especially the Chinese, suggest that they assume this condition to be true, as the importance of enabling downstream technologies for economic development through investment and structural support into their own semiconductor industry is highlighted across various public statements (DigiChina, 2017; President's Council of Advisors on Science and Technology, 2017; State Council of the PRC, 2014). When the effect of industrial investment is greater than the cost of preventive restriction, U has an incentive to preventatively restrict C. Again, public declarations suggest that this condition is assessed to be true. In a report to the US President, the President's Council of Advisors on Science and Technology (2017) suggested that Chinese efforts are going to reduce US market share in the semiconductor sector, while Chinese efforts are assessed to be effective. The report further elaborates that the risk from Chinese semiconductor industrial policy is sufficiently serious for the US to justify restrictive countermeasures. Therefore, it can be assumed that the condition rationalising restriction is fulfilled for U.

Since the two preconditions for restriction are fulfilled, the question arises whether the US receives an ambiguous or an unambiguous signal about the Chinese industrial investment. At the time of the investment, the signal transports the information whether an investment of a certain amount occurred or not in the logic of the game. Following this logic, it is unlikely that the signal was completely unambiguous, as the process and the extent of the investment have not been communicated publicly in any major policy. While government initiatives highlight the need for high investments in the semiconductor industry, they do not discuss the amount that the government is supposed to invest in the industry (Central Committee of the CPC, 2016; State Council of the PRC, 2014; State Council of the PRC, 2015a). In public press releases, the Chinese government neither communicated clear investment targets. One press release from the Chinese Ministry of Finance one year after the establishment of the big fund, described the raised funds to be over 100 billion Chinese Yuan in volume (Ministry of Finance of the PRC, 2015). Other major semiconductor initiatives like the EU Chips Act or the US CHIPS and Science Act, respectively, highlighted the investment volumes. (European Commission, 2024). Therefore, it can be argued that the signal has been ambiguous.

The interaction therefore leads to the mixed-equilibrium case, where U's assessment of the likelihood of C having invested is denoted by p_i. The insights from the President's Council of Advisors on Science and Technology (2017) suggest that the assessment about $p_i \in (0,1)$ has been relatively close to 1, thus increasing the likelihood to restrict. The result of this process was the first entry of a Chinese semiconductor (and high-tech) company in its entity list to deter the future development of the Chinese semiconductor industry.

This game-theoretic model of the interaction between the US and China in Phase 1 relies on several simplifying assumptions that are necessary to depict the first phase as analytically tractable. First, multiple Chinese policy initiatives are condensed into one strategically relevant investment decision, and the induced capability shift occurred abruptly in the game, while developing incrementally in reality. The same pattern of abstraction applies to the US insight into C's investment decision and its approach to countermeasures. While being recognized abruptly in the game, the insight developed gradually over time in the real world. Overall, these abstractions can be traced back to the two-period structure of the game, which has been chosen to depict the delayed returns on the industrial investment. Thus, the mechanism of how the interplay of information and commitment problems can create incentives to preventively attack is depicted and extracted from the interaction between the two countries.

4.2. Phase 2: The Escalation Into Industrial Warfare

The second phase of the escalation between the US and China is primarily characterised by continuous restrictions initiated by the US to set back the development of the Chinese semiconductor, industry while it continuously invests in its own strategic capabilities and structures to foster resilience from outside interventions. This pattern of interaction then leads to a far-reaching escalation, which initiates the final escalation phase. The game theoretic model to illustrate this has been derived from the model of Wolford, Reiter, and Carrubba (2011), as it provides a bargaining model of conflict which incorporates commitment problems due to shifting power as well as asymmetric information.

The two underlying bargaining problems of this conflict are, firstly, U's uncertainty over C's resilience to industrial warfare and, secondly, a shift in C's industrial power after every peaceful settlement between the countries. An increase in industrial power is generally interpreted as an increase in an industry's self-sufficiency and, therefore, as an increased likelihood of outside restrictions losing effectiveness. U's uncertainty over C's future self-sufficiency level and its ability to overcome U's restrictions is effectively uncertainty about C's post-peace capability jump. The commitment problem, therefore, arises from the uncertainty of whether the growth of C's leverage exceeds the cost of U's restriction costs. The purpose of this model is therefore to explain how such uncertainty is reduced and when screening leads to a lock-in logic that requires more far-reaching escalation.

4.2.1. Model of Phase 2

The game sequence starts with Nature determining C's resilience type to industrial warfare $rC_T \in \{rC_S, rC_W\}$. Resilience describes how high C's costs are in absorbing restrictions. Strong resilience rC_S or low-cost adaptation occurs with probability q, complementary to weak resilience rC_W and high-cost adaptation with likelihood 1 – q. Accordingly, $rC_W > rC_S$. C knows about its resilience type rC_T, while U only knows about the probability distribution of C's type. U's prior belief that C's resilience is strong, is therefore defined as θ = q.

Once C's type is determined, U either offers C x_t, a share of semiconductor-technology related rents constrained by a set of bilateral commitments, or U initiates a round of escalation which significantly deteriorates C's position. The per-period payoff is normalized to 1, making the share U receives 1 – x_t. An escalation is characterised by industrial warfare costs for both sides, lost market access, enforcement, coordination, and opportunity costs for U (=rU), as well as capability delays, substitution, retaliation, and long-term opportunity costs (=rC_T) for C. The outcome of the escalation is conceptually captured by evaluating whether the restriction meaningfully obstructs or is effectively mitigated by C. Let $p \in (0,1)$ denote C's baseline probability of overcoming restrictions, so that U's baseline probability of restricting effectively equals $1 - p$. In case of such an escalation, each side would receive only a portion of the period's payoffs compared to if peace had prevailed. Conceptually, the factor which diminishes the payoffs during industrial warfare is defined as φ ∈ [0,1], the conflict efficiency factor. C would receive φg during conflict while U receives φ(1 - g), g denoting C's retained conflict-value share.

Within one period, U first decides whether to offer x_t with t being the period of the offer. If U offers x_t and it is accepted by C, then the countries receive their respective payoffs and the period ends. A bargained solution denotes the end of a period and leads to a shift in relative industrial capability $\Delta \geq 0$ in favour of C. However, if U decides to escalate or C declines U's offer x_t, then a non-decisive escalation round occurs in which neither side can secure the full flow of cooperative rents. Instead, U and C respectively receive autarky rents φ(1 - g) and φg, while bearing the costs of escalation rU and rC_T. The outcome and restriction effectiveness in a non-decisive escalation round remain unreliable and fail to reveal C's resilience type. Nevertheless, U updates its belief θ_{t+1} about rC_T from C's rejection of proposal x_t and the decision to fight. After the first non-decisive round of escalation, U can either make another proposal x_{t+1} to C or escalate into a second round, which constitutes a decisive escalation round. The acceptance of x_t leads always into a shift of relative industrial capabilities Δ and decreases the likelihood of U restricting C effectively from 1 – p to $\frac{1-p}{1+\Delta}$. C's likelihood to overcome U's restrictions therefore rises to $1 - \frac{1-p}{1+\Delta}$. Consequently, the expected net value of resilience increases relative to rC_T. If a second decisive escalation is triggered by U, however, the strategic interaction terminates, and continuation payoffs collapse into an absorbing allocation in which one side locks in the dominant share of future semiconductor rents.

Figure 11

Game Tree of Phase 2

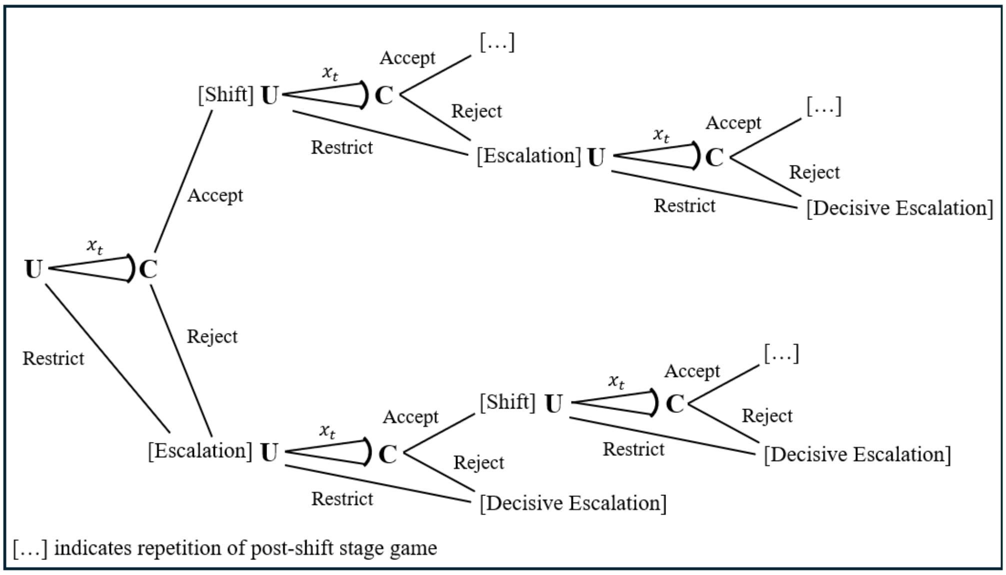


Illustration developed by the author

Post capability shift bargaining in which U makes proposals about x_t and C responds, repeats indefinitely as long as no second decisive escalation has occurred. (Maybe reference a potential figure). Finally, it is assumed that countries discount future payoffs by a discounting factor $\delta \in (0,1)$. This illustrates U's strategic dilemma, as it can either sustain escalation in the present in order to prevent C from further developing its industrial capabilities and relative strength or accept a bargained settlement that ends escalation, but thereby enables C's capability growth.

4.2.2. Model Goal and Constraints

Phase 2 explains how asymmetric information about C's resilience and a post-settlement capability shift produce a pattern of restriction and bargaining. The conditions under which U rationally stays in or exits this pattern are belief-dependent on U's belief about C's resilience capability and the belief that it can effectively induce a decisive escalation that would lock-in its advantageous position for the foreseeable future and forestall a decline of restriction effectiveness. The parameter and belief conditions under which the decisive escalation is chosen over the restriction pattern form the transition condition from phase two to phase three. In order to understand the underlying equilibria, it is necessary to clarify the constraints that bound feasible proposals x_t and shape U's choice between continued restriction and decisive escalation.

First, U faces asymmetric information about C's resilience costs rC_T and can only rely on the prior belief $\theta = q$. The parameter $q$captures U's initial prior and does not change, whereas U's belief about C's resilience is revised over time as proposals are accepted or rejected. Consistent with the original model, the fact that C chooses to fight is informative about resilience, while the operational effectiveness of any single non-decisive escalation round is treated as too noisy to identify the underlying type.

Second, any peaceful settlement induces a capability shift in favour of C that reduces the likelihood of effective restriction by U from $1 - p$ to $\frac{1-p}{1+\Delta}$ in future rounds, thereby strengthening C's relative resilience capabilities and increasing the demands that U must satisfy with its proposals x_t. As a result, x_t cannot be chosen freely, but is restricted by the dynamic erosion of U's bargaining position as well as by type-dependent acceptance conditions. Type-dependent acceptance conditions are the type-specific constraints that determine, for each resilience type $rC_T \in \{rC_S, rC_W\}$, whether x_t is accepted or rejected by C. The next step is therefore to specify the proposal types available to U and the type-dependent acceptance conditions that determine which values of x_t can be sustained as a bargained outcome.

4.2.3. Proposal Types and Acceptance Conditions

C will not arbitrarily accept or reject any x_t that is offered to it by U. In order to be feasible, x_t must satisfy C's type-dependent acceptance condition. At the same time, U must make the decision to offer x_t under uncertainty of C's resilience type, and therefore it faces the same uncertainty about the potential consequences of implementing a restriction regime. For a given resilience type rC_T, acceptance of x_t yields at least as much expected value in perpetuity as rejection and a transition into industrial warfare. In the underlying bargaining model, equilibrium proposals are therefore bounded by the minimum concession required to secure acceptance given the realised path of play up to period t. U therefore prefers to offer the smallest x_t that satisfies the targeted acceptance constraint x_{AT} depending on C's resilience type.

While acceptance yields x_t for C, rejection triggers a non-decisive escalation round in which the total value to be distributed is reduced by φ and C is only able to realise the value φg while losing rC_T. Because the rejection payoff depends on rC_T, the minimum concession required for acceptance differs across resilience types. This establishes type dependent acceptance conditions that bound the set of feasible proposals. Such acceptance conditions reflect the logic that both players face in given histories of their interaction and create the threshold under which different behaviour of the opponent is incentivised.

For a given history h1, U knows about the resilience type of C. Restriction by U or rejection of the proposal ends the game in a decisive restriction. For investigating whether such a restriction regime is advantageous for C or U, the question arises whether the benefits of bargaining outweigh the potential outcome of decisive restriction. Acceptance of a constant x_{AT1} that is offered in every future period implies that U of type rC_T will accept the proposition if:

$$\frac{x_{AT1}}{1-\delta} \geq \frac{1}{1-\delta}\left(1-\frac{1-p}{(1+\Delta)}\right) - rC_T + \varphi g \Leftrightarrow x_{AT1} \geq 1-\frac{1-p}{1+\Delta} + (1-\delta)(\varphi g - rC_T)$$

The minimum acceptable concession, therefore, differs across resilience types. Therefore let $\underline{x_s}$ and $\underline{x_w}$ denote the minimum proposals that induce acceptance by the strong and weak resilience type, respectively. $rC_w > rC_s$, consequently, leads to $\underline{x_s} >$

$\underline{x_w}$ and this ordering implies that any proposal $\underline{x_s}$ which is made to satisfy a strongly resilient C, will also be accepted by a weak type, while the converse does not hold.

This nesting directly subdivides the set of feasible proposals into three regions. For offers below $\underline{x_w}$, both types reject, and no peaceful settlement is feasible. For proposals between $\underline{x_w}$ and $\underline{x_s}$, the weak type accepts, while the strong type rejects, which creates scope for separating proposals that screen resilience through rejection behaviour. For offers at or above $\underline{x_s}$, both types accept, which corresponds to a pooling proposal that settles regardless of the realised type.

Since a pooling proposal requires satisfying the strong type's acceptance constraint, the pooling proposal is defined by $x_t^P \geq \underline{x_S}$. A separating proposal, which is only accepted by a C of weak resilience is defined by $\underline{x_s} > x_t^S \geq \underline{x_W}$. Acceptance or rejection of an offer x_{AW2} requires a comparison with the cost of a decisive restriction escalation. This logic describes history h2, where C has the belief $\theta = q$ about C's resilience type.

An offer x_{AW2} would lead to acceptance by C of weak resilience and to rejection and decisive restrictive escalation by C of strong resilience type. Since the acceptance or rejection of an offer $x_t < \underline{x_S}$ provides strong implications about C's resilience type, U cannot offer x_{AW2} in perpetuity. Later proposals have to ensure that they will always be accepted by C, given that their type is known. Therefore, in the follow-up periods, U has to propose x_{AT1} to C. Consequently, C with little resilience rC_W will always accept the proposal x_{AW2}, if:

$$x_{AW2} + \delta \frac{x_{AW1}}{1-\delta} \geq \frac{1}{1-\delta}\left(1 - \frac{1-p}{1+\Delta}\right) - rC_W + \varphi g$$

$$x_{AW2} \geq \frac{1}{1-\delta}\left(1 - \frac{1-p}{1+\Delta} - \delta x_{AW1}\right) - rC_W + \varphi g$$

Correspondingly, x_{AW2} does not satisfy C with strong resilience rC_S, if:

$$\frac{1}{1-\delta}\left(1 - \frac{1-p}{1+\Delta}\right) - rC_S + \varphi g > x_{AW2} + \delta \frac{x_{AW1}}{1-\delta}$$

$$\frac{1}{1-\delta}\left(1 - \frac{1-p}{1+\Delta} - \delta x_{AW1}\right) - rC_S + \varphi g > x_{AW2}$$

Defined as history h2, where U has not yet updated its belief and consequently $\theta = q$, U prefers to make the smallest possible offer to C, which satisfies these constraints, to make a separating proposal. After substitution of $x_{AT1}$from h1 follows:

$$x_{AT2} = 1 - \frac{1-p}{1+\Delta} + (1 - \delta)(\varphi g - rC_T)$$

x_{AT2} equals x_{AT1} for C of both resilience types, therefore $x_{AW2} = x_{AW1}$ as well as $x_{AS2} = x_{AS1}$. Furthermore x_t^S is defined as x_{AT2}, as the minimum acceptance criterion for a separating proposal. Therefore, U prefers making proposals x_{AT2} and C prefers accepting them in perpetuity to escalating its restriction regime.

Under incomplete information, the relevant implication for U is that separating proposals generates information about C's resilience type through rejection behaviour. However, pooling proposals settles without revealing the resilience type. The selection between these proposal classes is therefore belief-dependent and varies with U's prior assessment of C's resilience θ with probability q for C having strong resilience. Under this framework, the condition for U offering a pooling proposal in each period over a deviation to the separating proposal is:

$$\frac{1 - x_{AS1}^*}{1 - \delta} \geq q\left(\frac{1}{1-\delta}\frac{1-p}{1+\Delta} - rU + \varphi(1 - g)\right) + (1 - q)\frac{1 - x_{AW1}^*}{1 - \delta}$$

$$q \geq \frac{rC_W - rC_S}{rC_W + rU + \varphi} \equiv \bar{q}$$

Consequently, a strong type is assumed, and a pooling proposal offered when $q \geq \bar{q}$, while a weak type is assumed with a separating proposal offered when $q < \bar{q}$. U wants to avoid conceding an unnecessarily large share of semiconductor rents, so it must gain insights about C's resilience type. U's belief about C's resilience type decisively impacts U's decision to offer $\underline{x_w}$ or $\underline{x_s}$ and the information to reduce U's uncertainty is generated by C's bargaining behaviour while accepting or rejecting U's proposals. Belief updating, therefore, progresses by relying on observed responses and the decision to enter industrial warfare.

For the history h3, U knows about C's type, which leads to q = 0 or q = 1. Acceptance of an offer keeps the game in history h3, while rejection leads to the game of h1. As a first rejection does not end the game as in histories h1 and h2, rejecting a proposal leads to C convincing U that it is of strong resilience, therefore q' = 1. U therefore behaves as in history h1. Therefore, C will accept a proposal x_{AT3} in perpetuity if:

$$\frac{x_{AT3}}{1-\delta} \geq -rC_T + \varphi g + \delta \frac{x_{AS1}}{1-\delta} \Leftrightarrow x_{AT3} \geq (1-\delta)(\varphi g - rC_T) + \delta x_{AS1}$$

Given these constraints and the game's framework, U's and C's options to pursue their individual goals are set. U can propose an offer x_t which will be accepted only by the strong resilience type of C, by both the weak and the strong type, or none of them. C, on the other hand, has the option to pretend that it is of strong resilience, even if that is not the case. For the analysis of the game under uncertainty, the mechanism of U screening the resilience type and potential deception of C must be focused on. Since U only has its belief about C's resilience $\theta = q$, it is crucial for the next step to involve U's belief to understand expectations and value of U's strategies.

4.2.4. Screening Under Unresolved Resilience Uncertainty

Building on the proposal types and acceptance conditions, the strategic relevance of proposals shifts to a screening problem under unresolved resilience uncertainty. U still chooses between a pooling proposal, a separating proposal, and immediate restriction, yet the continuation implications of acceptance and rejection differ from the previous histories and therefore require a separate derivation. Therefore, the history-specific interaction logic must be translated into formal conditions, and the equilibrium condition under which U prefers pooling over screening (or vice versa) must be derived. The resulting threshold determines whether uncertainty about C's resilience type is preserved through settlement or reduced through strategically induced rejection behaviour.

For history h4, U does not know about C's resilience type and has the belief $\theta = q$. Moreover, no restriction due to rejection has occurred so far. Restriction without any proposal leads this game to transition into game h2. If U chooses to make a separating offer, then the game transitions to history $h1$ upon rejection and history $h3$ upon acceptance. For a pooling proposal, the game remains in h4. U's optimal pooling proposal will be the smallest proposal that ensures acceptance from a strongly resilient C and therefore also from a weak one. A proposal x_{AS4} will be accepted if it fulfills the condition:

$$\frac{x_{AS4}}{1-\delta} \geq (\varphi g - rC_S) + \delta \frac{x_{AS1}}{1-\delta} \Leftrightarrow x_{AS4} \geq (1-\delta)(\varphi g - rC_S) + \delta x_{AS1}$$

The next step is to analyse h4 for a situation where U wants to offer a separating proposal to C. For U in this history, the value of a separating proposal is derived from the value of the information it can generate about C's resilience type through observed bargaining behaviour. Unlike a pooling proposal, a separating proposal allows U to update its belief based on whether C accepts or rejects the offer. The attractiveness of such a proposal, therefore, depends not only on the immediate concession but also on the continuation value associated with type revelation.

For this mechanism to work, rejection must constitute an informative signal rather than costless strategic posturing. Consequently, a weakly resilient C must not be able to profitably imitate a strongly resilient C by rejecting the offer in order to induce more favourable future proposals. If such mimicry were profitable, rejection behaviour would no longer separate types, and the screening mechanism would collapse. The separating proposal must therefore satisfy incentive conditions that make acceptance optimal for the weak type and rejection optimal for the strong type.

To make separation informative and avoid a weakly resilient C benefiting from rejecting the offer in order to imitate a strongly resilient type. The separating offer must therefore satisfy the weak type's incentive condition:

$$x_{AW4} + \delta \frac{x_{AW3}}{1-\delta} \geq \varphi g - rC_W + \delta \frac{x_{AS1}}{1-\delta}$$

$$x_{AW4} \geq \frac{\delta}{1-\delta}(x_{AS1} - x_{AW3}) + \varphi g - rC_W$$

In addition, the separating offer may not satisfy the strongly resilient type's acceptance condition, since otherwise both types would accept, and the proposal would become pooling rather than separating. This condition is fulfilled if:

$$\varphi g - rC_S + \delta \frac{x_{AS1}}{1-\delta} > x_{AW4} + \delta(\varphi g - rC_S) + \delta^2 \frac{x_{AS1}}{1-\delta}$$

$$(1-\delta)(\varphi g - rC_S) + \delta x_{AS1} > x_{AW4}$$

Taken together, these conditions define the feasible range of separating offers of h4:

$$\varphi g - rC_S + \delta \frac{x_{AS1}}{1-\delta} > x_{AW4} \geq \frac{\delta}{1-\delta}(x_{AS1} - x_{AW3}) + \varphi g - rC_W$$

As U prefers to make the smallest possible separating proposal to C, which satisfies these constraints, U's optimal separating proposal is:

$$x_{AW4} = \frac{\delta}{1-\delta}(x_{AS1} - x_{AW3}) + \varphi\mathrm{g} - rC_W$$

The next final question to be discussed is whether U has an incentive to immediately restrict without offering any proposal. As this model is derived from Wolford, Reiter, and Carrubba (2011), and the addition of payoffs during escalation rounds $\varphi\mathrm{g}$ and $\varphi(1-\mathrm{g})$ does not change the fundamental character of results, the proof that restriction is not beneficial in history h4 can be consulted. It highlights that under any belief of $\theta = \mathrm{q}$, and C's actual resilience type $rC_T \in \{rC_S, rC_W\}$, U has no incentive to immediately restrict C, as immediate restriction is strictly dominated in this history. Thus, there is no equilibrium path that would be followed under the assumption of rational actors.

Since U strictly prefers not to restrict C, the relevant choice reduces to a comparison between the expected value of a pooling proposal and that of a separating proposal. The condition for screening therefore, compares the expected continuation values of pooling and separating and identifies the belief threshold at which U switches between both strategies:

$$\frac{1-x_{AS4}}{1-\delta} \geq q\left(\varphi(1-\mathrm{g}) - rU + +\delta\frac{1-x_{AS1}}{1-\delta}\right) + (1-q)\left(1 - x_{AW4} + \delta\frac{1-x_{AW3}}{1-\delta}\right)$$

$$q \geq \frac{rC_W - rC_S}{rC_W + rU + 1 - \varphi} \equiv \underline{q}$$

In case of no prior round of restriction, U prefers a separating proposal if q < $\underline{q}$ and vice versa, a pooling proposal if q ≥ $\underline{q}$. It is worth noting that $\bar{q} > \underline{q}$ or that U is generally more willing to make a separating proposal after a battle, as in h2, compared to no battle, as in h4.

As screening is not a separate objective from bargaining, but a strategic use of bargaining to generate information through observed rejection behaviour, it can be used to analyse game progression. Whether uncertainty is preserved or reduced directly affects the continuation path of the interaction and, therefore, the conditions under which the game transitions into the next phase. The implications of screening and its effect on outcomes are analysed for understanding interaction developments and the condition of phase progression.

4.2.5. Condition for Phase Transition

The interaction between C and U within the phase 2 model does not constitute a static negotiation problem. Once the choice of proposal, rejection behaviour and updating of beliefs are linked, the interaction after the shift generates a dynamic process in which the further course depends both on C's realised reactions and on the resulting changes in U's expectations. Screening, therefore, influences not only the choice of proposal within a given history but also the subsequent development dynamic of the game.

This dynamic, however, is not only shaped by updated beliefs, but also by the change in restriction effectiveness with every post-agreement shift in resilience capabilities. Bargaining agreements change the feasibility and attractiveness and, thus, the strategic environment of future bargaining outcomes. For U it becomes continuously more unattractive to propose x_t, as its potential restrictive leverage decreases, while for C its growing restriction resilience provides an incentive to only be satisfied with equally growing bargaining outcomes. A holistic analysis of the progression of the game must therefore be analysed jointly in terms of beliefs and the magnitude of the underlying shift.

At history h5, one restriction round has occurred already, and U knows C's resilience type. Another round of restrictive escalation, therefore, ends the game and prevents a shift in resilience capabilities in favour of C, while acceptance leads to said shift and history h1. The condition that satisfies C to accept an offer x_{AT5}, which prevents a decisive round of escalation is fulfilled, when:

$$x_{AT5} + \delta\frac{x_{AT1}}{1-\delta} \geq \frac{p}{1-\delta} - rC_T + \varphi g \Leftrightarrow x_{AT5} \geq \frac{(p-\delta x_{AT1})}{1-\delta} - rC_T + \varphi g$$

While U's options to maximise its payoff in this situation can be summarized as offering x_{AT5} and triggering the decisive round of escalation, C faces another bargaining related problem. C knows that with every shift in resilience capabilities, its bargaining position gradually improves. Since it cannot credibly commit not to use its increased bargaining power after a shift, it has incentives to be very generous before it occurs, by agreeing to a bargaining solution without insisting on the entirety of its payoff. Such a binding feasible concession to achieve a favourable outcome can be described as an interior solution or corner solution. The former describes a concession where a share of one's own payoffs is provided, while the latter describes the concession of one's entire payoff. In this case, C could offer x_{AT5}, which would increase the payoff of U to 1 in the first round. However, since the industry-related payoffs cannot be given up entirely, as this would mean handing over one's entire industry and semiconductor-related rents, the share that C must keep is its autarky share φg. The interior solution which C can offer to U, therefore becomes $1-\varphi g$. If this proposition is being made to U, the decision whether to decisively restrict is being represented on the condition:

$$\frac{1-p}{1-\delta}-rU+\varphi(1-g)>1-\varphi g+\delta\frac{1-x_{AT1}}{1-\delta}$$

The corresponding shift, which fulfills this condition, is defined as:

$$\Delta>\frac{\delta(1-p)}{\delta-\mathrm{p}+(1-\delta)[\varphi-\mathrm{rU}+\delta(\varphi\mathrm{g}-rC_T)]}-1$$

Depending on C's resilience type, this is the shift frontier above which no offer could satisfy U to such extend that it chooses not to decisively restrict C. When C is aware of the shift almost being big enough to fulfill this condition, it must offer the interior solution to avoid an escalation by U, but if the shift is smaller x_{AT5} becomes the condition-efficient proposal. Therefore, the most the U is willing to offer to C to stay on the equilibrium path is:

$$x_{AT5}=\max\left\{\frac{(p-\delta x_{AT1})}{1-\delta}-rC_T+\varphi\mathrm{g},\ \varphi\mathrm{g}\right\}$$

Since the shift frontier above which no offer could satisfy U is type-dependent, U's choice over decisive restriction or making an acceptable proposal for q' = 1 is:

$$\Delta>\frac{\delta(1-p)}{\delta-\mathrm{p}+(1-\delta)[\varphi-\mathrm{rU}+\delta(\varphi\mathrm{g}-rC_S)]}-1\equiv\underline{\Delta}$$

Accordingly, the shift frontier for the weak type q' = 0 is:

$$\Delta>\frac{\delta(1-p)}{\delta-\mathrm{p}+(1-\delta)[\varphi-\mathrm{rU}+\delta(\varphi\mathrm{g}-rC_W)]}-1\equiv\hat{\Delta}$$

Consequently, the range between $\underline{\Delta}$ and $\hat{\Delta}$ defines the shift range, where decisive restriction becomes an option for U when there has been one round of escalation already. While for $\Delta>\hat{\Delta}$ it is the only alternative on the equilibrium path. For $\Delta<\underline{\Delta}$ both proposal types strictly dominate decisive restriction and therefore make it an unviable option for U.

At history h6, one round of restrictive escalation has already taken place, but U does not know whether it faces a weakly or strongly resilient C. Since U's uncertainty over C's type persists at this history, its strategic options are no longer determined by the shift and C's behaviour alone, but by the interaction between the magnitude of the shift and U's belief about C's resilience type. Solving for the shift where decisive restriction becomes an option for U in h6 leads to the same range as in h5. The proof and the derivation of this insight is described in the Appendix under chapter 4).

4.2.6. Equilibrium Classification and Conditions for Decisive Restriction

The history-specific results, logic, and constraints show that the interaction between C and U cannot be characterised by a single bargaining pattern. U's belief about C's resilience type governs whether uncertainty is more likely to be managed through pooling or reduced through screening, while the magnitude of the underlying shift in resilience capabilities changes the effectiveness of future restrictions and thereby affects whether continued bargaining remains strategically attractive. Depending on U's prevailing belief about C's resilience type and the strategic implications of the underlying shift in relative capabilities, the same bargaining framework can sustain continued settlement, induce screening behaviour, or generate incentives for decisive restriction. This model's equilibrium structure, therefore, emerges from the joint effect of these two dimensions, and its analysis allows us to identify the conditions under which the game transitions into decisive escalation. Thus, the triggering conditions for phase transition into the final phase of the escalation between U and C can be identified.

Figure 12 shows the four different equilibria that can result from the two dimensions' interplay. These equilibria are tied to the previously defined constraints of the relative shift in resilience capabilities $\underline{\Delta}$ and $\overline{\Delta}$, as well as U's prior belief $\theta = q$ about C's resilience. The shift thresholds of $\underline{\Delta}$ and $\overline{\Delta}$ divide the equilibria into three regions. Continued settlements can be sustained for $\Delta < \underline{\Delta}$, a restriction regime is being imposed for $\Delta > \overline{\Delta}$, and screening-for-restriction that comprises at least one round of restrictive escalation takes place for $\underline{\Delta} < \Delta < \overline{\Delta}$. On the other hand, the belief thresholds of $\underline{q}$ and $\bar{q}$ determine when offering a separating or a pooling proposal is viable for U.

For any $\Delta < \underline{\Delta}$, the cost of escalatory restriction exceeds the secured locked-in payoffs of a potential restrictive escalation. Therefore, the equilibrium logic of this region leads to continued settlements between U and C. However, within this region, two equilibria can be generated. Screening for bargaining occurs for $q < \underline{q}$, as U believes to face a C of weak resilience and therefore chooses to offer a separating proposal, which can lead to at least one rejection round. For $q > \underline{q}$ within this shift range, the option of immediate restriction is dominated by both proposal types, as proven in history h5, and thus, U finds itself in history h4, where the condition of U offering a pooling proposal under no option of restriction has been defined as $q > \underline{q}$.

A shift of $\Delta > \overline{\Delta}$, on the other hand, leads to immediate restriction by U, to pre-empt the shift in restrictive capabilities, which deteriorates U's bargaining position. Within this capability shift region, U has an incentive to restrict C, independently of its belief θ = q about C's resilience, as the value of restrictive escalation, exceeds U's value of any separating proposal. This is given when:

$$q\left[\varphi(1-g) - rU + \delta\left(\frac{1-p}{1-\delta} + \varphi(1-g) - rU\right)\right] + (1-q)\left(1 - \varphi g + \frac{\delta(1-x_{AW3})}{1-\delta}\right) \geq \varphi(1-g) - rU + \delta\left(\frac{1-p}{1-\delta} + \varphi(1-g) - rU\right)$$

$$\Delta < \frac{\delta^2(1-p)}{(1-\delta^2)[\varphi(1-g) - \mathrm{rU} + \delta(\varphi g - rC_S)] + \delta(1-p+\delta) - \varphi g(1-\delta) - 1} - 1 \equiv \overline{\Delta}$$

Figure 12

Possible Equilibria in Phase 2

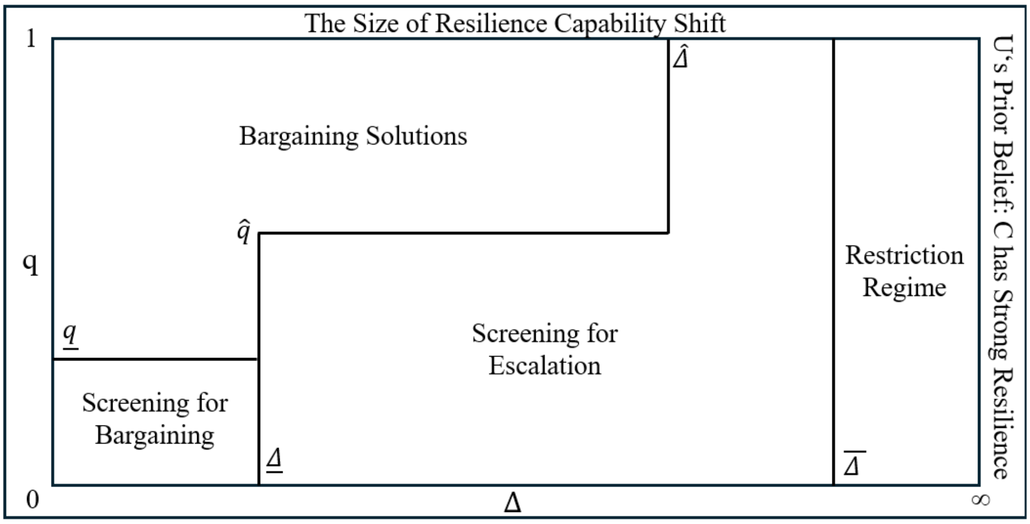


Illustration derived from Wolford, Reiter, and Carrubba (2011) and adapted to model by the author

Consequently, only one equilibrium is generated within this region, which suggests U to escalate its restrictions and decisively escalate if it finds C to be of strong resilience. Therefore, this region is defined as the "Restriction Regime".

The capability shift region of $\underline{\Delta} < \Delta \leq \overline{\Delta}$ is the only region in which commitment pressures and asymmetric information jointly shape equilibrium behaviour without one mechanism fully dominating the other. Bargaining in this region serves U not only by achieving settlements, but as a means to screen C's resilience type.

For the range of $\hat{\Delta} < \Delta \leq \overline{\Delta}$ Achieving settlements through a pooling proposal, however, is only viable as long as any pooling proposal exceeds the value of restrictive escalation for U. Under such conditions, a strongly resilient C, or a weak imitating C, is willing to give up as much of its available payoff as the industry structure allows it. U receives $1 - \varphi g$ in the first period, to create an incentive not to restrict the strong C. U will prefer to do so under the condition:

$$1 - \varphi g + \frac{\delta}{1-\delta}(1 - x_{AS4}) \geq \varphi(1-g) - rU + \delta\left(\frac{1-p}{1-\delta} + \varphi(1-g) - rU\right)$$

$$\Delta < \frac{\delta^2(1-p)}{(1-\delta^2)[\varphi - rU - 1 + \delta(\varphi g \ - \ rC_S)] + \delta(1-p) - \delta\varphi g(1-\delta)} \equiv \tilde{\Delta}$$

$\tilde{\Delta}$ denotes the constraint of U having no incentives to offer a pooling proposal to C. Therefore, the only offer which C receives if $\tilde{\Delta} < \Delta \leq \overline{\Delta}$ is a separating proposal with the purpose of identifying C's type. Acceptance or rejection leads to history h5 where C's type is known, and U chooses to attack, since $\Delta > \tilde{\Delta} > \hat{\Delta}$ as previously defined.

For $\hat{\Delta} \leq \Delta < \tilde{\Delta}$ both a pooling as well as a separating proposal are viable for U. The final choice of the proposal is therefore determined by the belief θ = q and the value of the respective proposals. For history h7, the initial decision of U is being derived. This means that no restriction has occurred as far as U has only its belief θ = q about C's resilience type. Under these conditions, a pooling proposal that satisfies both types of C is defined as:

$$x_{AT7} + \delta\frac{x_{AS4}}{1-\delta} \geq \varphi g - rC_S + \delta\left(\frac{p}{1-\delta} + \varphi g - rC_T\right)$$

$$x_{AT7} \geq \frac{\delta}{1-\delta}(p - x_{AS4}) + (1+\delta)(\varphi g - rC_T)$$

Since $rC_S < rC_W$, C will independently, regardless of its type, accept the offer x_{AS7}. The maximum proposal offered to C is therefore:

$$x_{AS7} = \max\left\{\frac{\delta}{1-\delta}(p - x_{AS4}) + (1+\delta)(\varphi g - rC_S), \varphi g\right\}$$

A separating proposal which only the weakly resilient C accepts and leads to U believing q' = 0 upon rejection or q' = 1 upon acceptance is constrained as:

$$x_{AW7} + \delta\frac{x_{AW3}}{1-\delta} \geq \varphi g - rC_T + \delta\left(\frac{p}{1-\delta} + \varphi g - rC_T\right)$$

$$\varphi g - rC_T + \delta\left(\frac{p}{1-\delta} + \varphi g - rC_T\right) > x_{AW7} + \delta(\varphi g - rC_S) + \delta^2\frac{x_{AS1}}{1-\delta}$$

The maximum proposal that U is willing to offer C is the smallest possible separating proposal from its own perspective. To separate successfully, U offers C:

$$x_{AW7} = \max\left\{\frac{\delta}{1-\delta}(p - x_{AW3}) + (1+\delta)(\varphi g - rC_S), \varphi g\right\}$$

With the payoffs defined for x_{AS7} and x_{AW7} the proposals can be compared, and an incentive condition can be established. Accordingly, U prefers a pooling over a separating proposal if:

$$1 - x_{AS7} + \delta\frac{1-x_{AS4}}{1-\delta} \geq q\left(\varphi(1-g) - rU + \delta\left(\frac{1-p}{1-\delta}\varphi(1-g) - rU\right)\right) + (1-q)\left(1 - x_{AW7} + \delta\frac{1-x_{AW3}}{1-\delta}\right)$$

$$q \geq \frac{(1+\delta)(rC_W - rC_S)}{1 + (1+\delta)(rC_W + rU - \varphi)} \equiv \hat{q}$$

Although $\hat{q} < \bar{q}$, U having the belief $\hat{q} < q$ leads to an initial pooling proposal along the entire range of $\underline{\Delta} \leq \Delta < \tilde{\Delta}$. Conditional on acceptance of an initial proposal, for $q > \hat{q}$ the game transitions into history h4 where a pooling proposal continues being offered, if $q > \bar{q}$. If this condition does not hold, then U offers a separating proposal, which upon acceptance or rejection leads to belief updating of respectively q' = 0 or q' = 1, and therefore type revelation. For an identified weak C, the game transitions to history $h3$, whereas a strong C leads to history h1 and a restrictive escalation, due to $\Delta > \underline{\Delta}$ as proven in h5.

Any belief of $q < \hat{q}$ in a shift region of $\underline{\Delta} \leq \Delta < \bar{\Delta}$ leads to an initial separating proposal which again results in type identification through screening, as given in x_{AW7}. Again, for a weak C, the equilibrium path follows history h3, while for a strongly resilient C, it results in history h1 and restrictive escalation (Area C, F, and I). For the shift range of $\underline{\Delta} \leq \Delta < \hat{\Delta}$ and $q > \hat{q}$, U offers C an initial pooling proposal, which leads to continued pooling proposals for U's belief $q \geq \bar{q}$ (Area A) and accepted separating proposals by C for $\bar{q} \geq q > \hat{q}$ (Area B). If a weak C would choose to pretend to be of strong resilience, which would move the game from h3 to h1. Since the proposal of x_{AT3} is defined to be equal to bigger than $(\varphi g - rC_T)(1 - \delta) + \delta x_{AS1}$, C will weakly prefer to accept the separating proposal. Therefore, Areas A and B are both part of the "Bargaining Solution" area of figure 12, since none of the countries has a profitable deviation to move away from the equilibrium path to achieve a potential advantage.

Figure 13

Possible Outcomes within the bargaining range

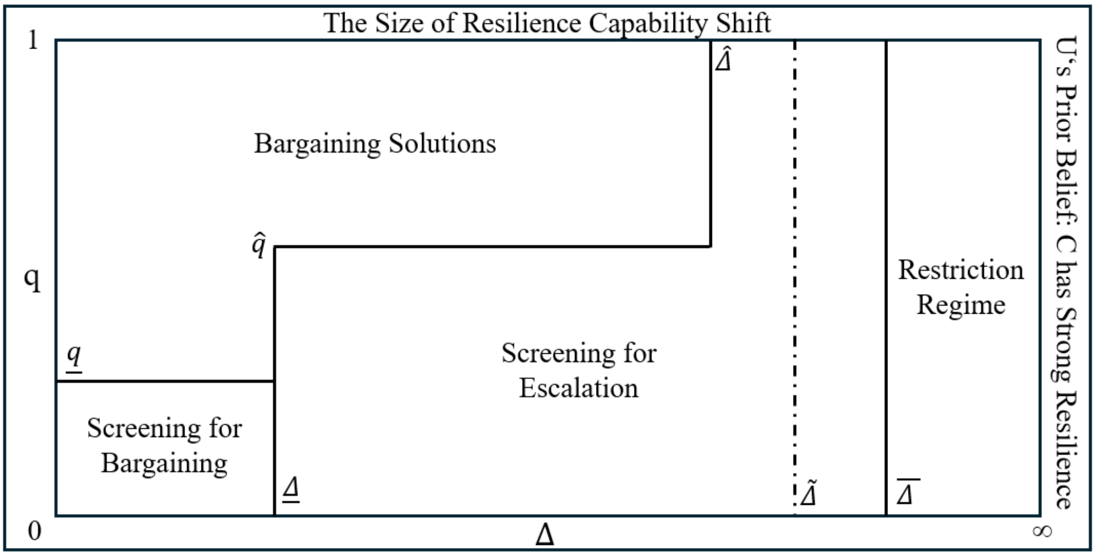


Illustration derived from Wolford, Reiter, and Carrubba (2011) and adapted to model by the author

Within the intermediate region of the resilience shift, multiple outcomes can be achieved, which comprise the entire range of interaction scenarios between U and C. For the areas A and B, no restriction round occurs on the equilibrium path. On the other hand, for the areas of C), F), and I), U applies screening through the separating offer to identify C's resilience type and restricts it, if it is strongly resilient. Otherwise, bargaining results in offering the separating solution. Within the area of E), a pooling proposal is offered to C, before it gets screened and eventually attacked if it is of strong resilience. In the areas of G) and H), the shift in resilience capabilities is sufficiently high to immediately screen C to prevent a potentially strongly resilient C from benefitting from powershifts from accepted pooling proposals. Area D) represents the most advantageous area for C. It is the area with the highest shift in resilience power where U does not screen for C's type initially, as it aims to avoid the costs of escalation and the powershift is not large enough to immediately screen C. Within this area, C can rise in resilience and industrial power over time, as U does not have a profitable deviation from the equilibrium path.

4.2.7. Interim Interpretation in Real-World Chip-War Terms

The second phase model abstracts from the empirical complexity of the Chip War through three central mechanisms. First, it reduces the uncertainty regarding C's adaptation capacity, self-sufficiency, and ability to absorb restrictions to a more clearly defined informational problem about C's resilience type, by translating the broad range of C's industrial policies, as well as the repeated restrictions imposed by U throughout phase two, into a single question of whether C can absorb and overcome restrictive pressure at low or high cost.

Second, it condenses the multidimensional development of industrial power into a shift in relative industrial capability Δ in C's favour. In the model, the extent of this shift is known by both players, it does not change over time, and it occurs only after peaceful settlement has been reached, not after non-decisive restriction rounds. Doing so allows the shift in power to be quantified and analysed through the model.

Third, it represents the confrontation as a structured bilateral bargaining sequence over semiconductor-related rents, thereby reducing the multi-layered real-life interaction to an ordered bargaining process. These abstractions aim to isolate the two underlying strategic problems for U that induce the commitment problem in phase two, namely uncertainty over C's resilience and the expectation that a peaceful settlement would further improve C's relative industrial position.

Inside the model, the course of the bargaining interaction is determined by the extent of the industrial power shift Δ and the U's prior belief $\theta = q$ about C's resilience type. Depending on the expression of those variables, U either creates bargaining solutions where no restriction occurs, screens for C's resilience type to potentially restrict a strong C, or immediately restricts C as the shift in power is great enough that the cost of restriction is outperformed by the potential deterioration of the bargaining position.

For the middle case, screening is therefore used as a tool of information revelation to find out whether C is weakly or strongly resilient. By making a separating proposal for which acceptance is optimal for the weak type but unacceptable for the strong type, U can update its belief from C's response and adjust its subsequent choice between renewed bargaining and further restriction accordingly. Since U faces asymmetric information regarding C's resilience costs, the screening process becomes necessary to reduce uncertainty over whether C can absorb restrictive pressure at low or high cost. This informational problem, however, is linked to a commitment problem, as every peaceful settlement induces a shift in relative industrial capability in C's favour, which reduces the future effectiveness of U's restrictions and thereby deteriorates U's future bargaining position.

The results of the prior sub-chapter suggest that given the model abstraction and rationality of the players, the interaction and thus the outcome between both players is pre-determined depending on the extent of Δ and $\theta = q$ (See Figure 13). However, when this concept is applied to the real-world analysis of the Chip War, the US faces greater difficulties in identifying both the actual extent of the relative power shift between the industries and China's ability to absorb and overcome restrictive pressure. Both dimensions are more multilayered in reality, as industrial power cannot be observed through one single indicator, and beliefs about resilience cannot be inferred through one clearly structured bargaining move alone.

Instead, both have to be assessed through repeated rounds of costly interaction and the observation of imperfect proxies, such as industrial performance, technological progress, adaptation under restriction, and thus, the broader development of self-sufficiency. The real-world bargaining interaction of phase two can therefore still be understood through the same two-dimensional logic as the model, but the process through which relevant information is revealed remains more gradual, costly, and incomplete. The United States could therefore only infer China's resilience and the extent of the underlying shift in industrial power gradually from observed industrial performance, technological progress, and adaptation under prior restrictions. While this data provided insights about the general trend of the relative development, such indicators remained incomplete and open to strategic misrepresentation. Despite the uncertainty, the strategic problem for the US arose because it knew that a shift in power was occurring, leading to the insight that such a development would weaken its future bargaining position.

However, the strategic problem for the United States did not depend on knowing the full extent of the shift with certainty, but on the expectation that continued peaceful settlement would further weaken its future bargaining position. Therefore, it started deterring the Chinese semiconductor industry with increasingly restrictive measures. First with the addition to the entity list of one of China's leading semiconductor firms (Federal Register of the US, 2019a), then banning exports to this entity (Federal Register of the US, 2020a), an later the addition of multiple companies to entity lists(Federal Register of the US, 2019b, 2019c) (Federal Register of the US, 2020b) until the imposed threat for the US semiconductor industry was detected and China had been identified as a strategic competitor in this domain (White House, 2021).

From this moment forward, both the scope of Chinese capability development and the extent of China's ability to absorb and overcome restrictive pressure were unambiguous enough to go into what the model described as decisive restriction. In reality, the US increased the escalatory potential by directly attacking the chokepoint of the Chinese semiconductor value chain, high-end semiconductor manufacturing equipment, thus ending the bargaining-driven interaction and initiating an interaction that focused on coercing action through high-impact measures on the Chinese semiconductor value chain and its development efforts. Thereby, denoting the end of phase two.

4.3. Phase 3: Peaking Escalation and Brinkmanship

Phase 2 has shown that the escalation between the United States and China is not limited to repeated bargaining and limited restrictive rounds. Under the given conditions of extensive capability shifts and information gains through screening and belief updating, the interaction reaches a point at which continued settlements no longer remain strategically attractive for the United States. Thereby, phase 2 explains why the interaction between the United States and China can culminate in a decisive escalation, but it does not fully explain the strategic logic of the conflict once this escalation has been triggered. Once the decisive escalation is chosen, the US increases the escalatory potential by targeting the core bottlenecks of the Chinese semiconductor value creation to counteract the powershift in favour of the Chinese industry. The strategic problem, therefore, changes from managing bargaining under asymmetric information and a power shift to how such broader escalation unfolds under rising systemic risk.

To explain how the conflict unfolds once decisive escalation has been triggered and which incentives lead both sides to confront each other with broader restrictive measures, despite rising costs and systematic risk, the interaction will be analysed through a separate game in phase 3. By deriving the model from Powell (2015), who integrated the trade-off between power and risk into the logic of a brinkmanship game, the analysis of the third phase can explain why the interaction between the US and China does not necessarily culminate in complete techno-economic decoupling.

Relevance and of Brinkmanship for This Case

The interaction between the US and China in Phase 3 must be classified as a Brinkmanship game, as additional restrictive steps of the confrontation at this time not only weakened the opponent directly but also raised the shared risk that the confrontation spills into broader techno-economic decoupling. The consequences of a scenario where a foundational upstream input like semiconductors is disrupted would extend across more than 300 downstream industries (SIA, 2021b)

The Innovation Technology & Innovation Foundation (ITIF) (2025) presented an analysis of the consequences of decoupling in the semiconductor industry. In a full-decoupling scenario, US firms would lose about $77 billion in semiconductor sales in the initial year, around $14 billion in R&D, more than 80,000 industry jobs, and almost 500,000 downstream jobs. China, by contrast, would face the disruption of external supply, as its market depends on imports of semiconductors from the US, valued at US$77 billion (Innovation Technology & Innovation Foundation, 2025).

The consequences would also be global, since semiconductors enable more than $7 trillion in annual downstream economic activity, equivalent to roughly 7 percent of world economic activity (Innovation Technology & Innovation Foundation, 2025).. The ITIF(2025) also argues that weaker semiconductor revenues and lower R&D would spill over into cloud computing and data centers, AI and machine learning, telecommunications and 5G, high-performance computing, enterprise software, and consumer electronics would face higher costs, slower innovation, and lower competitiveness as semiconductor revenues and R&D weaken (Innovation Technology & Innovation Foundation, 2025).

Taken together, these effects suggest that decoupling in the semiconductor industry would constitute a brinkmanship scenario as each additional restrictive move can increase pressure on the opponent while simultaneously raising the shared risk of a broader outcome whose costs neither side can fully control (Nalebuff, 1986).

4.3.1. Model of Phase 3

In this game of techno-economic brinkmanship, the United States U takes the role of the challenger, as it initiates the restriction by choosing the restriction intensity p, while China C acts as the defender that responds to this move by determining the retaliatory risk of escalation r. U afterward must decide whether to stay firm ($fU = 1$) or to quit the confrontation ($f_U = 0$). If it stays, C must make the same decision ($f_C \in [0,1]$). If both decide to stay firm, the interaction ends, and the outcome is determined by lottery (See Figure 14).

Figure 14

Game-Tree Model 3

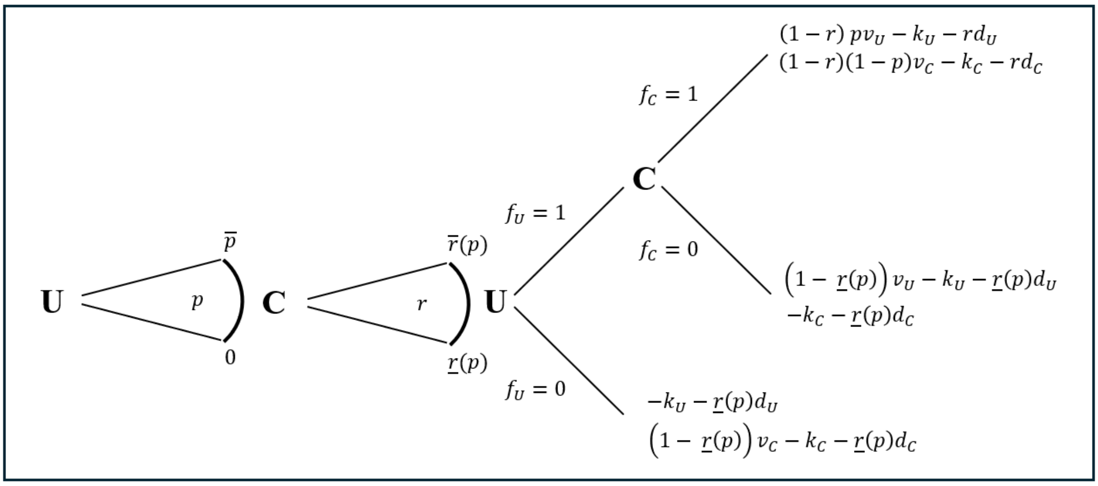


Illustration developed by the author

The higher the restriction intensity chosen by U, the greater its expected coercive effectiveness, if the confrontation does not lead to techno-economic decoupling. Moreover, a higher degree of restriction intensity leads to a higher risk of escalation and a less controllable disruption of the techno-industrial relationship between the two countries. U formally starts the game by choosing whether to impose p or not, and the game ends when U refuses to escalate, so that C retains its strategic-industrial position, which is worth v_C, while U's payoff is normalized to zero. In contrast, if U initiates an escalation, it chooses the restriction intensity $p \in (0, \overline{p}]$, which describes the probability that U's restrictions succeed in degrading China's strategic-industrial position, thereby preventing continuous shifts of industrial capabilities. The probability that U's restrictions fail is $1 - p$. The upper bound $\overline{p}$ denotes the maximum restriction intensity which is available to U. Moreover, any choice of choosing $p > 0$, lead to escalation costs k_U and k_C respectively.

Increasing the restriction intensity leads to a higher risk of retaliatory escalation. Once U has chosen p, C chooses the level of retaliatory escalation risk r, which represents the risk that the confrontation expands beyond targeted restrictions into broader techno-economic decoupling. This risk r is directly bounded by p, by a lower bound $\underline{r}(p) \leq r$, as well as an upper bound $\overline{r}(p) \geq r$, which defines the range of the extent of risk C can choose to retaliate as $\underline{r}(p) \leq r \leq \overline{r}(p)$. The lower bound $\underline{r}(p)$ captures the minimum retaliatory escalation risk already embedded in bringing p to bearwhereas the upper bound $\overline{r}(p)$ captures the maximum level of retaliatory action that C can generate in response to U's move. Moreover, the lower bound of retaliatory escalation risk is defined by $\underline{r}(0) = 0$, $\underline{r}'(p) > 0$, and $\underline{r}''(p) > 0$ as long as $\underline{r}(p) < 1$. The same definitions also all apply to the upper bound $\overline{r}(p)$. The difference between $\overline{r}(p) - \underline{r}(p)$ is defined as the scope of retaliatory escalation, which is assumed to increase at an increasing rate with rising restriction intensity. An example which would satisfy these conditions is $\underline{r}(p) = \underline{h}p^2$ and $\overline{r}(p) = \overline{h}p^2$ with $\underline{h} < \overline{h}$.

The two risk functions and their relation capture the stability-instability paradox, since a higher restriction intensity leads to a higher probability of deciding the conflict, but at the same time increases the risk of techno-economic decoupling. Therefore, higher stability in the outcome of the escalation leads to instability concerning the catastrophic outcome, which both parties have incentives to avoid. Additionally, the stability-instability paradox highlights that the scope of risk which can result from escalation might be exogenously given, but the actual level of risk is endogenously determined by the defender C.

After U chooses p and C chooses r, U decides whether to quit or continue its restricting behaviour. The advantage of quitting is that U and C only have to face the minimum retaliatory escalation risk $\underline{r}(p)$, instead of the potentially higher risk r. The disadvantage is that quitting means foregoing any chance of prevailing in the confrontation. Accordingly, if U quits, its payoff is:

$$\left(1 - \underline{r}(p)\right)(0 - k_U) - \underline{r}(p)(k_U + d_U) \Leftrightarrow -k_U - \underline{r}(p)d_U$$

The payoff of zero represents the non-existent value U derives from restrictive escalation and setting back C's capability development. d_U on the other hand, describes the costs U would have to face in the case of techno-economic decoupling. At the same time, C's payoff in the case of U quitting is:

$$\left(1-\underline{r}(p)\right)(v_C-k_C)-\underline{r}(p)(k_C+d_C) \Leftrightarrow \left(1-\underline{r}(p)\right)v_C-k_C-\underline{r}(p)d_C$$

This payoff represents C's expected value of retaining its strategic position. Vice versa, if U stands firm in its restrictive escalation and C backs down to stop the escalation spiral, the respective payoffs for U and C are:

$$\left(1-\underline{r}(p)\right)(v_U-k_U)-\underline{r}(p)(k_U+d_U) \Leftrightarrow \left(1-\underline{r}(p)\right)v_U-k_U-\underline{r}(p)d_U$$

v_U denotes the value U derives from sustaining its leading strategic-industrial position. C's payoff, on the other hand, becomes:

$$\left(1-\underline{r}(p)\right)(0-k_C)-\underline{r}(p)(k_C+d_C) \Leftrightarrow -k_C-\underline{r}(p)d_C$$

In this case, the payoff of zero represents the absence of industrial development for C's semiconductor industry.

If both states choose not to leave the conflict, U succeeds in degrading China's strategic-industrial position with the probability p. The expected payoffs for this case are, respectively:

$$p(v_U-k_U)+(1-p)(0-k_U) \Leftrightarrow pv_U-k_U \text{ and}$$

$$p(0-k_C)+(1-p)(v_C-k_C) \Leftrightarrow (1-p)v_C-k_C$$

This is valid as long as the contest between C and U does not escalate into the catastrophe scenario with probability $(1-r)$. The overall expected payoff, which incorporates the risk of techno-economic decoupling, is defined as:

$$(1-r)(pv_U-k_U)-r(k_U+d_U) \Leftrightarrow (1-r)\,pv_U-k_U-rd_U$$

$$(1-r)[(1-p)v_C-k_C]-r(k_C+d_C) \Leftrightarrow (1-r)(1-p)v_C-k_C-rd_C$$

A further key concept of the model is resolve. In the present context, resolve denotes the maximum systemic escalation risk of techno-economic decoupling that a state is willing to run in order to preserve its own strategic-industrial position under confrontation. Thus, resolve is defined as the maximum risk a state would run in order to sustain its industrial position. U's resolve is derived by comparing the payoff of continuing and quitting its restrictive behaviour. Hence, U prefers to stand firm facing a risk r if:

$$(1-r)\,pv_U-k_U-rd_U \geq -k_U-\underline{r}(p)d_U$$

$$\frac{pv_U+\underline{r}(p)d_U}{pv_U+d_U} \geq r \equiv R_U(p)$$

Correspondingly, C compares its payoff of continuing to quitting, therefore C prefers to stand up to the restrictions if:

$$(1-r)(1-p)v_C - k_C - rd_C \geq -k_C - \underline{r}(p)d_C$$

$$\frac{(1-p)v_C + \underline{r}(p)d_C}{(1-p)v_C + d_C} \geq r \equiv R_C(p)$$

The resolve frontiers $R_U(p)$ and $R_C(p)$ therefore, lead U and C to quit the escalation, when $r > R_U(p)$ for U or for C when $r > R_C(p)$.

Taken together, the phase 3 model is analysed as a reduced-form brinkmanship game under complete information. The model formalises the third phase of the chip war as an interaction in which broader restrictive pressure may improve the strategic position of U under limited confrontation, but at the price of increasing the systemic retaliation risk that can lead to techno-economic decoupling of both industries, which U as well as C ultimately seek to avoid. The resolve of both countries describes how far they would go in risking an escalation that would end in decoupling. U's and C's high resolve, as well as the high restriction intensity p constitute the framework for a scenario of this model, which is able to illustrate the incentives under which both the United States and China pursued their confronting industrial strategies.

4.3.2. Classification of Model Variables

To identify the relevant equilibrium path, the balance of resolve must first be specified. This requires a discussion of the relative magnitude of the strategic stakes v_U and v_C, the costs of decoupling d_U and d_C, as well as the extent of the restriction intensity p and the scope of retaliatory escalation $\overline{r}(p) - \underline{r}(p)$ that characterises the interaction of both states in the third phase.

The strategic stakes of the two sides under limited confrontation are very high and broadly comparable, even though they derive from different strategic objectives. For U, v_U reflects the value of preserving its leading strategic-industrial position in the semiconductor sector and, with it, the ability to contain further shifts in relative technological power and solely profiting from new technological discoveries across multiple domains. For China, v_C reflects the value of retaining its strategic-industrial position as well as the possibility of continued technological catch-up and greater industrial autonomy. Both countries have made claims to be the leading technological nation in the field of semiconductors in the future, and both countries have launched extensive financial, legislative as well as infrastructural initiatives to pursue this goal. Accordingly, the third phase of the conflict is not characterised by low stakes on either side, but by a confrontation in which both actors have very strong and comparable incentives to avoid conceding their respective strategic positions. Therefore, the respective value of the strategic stakes captured by v_U and v_C can be regarded as broadly comparable, rather than favouring either side.

The costs of full techno-economic decoupling d_U and d_C comprises the wider costs that would arise from the complete decoupling of the Chinese and US semiconductor industry. This would include substitution and opportunity costs of technological development, across the semiconductor industry as well as every downstream industry dependent on semiconductors and chips. Hence, d_U and d_C must be understood as very high for both industries. However, in this case, the magnitude of both variables is not comparable, due to the nature of the respective restrictions both states install against each other. While the US restricts China's access to high-end semiconductor manufacturing equipment to impede its high-end development, China is able to set back the entire value chain of the US, as it dominantly controls the access to the most upstream raw materials of the value chain. Rare earths are indispensable for the production of semiconductors, and therefore, it can be assumed that the substitution and opportunity costs are plausibly higher for the United States. China, on the other hand, would still be suffering severe losses in frontier development and high-end technological catch-up, but would retain greater continuity across larger parts of its broader industrial base. Hence, while both sides face very high costs from decoupling$d_U$it can be argued that $d_C > d_C$.

Given the restrictive build-up from previous phases and the targeting of key bottlenecks of the Chinese semiconductor industry, the probability that U's restrictions succeed in degrading China's strategic-industrial position is comparably high; therefore, the magnitude of the restriction intensity p for the scenario of phase 3 must also be understood as high.

Complementary, the upper bound of retaliatory escalation risk $\overline{r}(p)$ is substantial, because Chinese countermeasures such as restrictions on rare earths and other critical inputs could sharply increase the expected costs of continued escalation for the United

States and thus, intensify the danger of broader techno-economic decoupling. China is therefore plausibly able to raise r far beyond the minimum level $\underline{r}(p)$ making a purely minimum-risk equilibrium path unlikely.

Overall, this parameter constellation suggests that the balance of resolve in the third phase of the conflict does not favour the United States. Since the strategic stakes captured by v_U and v_C are broadly comparable; the more consequential asymmetry lies in the systemic breakdown costs of full techno-economic decoupling. If these costs are plausibly higher for the United States than for China, then the maximum systemic escalation risk that U is willing to run is correspondingly constrained more strongly. At the high restriction intensity relevant to phase 3, the balance of resolve therefore tilts toward China, even though both sides continue to face very high stakes in the confrontation.

4.3.3. Relevant Equilibrium Path for the Final Escalation

To determine the relevant equilibrium path, it must be specified whether C sticks to the lower bound of the retaliatory risk response or raises the risk of escalation beyond the lower bound by choosing $r > \underline{r}(p)$. Under the condition of complete information, bluffing or choosing $r > \overline{r}(p)$ is always out of equilibrium (Powell, 2015), there exist three scenarios that can determine the interaction and outcome between the states. First, C is unwilling to outbid U, because $R_C(p) < R_U(p)$. Second, C is willing but unable to outbid U, since $R_C(p) > R_U(p)$, but $\overline{r}(p) < R_U(p)$. And lastly, C is willing and able to outbid U, as $R_C(p) > R_U(p)$ and $\overline{r}(p) > R_U(p)$. Given the previously established balance of resolve and the high upper bound of retaliatory escalation risk, the latter is most plausible. This turns this interaction into a contest of resolve, where the outcome is determined by

$$R_U(p) < r \leq \min\{R_C(p), \overline{r}(p)\}$$

Since the balance of resolve arguably tilts toward C and the upper bound of reciprocal systemic escalation risk is sufficiently high, C can raise r beyond $\underline{r}(p)$ to meaningfully deteriorate the expected payoff of continued escalation for U. Consequently, U must consider the possibility that further retaliatory escalation will expose it to a broader retaliation as well as higher risk for decoupling.

The relevant equilibrium path is therefore one of reciprocal brinkmanship under rising systemic risk; hence, the conditions under which this contest of resolve leads to a temporary ceasefire must be investigated to understand the termination of phase three and why the conflict is stabilised at a lower level instead of escalating into techno-economic decoupling.

4.3.4. Condition for De-escalation

Although the relevant equilibrium takes the form of a contest of resolve, this does not imply that escalation continues indefinitely. Any increase in retaliatory escalation risk may strengthen coercive pressure in the short run but simultaneously raise the expected costs of broader escalation. This effect is disproportionately evident due to the definitions of the risk functions $\underline{r}'(p) > 0$, and $\underline{r}''(p) > 0$, which are also valid for $\overline{r}(p)$. Therefore, high levels of restriction intensity become increasingly less attractive as the trade-off between restriction intensity p and escalatory risk through retaliation r increasingly constrain U's payoff and the amount of power it is rational to bring to bear.

Consequently, the optimal $p = p^*$ for U cannot be $\overline{p}$ in the case of a contest of resolve. Furthermore, p^* must be greater than the level of $\tilde{p}$, the restriction intensity at which the maximal risk that U is willing to take equals the maximum risk that C can generate at given $\tilde{p}$. Accordingly, $\tilde{p}$ satisfies the condition $R_U(\tilde{p}) = \overline{r}(\tilde{p})$. If p^* was to be smaller than $\tilde{p}$, then U's resolve would exceed the upper bound of risk C could invoke $R_U(p) > \overline{r}(p)$, thereby outbidding C. This case does not match the contest of resolve, as this case has been defined with $\overline{r}(p) > R_U(p)$.

Since $p^* > \tilde{p}$, $R_C(p) > R_U(p)$ as well as $\overline{r}(p) > R_U(p)$, every attempt of U increasing the restriction intensity p beyond $\tilde{p}$ would lead to C implementing $r > R_U(p)$. Hence, U sets $p \leq \tilde{p}$, where it cannot be outbid by C, and C consequently sets $r = \underline{r}(p)$. Under such conditions, U's payoff is: $\left(1 - \underline{r}(p)\right) pv_U - k_U - \underline{r}(p)d_U$ for $p \in (0, \tilde{p}]$. The maximum occurs at either 0 or $\tilde{p}$ for p (Powell, 2015). The condition for implementing $\tilde{p}$ is fulfilled if:

$$-k_U < \tilde{p}v_U - k_U - \underline{r}(\tilde{p})(\tilde{p}v_U + d_U)$$

$$d_U < \frac{\left(1 - \underline{r}(\tilde{p})\right) \tilde{p}v_U}{\underline{r}(\tilde{p})}$$

Otherwise, U will refuse to exert restriction intensity and $p = 0$.

Taken together, the relevant equilibrium path under the discussed parameters is one in which the confrontation takes the form of a contest of resolve but does not escalate without limit. As $\overline{r}(p) > R_U(p)$, the retaliatory risk that C can create becomes sufficient to outbid the level of retaliatory risk U is willing to bear, making further increases in restriction intensity irrational for U. Additionally, the framework suggests that under the given parameters of a conflict of resolve, it is rational for U not to restrict C.

In this sense, the model shows that the logic of phase three is not one of unlimited escalation toward full decoupling, but one of constrained brinkmanship under rising systemic risk. The outcome is thus determined by the point at which the trade-off between coercive pressure and retaliatory escalation risk binds strongly enough to prevent further broad-based escalation.

4.3.5. Real-Life Interpretation of the third Phase

This model abstracts from the historical interaction of phase 3 in several important aspects. Instead of reproducing the escalation as a process with multiple actions and reactions unfolding over roughly two years, it condenses the strategically most relevant logic of the confrontation into a reduced form of a strategic game under complete information. Therefore, restriction intensity and retaliatory escalation risk are represented as single strategic choices, although in reality, both consisted of a sequence of heterogeneous measures that increased economic and political pressure. Moreover, the model treats the United States and China as unitary actors and therefore abstracts from the role of firms, allied governments, regulatory authorities, and domestic political constraints. Finally, complete information should be understood as an analytical simplification that abstracts from remaining informational frictions. Thus, the strategic trade-off between coercive pressure and retaliatory escalation risk is isolated.

While phases 1 and 2 were primarily shaped by uncertainty about China's capability development and the implications of the underlying shift in industrial power, the interaction across these two phases had already revealed the main direction of that capability shift. The transition to phase 3 was then triggered by a decisive escalation in which the United States changed the degree of escalation of its restrictive measures. Through the implementation of the trilateral agreement between the US, Japan, and the Netherlands, which limited China's access to high-end semiconductor manufacturing equipment, the confrontation moved from repeated bargaining and entity-level restrictions to direct pressure on these core vulnerabilities. The strategic problem was no longer primarily how to locate a mutually acceptable settlement under capability uncertainty, but how much risk of broader and less controllable techno-economic decoupling each side was willing to bear in order to coerce the other.

The restriction intensity p therefore corresponds to the degree of escalatory pressure the US directed against the Chinese semiconductor industry when it limited its access to semiconductor manufacturing equipment through the trilateral agreement and later through the export-control measures against the Chinese semiconductor industry. In contrast, the risk of retaliatory escalation r(p) comprises the Chinese capabilities in retaliating against the US actions through its own export-control measures, directing the US chokepoint of upstream raw materials, which are critical for the US semiconductor production and mostly controlled and sourced by China.

The US restriction level served as a starting point for the determination of the Chinese retaliatory response r(p). This assumption is backed by the initial escalation leading to phase 3, the higher number of restrictions that have been introduced against the Chinese by the US, the escalatory level of the measures, as well as the last restriction round before the meeting in Kuala Lumpur. The premise of the model that the extent of p determines the range of retaliation risk is thus reflected in the dynamics of the third phase of the chip war (Compare results of table phase 3).

Given the previously established balance of resolve, which suggests that China and the US would face the costlier consequences from decoupling $d_U > d_C$, the relevant equilibrium path of phase 3 is one in which China is both willing and able to outbid the United States in retaliatory risk. Therefore, the Chinese side is able to impose a higher degree of retaliatory measures on the US than the US is credibly willing to endure.

The de-escalation condition derived in the preceding sub-chapter then narrows the relevant US choice to either 0 or $\tilde{p}$, since any increase in restriction intensity beyond $\tilde{p}$ would enlarge the retaliatory risk structure to a level that China can exploit to make further escalation irrational for the US. Given that the derived assumptions about the balance of resolve and the ratio between the costs of decoupling are true, the real-life interaction between the two countries suggests that both countries reached a point p beyond $\tilde{p}$, as the latter settlement in Kuala Lumpur de-escalated the restrictions back to the level prior to the latest restriction round. The Kuala Lumpur settlement therefore, denotes the restriction intensity and retaliatory escalation $\tilde{p}$ and r($\tilde{p}$). Consequently, the Affiliates' 50%-Rule for End-User Controls denoted a restriction intensity $p > \tilde{p}$.

Phase 3 thus ends in the model at a bounded equilibrium $\tilde{p}$ and r($\tilde{p}$), where continued coercive pressure remains possible, but any further increase in restriction intensity becomes irrational because it enlarges the retaliatory risk of broader techno-economic decoupling and equilibrium. In empirical terms, the Kuala Lumpur settlement reflects this logic by bringing the confrontation back from a restriction level $p > \tilde{p}$ and reaching a temporary settlement that dismisses the Affiliates' 50%-Rule for End-User Controls from the US and the export controls on rare earth items from the PRC, but retains the residual restrictive framework on both sides.

5. Conclusion

The Chip War denotes the strategic confrontation between the United States and China over leadership, control, and future advantage in the semiconductor industry. Over the course of this confrontation, both states used semiconductor-related industrial and trade policies to shape dependencies, alter relative industrial capabilities, and strengthen their future bargaining positions. The escalation of the Chip War between the mid-2010s and 2025 is therefore best understood as a dynamic bargaining process in which uncertainty, asymmetric information, and commitment problems progressively undermined the prospects for durable settlement and pushed the confrontation through successive phases of escalation. While the first two phases were structured by uncertainty about capabilities and commitment problems, the final phase was shaped by uncertainty about resolve and followed the logic of brinkmanship.

To answer the research question, the empirical reconstruction identifies the strategic and industrial conditions under which the three-phase escalation of the Chip War takes place. By tracing shifts in relative industrial capabilities, strategic chokepoints, and the political interaction between both states, it establishes the framework conditions that make the course of escalation analytically intelligible. On this basis, the formal models condense the interaction into phase-specific strategic games in order to isolate the decisive mechanisms that drive its escalation under changing conditions of uncertainty, commitment problems, and later resolve.

The strategic and industrial conditions identified in the empirical reconstruction reveal a pattern of escalation that leads from long-term capability-building and protective measures to firm-level restrictions and, ultimately, to direct attacks on the central chokepoints of the opposing semiconductor value chain. The framework conditions of this development comprise a sustained catch-up by the Chinese semiconductor industry, which narrows the gap in industrial and technological capabilities without overturning the United States' leading industrial position. At the same time, neither side achieves full self-sufficiency, as both remain constrained by distinct strategic chokepoints that are largely controlled by their political adversary. The course of the Chip War is therefore shaped both by a relative shift in industrial capabilities and by persistent mutual vulnerabilities, which together reinforce the escalatory potential of the rivalry.

The analysis of the interaction under these conditions shows that the Chip War evolves through distinct phases of escalation driven by changing informational and strategic conditions. It further suggests that non-military instruments such as industrial policy, export controls, and chokepoint restrictions can generate strategic dynamics similar to those associated with bargaining failure and brinkmanship in classical conflict settings. The broader contribution of this thesis therefore lies in showing that game-theoretic concepts commonly used to explain war and crisis escalation can also be applied to clarify the strategic logic of geo-economic confrontation in the semiconductor industry. Future research can build on this framework by incorporating strategically relevant third actors, most notably Taiwan, in order to examine how additional players reshape the bargaining dynamics of the Chip War. It may also extend the present analysis beyond reconstruction by using the strategic logic developed in this work to assess the future interaction between China and the US after the ending of the temporary restrictive ceasefire.

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Appendix

1) Game-Theoretical Basics

To introduce the unfamiliar reader to the concepts discussed in this thesis, this Appendix chapter introduces the most common elements of Game Theory.

1.1) Structural Framework for Game-Theoretic Analysis

To create a strategic game that resembles an interaction or specific situation, game theory classifies strategic situations into respectively two time-structural and informational dimensions. Whether players move and whether interaction is one-off or not defines the time structure of the players' interaction. What actors know and what they can observe frames their informational level. Depending on those four dimensions, different game-theoretical frameworks can be drafted to illustrate specific situations as a game.

The first time-structural dimension describes whether a game is simultaneous or sequential. In a simultaneous game, players usually decide at the same point in time about their moves and therefore cannot observe the other's action. In a sequential game, however, at least one player moves after observing an earlier move. This observation is then used as the basis for the optimal decision of the follower.

How many times an interaction between the players occurs defines whether a game is static or dynamic. A static game is characterised by one interaction, and therefore one decision per player, like in a one-time auction bid. On the other hand, the dynamic game has multiple stages of interaction and allows the players to update their beliefs and strategies over time based on the history of past interactions. An auction with repeated bidding would be the exemplary equivalent.

Whether players have information about the participating players of the game, the set of possible actions, the payoffs of interactions, as well as the factors that influence outcomes, determines whether a game is played under complete or incomplete information. When all players have access to all the information the game is described as a game under complete information. If this is not the case, it is a game under incomplete information. A classic example of complete information is the Prisoner's Dilemma, where both players know the outcomes if they and their counterpart do or do not cooperate with the authorities.

Perfect or imperfect information of a game is determined by the players' ability to observe their opponent's choice of action. In some strategic situations, all relevant actions are transparent. Therefore, each side can identify what the other has done, which steps have been taken, and how the present situation has emerged from these observable moves, like in a game of chess. In other situations, however, observation is limited, as a player may know the general setting and still be unable to determine which specific actions have occurred, either because certain steps are taken privately or because only indirect indicators are available. Playing Poker would be an example of imperfect information, as the players face limited observability and lack crucial information on how certain game situations emerge, while the same rules and objectives apply to all players.

1.2) Elements of Game-Theoretic Modelling and Bargaining

To understand how the semiconductor rivalry between the US and China can be illustrated through strategic games, the logic of game theoretic modelling and the role of bargaining, uncertainty and private information for modelling and interaction must be understood. Furthermore the depiction of this abstraction of reality must be discussed.

Game-Theoretic Modelling

Game-theoretic modelling is a method of reducing the complexity of real-world interactions to their strategically most relevant elements. While reproducing reality in all its detail would be too multi-dimensional to be represented in full without losing analytical clarity, modelling simplifies an interaction into formal structure with actors, payoffs, preferences, choices, and outcomes, which allow conclusions about the motivation behind actions (Brams, 1993). This abstraction enables the isolation of strategic logic that connects the decisions of an actor to its counterpart's anticipated response. Thus, game-theoretic modelling captures the essential mechanisms of interdependent decision-making in an analytically tractable form, and allows conclusions about the strategic incentives that shape action and interaction (Osborne, 2003).

A game-theoretic model is not a simplification of reality that follows arbitrary guidelines on how to be constructed. The basic framework for the construction is captured through the strategic framework which must be able to capture the structure of the interaction it is supposed to represent. The strategic framework defined by the informational dimensions of completeness and perfection, as well as by the time-structural dimensions of simultaneity and repetition (Brams, 1993), determines the sequence of moves, the degree of uncertainty, and the extent to which uncertainty can be reduced through observability and screening. Thus, the framework of these two dimensions determines how actors make decisions, what they know when making them, and how their interaction is represented analytically within the model.

Core Elements of Game-Theoretic Modelling

The core elements of game-theoretic models can be summarized as players, their actions and strategies, payoffs and preferences, as well as outcomes and the equilibria through which these outcomes are analysed.

Players or actors in a game are the entities that make decisions about actions and strategies that define the course and outcome of the game. Players make decisions under consideration of the reaction of other players and the consequences of their actions. Therefore, they make decisions under strategic interdependence (Osborne, 2003).

Actions describe the options that players can choose from at every decision node. A strategy, by contrast, is broader than a single action and can be understood as a contingent plan of behaviour that specifies how a player acts across possible periods of interaction (Brams, 1993).

The consequences of actions and strategic choices are evaluated through payoffs (Osborne, 2003). Payoffs are the element that enables preferences and transitivity of outcomes and therefore determine what strategies a player chooses under consideration of their counterpart's strategy.

Outcomes describe the result of the game under a given combination of choices. Since each player's strategy is constrained through strategic interaction and mutual interdependence, the central task of game-theoretic analysis is to determine which outcomes are likely to arise when each actor decides in anticipation of the other's behaviour and under the premise of payoff maximization (Brams, 1993). This is captured by the concept of equilibria. An equilibrium describes a constellation of strategies in which no player has an incentive to unilaterally deviate, given the strategies of the other players (Osborne, 2003). An equilibrium, therefore, identifies the strategic outcomes that are stable under the assumptions of the model and the rationality of the players (Brams, 1993). Thus, equilibria provide the analytical basis for evaluating how rational actors are expected to behave.

Bargaining as Strategic Interaction

Bargaining describes a form of strategic interaction in which players seek agreement over the division of gains that can be realised through cooperation. Since joint action can generate outcomes that are preferable to non-agreement, bargaining generally creates an incentive to settle (Powell, 2002). At the same time, however, each side aims to secure the most favourable share of these gains for itself. For agreement to emerge, there must therefore exist a feasible bargaining space within which both parties prefer settlement to the status quo. If no such settlement is reached, the status quo remains in place.

The existence of a mutually preferable bargaining range, however, does not determine which outcome within that range will ultimately be selected. The reason is that bargaining is not only cooperative, but also distributional (Schelling, 1956). Although both sides may prefer agreement to non-agreement, each additional gain secured by one actor reduces the share available to the other. The bargaining problem, therefore, lies not only in reaching an agreement, but in determining which division of the bargaining surplus is acceptable to both sides. Thus, the procedure through which bargaining is conducted, including who makes offers, in what order they are made, and whether outside options exist if no agreement is reached, influences the bargaining outcome (Powell, 2002).

One key aspect in shaping the procedure of bargaining is the expectation that all players have towards the bargaining outcome. Each side must form a judgement about what its counterpart is likely to accept, reject, or seek to revise, and thus, must position its own demands accordingly. Bargaining is therefore intrinsically strategic, because outcomes are shaped not only by the set of feasible agreements, but also by how actors anticipate responses and attempt to influence one another's expectations (Schelling, 1956). Therefore, the final settlement results from an interaction between bargaining space, procedural structure, and the strategic management of expectations.

Uncertainty from Imperfect and Incomplete Information

As in real life, players of strategic games do not always have full information on the preferences and actions of their opponents. While bargaining, the bargaining object is generally known to all players, but preferences, actions, histories of past actions, as well as the bargaining object's value, may not be perfectly observable for an opponent, and because of this, strategic games cannot always be represented as situations of full transparency (Osborne, 2003).

Imperfect information resulting from the inability to observe past decisions creates uncertainty about the situation in which a player finds itself in (Osborne, 2003). Consequently, a player must consider multiple scenarios for its own decision-making in order to make a strategically rational decision under uncertainty. In case of incomplete information, a player faces uncertainty regarding strategically relevant characteristics of the game, like preferences, capabilities, or payoffs of the opposing party. As a result, interdependent decision-making takes place under assumptions of the opponent's behaviour, thus affecting the interaction between the players (Osborne, 2003). As a consequence of this uncertainty, players create beliefs about the strategic capabilities and the strategic situation of their opponents and base their actions on those.

Private Information, Beliefs and Screening

Uncertainty does not arise only because the nature of a situation prevents full insight into all relevant information. Instead, it may also result from the fact that strategically relevant information is privately held by one player and deliberately concealed or misrepresented in order to improve its own bargaining position. Such private information includes information like intent, resolve, or capabilities, and as the inability to observe these characteristics deteriorates the opponent's strategic position, a player has an incentive to misrepresent this information (Fearon, 1995).

In order to face uncertainty from private information, players build beliefs about the strategic environment or the strategic capabilities of their opponents. Beliefs can therefore be defined as subjective assessments about unknown but strategically relevant characteristics of the game, which allow players to form expectations about the likely behaviour, intentions, or type of the opposing side (Osborne, 2003). Therefore, beliefs provide the basis on which players position themselves strategically and choose their actions under conditions of uncertainty. Thus, it provides the basis on which players choose their bargaining position under uncertainty.

To reduce the uncertainty arising from private information, beliefs must be tested and revised through strategic interaction. Such a reduction cannot occur through communication alone, as adversaries have incentives to conceal and misrepresent information in order to improve their bargaining position. Therefore, players need to take costly or strategically structured actions that induce responses from the opposing side that reveal their private information (Cramton, 1984). In bargaining, the reduction of intent, resolve, or capability uncertainty requires costly action in order to take away the option of "cheap talk" and thus deliberate misrepresentation of information from the opposition (Fearon, 1995). Screening offers, rejections, counteroffers, or other costly responses, though, can reduce uncertainty by making hidden characteristics partially inferable from observed behaviour. For such behaviour to be informative, the structure of interaction must make misrepresentation unattractive, so that different hidden types have incentives to respond differently (Cramton, 1984). Under such conditions, screening can reduce uncertainty, update beliefs, and affect the continuation of the game (Wolford, Reiter, & Carrubba, 2011).

Visual Representation of Games in Game Trees

The visual representation of strategic games aims to capture the structure of the interaction between players. While simultaneous interaction is often represented in the form of a matrix, sequential interaction is commonly illustrated through a game tree (Brams, 1993). In such a representation, the game begins at an initial node and unfolds along branches that depict the actions available to the players. Each decision node identifies the player whose turn it is to move, while terminal nodes describe the possible outcomes at the end of the interaction (Osborne, 2003). Thus, the strategic interaction can be represented through the order of decisions and successive strategic choices, which both determine how different courses of action lead to different results (Brams, 1993).

In case the level of uncertainty regarding a variable of the game is not determined by a player, the uncertainty can be illustrated through a move by Nature. This non-strategic actor assigns outcomes according to a fixed probability distribution instead of purposeful choice (Osborne, 2003). Nature is typically placed at a chance node from which branches emerge that correspond to possible states or signals with probabilities attached to the respective branches (Osborne, 2003). By adding Nature, game trees depict not only who moves when, but also how uncertainty enters the interaction and shapes the information under which later decisions are made. Thus, Nature represents exogenous uncertainty that affects the strategic environment faced by the players (Osborne, 2003).

In case a player cannot locate the decision nodes it finds itself in, because the same information is available in each case, these nodes are grouped into one information set. Such an information set is typically illustrated by a dotted line connecting the decision nodes of the player at a given time. Thereby, game trees do not only represent the sequence of play, but also the informational conditions under which decisions are made.

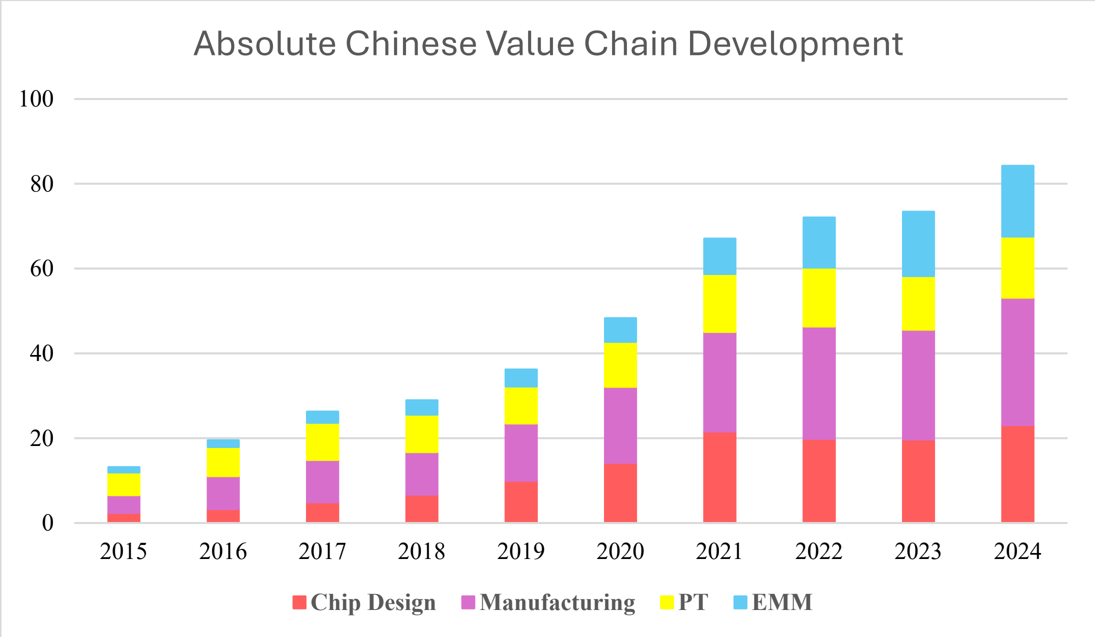
In bargaining games, a common way to illustrate proposals that are chosen from a range of possible distributions is in the form of a cone. While it is not a standardised form of illustration, it allows a visual representation of the lower and upper bounds of the possible proposal and thus, avoids creating a single path for every possible payoff distribution in a continuous spectrum (See figure 12 and figure 13).

Overall, game trees allow strategic interaction to be illustrated not merely as a set of possible choices, but as a structured process in which actions, responses, and informational constraints jointly shape the course of the game (Brams, 1993; Osborne, 2003).

2) Additional Tables from Chapter 3.1.

Figure 15

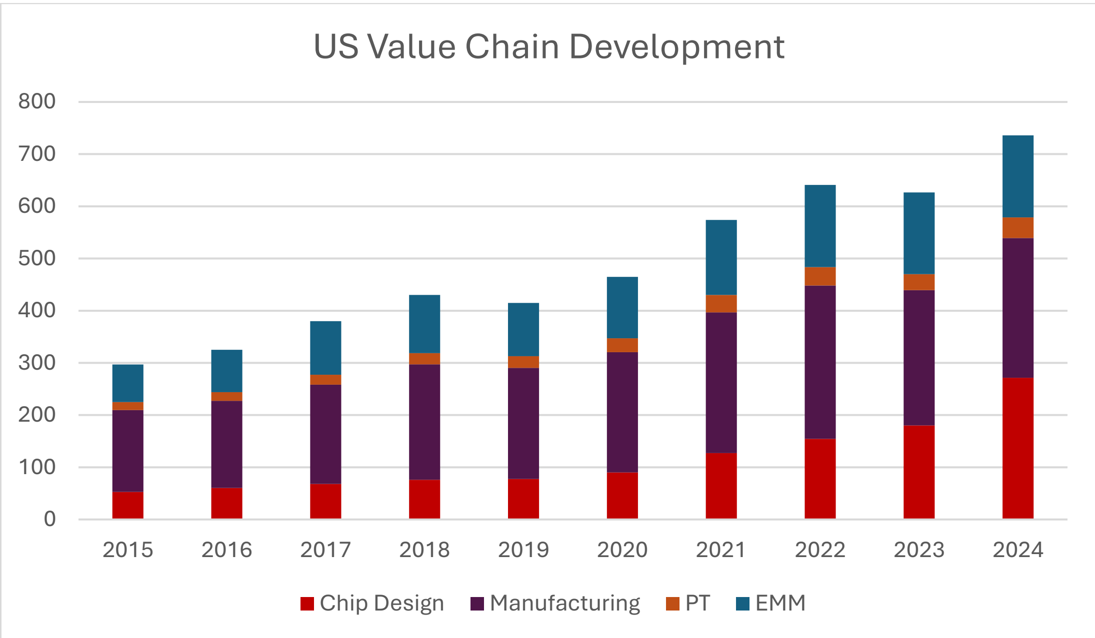
Absolute Chinese Value Chain Development



Revenue data derived from Moomoo (2024), categorised, analysed and summarised by the author

Figure 16

Absolute Value Chain Development US



Revenue data derived from Moomoo (2024), categorised, analysed and summarised by the author

Table 2

Growth Rates of the Value Chain Segments From 2015-2024

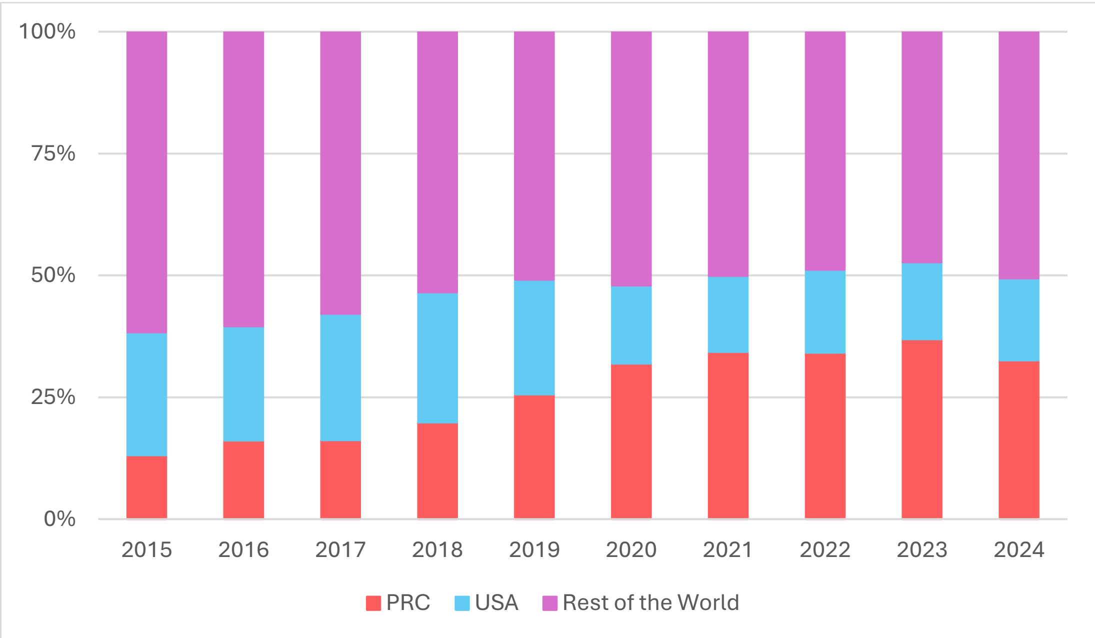
	Chip Design	Manufacturing	P&T	EMM	Σ Industry
China	864,88%	619,77%	167,56%	1258,59%	539,29%
USA	414,80%	70,67%	92,22%	118,61%	144,49%

Revenue data derived from Moomoo (2024), categorised, analysed and summarised by the author

For Patent Cooperation Treaty data, "PCT" has to be selected on the website of WIPO (2026) as the Intellectual Property Proxy. The indicator "5a – PCT publications by technology" and report type "yearly statistics" are selected for the same time frame. For the origin office and the field of technology, the selection is analogue to the patents.

Figure 17

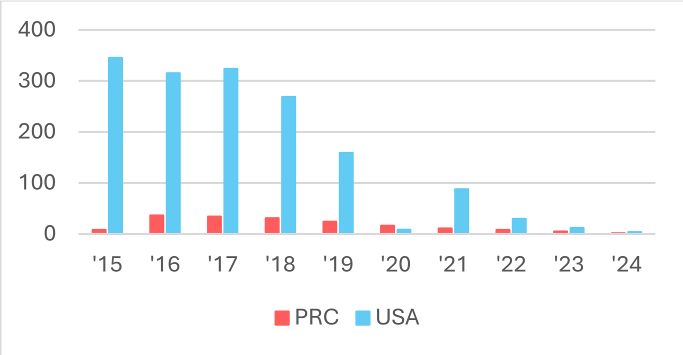
Patent Cooperation Treaties by Publishing Office



Patent data derived from WIPO (2026), contextualisation and illustration from the author

Figure 18

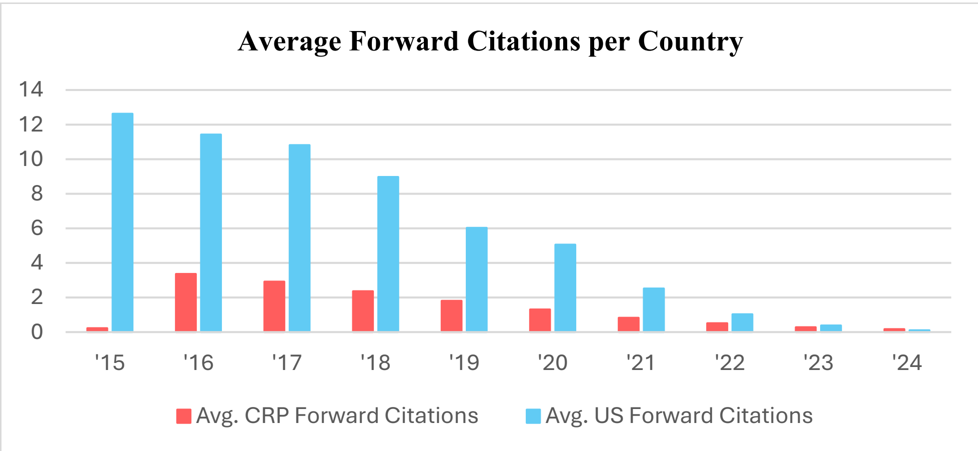
Average Citations of Top 1%



Patent data collected from Lens (2025), analysed and illustrated by the author

Figure 19

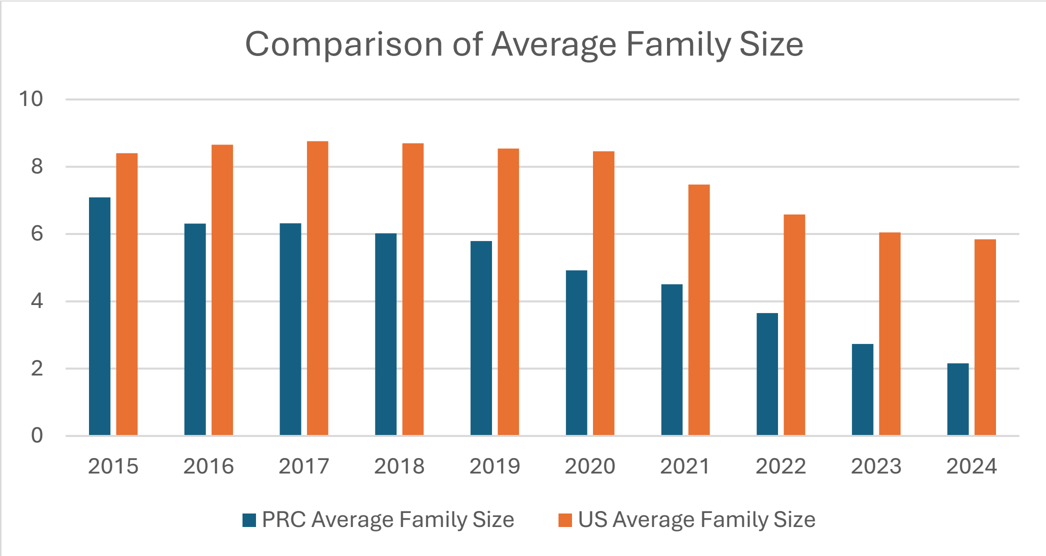
Average Forward Citations per Country



Patent data collected from Lens (2025), analysed and illustrated by the author

Figure 20

Comparison of Average Family Size



Patent data collected from Lens (2025), analysed and illustrated by the author

Table 3

Patent Data China

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Number of inventions	7564	12223	13994	15787	17550	19965	20990	22314	22358	18699
Average forward citations	0,22	3,36	2,92	2,36	1,81	1,31	0,83	0,51	0,28	0,17
Median citations	0	2	1	1	1	0	0	0	0	0
# of +5 citations	92	2934	2714	2388	1903	1449	764	382	103	29
# of +10 citations	19	951	867	648	517	297	116	48	3	3
# of +20 citations	0	179	195	124	85	36	6	1	0	0
Citation avg. of top 1% patens	8,05	36,34	34,07	30,96	24,03	16,21	10,96	8,07	4,91	1,42
Median family size	6	5	5	5	5	3	3	3	2	2
Average family size	7,09	6,31	6,32	6,02	5,79	4,92	4,51	3,65	2,74	2,16
# of 5+ family size	4638	6480	7578	8095	8968	8732	8936	7622	4512	1627
# of 10+ family size	2175	2748	3283	3458	3522	2905	2040	782	173	22
# of 20+ family size	185	294	323	301	226	121	59	21	14	2

Patent data collected from Lens (2025), analysed and categorised by the author

Table 4

Patent Data USA

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Number of inventions	16537	16650	17858	18217	19501	19228	20085	20731	18956	16201
Average forward citations	12,63	11,42	10,81	8,97	6,03	5,06	2,52	1,03	0,38	0,10
Median citations	5	4	4	3	2	2	1	0	0	0
# of +5 citations	8596	8127	8141	7369	6323	4437	2380	773	168	27
# of +10 citations	5055	4564	4374	3800	2890	1714	656	149	46	5
# of +20 citations	2224	1937	1836	1550	959	515	165	66	24	2
Citation avg. of top 1% patens	345,4	315,1	323,5	268,7	158,7	8,8	87,69	29,57	11,86	3,49
Median family size	6	6	7	7	7	7	6	5	4	4
Average family size	8,40	8,65	8,76	8,70	8,54	8,46	7,47	6,58	6,05	5,84
# of 5+ family size	11090	11445	12594	12797	14104	14234	13999	12259	9157	7363
# of 10+ family size	4858	5125	5797	5983	6198	5877	4455	3465	2973	2454
# of 20+ family size	869	967	1008	951	918	828	645	590	548	431

Data collected from Lens (2025), analysed and categorised by the author

3) Chapter 3.2 Timelines and Interaction

Table 5

Policy Measures conducted in Phase 1 of the Chip War (2014-2023)

Country	Year	Policy and Measure	Policy Type	Source
China	2014	Outline for Advancing the Development of the National IC Industry	Instructive	(State Council of the PRC, 2014)
China	2014	National IC Investment Fund - Phase I -	Financial	(Lan & Topp, 2024)
China	2015	Made in China 2025	Instructive	(State Council of the PRC, 2015a)
China	2016	13th Five-Year-Plan	Instructive, Structural	(National Development and Reform Commission of the PRC, 2016)
USA	2016	Blocking Acquisition of Aixtron's US business through Chinese Investment Fund	Restrictive	(US Department of Treasury, 2016)
USA	2017	President's Advisory Report on Semiconductor Leadership	Instructive	(President's Council of Advisors on Science and Technology, 2017)
USA	2017	Blocking Acquisition of Lattice Semiconductor through Chinese Investment Fund	Restrictive	(US Department of the Treasury, 2017)
China	2017	New Generation AI Development Plan	Instructive/ Structural	(DigiChina, 2017)
USA	2018	Blocking Acquisition of Qualcomm by Broadcom	Restrictive	(White House, 2018)
USA	2018	Export Control Reform Act	Structural	(Congress of the US, 2018)
USA	2018	Foreign Investment Risk Review Modernization Act	Structural	(US House of Representatives, 2018)
USA	2019	Addition of multiple Chinese semiconductor companies to the U.S. entity list (e.g. Huawei)	Restrictive	(Federal Register of the US, 2019a)

Table 6

Policy Measures conducted in Phase 2 of the Chip War (2019-2023)

Country	Year	Policy and Measure	Policy Type	Source
China	2019	National IC Investment Fund - Phase II -	Financial	(SIA, 2021b)
USA	2019	Addition of multiple Chinese semiconductor companies to the US entity list	Restrictive	(Federal Register of the US, 2019b, 2019c)
USA	2020	Export Ban to Huawei Technologies	Restrictive	(Federal Register of the US, 2020a)
China	2020	Introduction of the "Promoting the Integrated Circuit and Software Industries Act"	Structural	(State Council of the PRC, 2020)
China	2020	Introduction of Chinese Unreliable Entity List	Structural	(Ministry of Commerce of the PRC, 2020)
China	2020	Introduction of Chinese Export Control Law	Structural	(National People's Congress of the PRC, 2020)
USA	2020	Addition of multiple Chinese semiconductor companies to the US entity list (e.g. SMIC)	Restrictive	(Federal Register of the US, 2020b)
China	2021	14^{th} Five-Year-Plan	Instructive, Structural	(Center for Security and Emerging Technology, 2021)
USA	2021	Sanctions against Chinese chip and supercomputer entities	Restrictive	(Federal Register of the US, 2021)
China	2021	Introduction of the Anti-Foreign Sanctions Law	Instructive, Structural	(Communist Party Member Network, 2021)
USA	2021	100-Day Supply Chain Review	Instructive	(White House, 2021)
USA	2022	Introduction of the CHIPS and Science Act	Structural, Financial	(Congress of the US, 2022)
USA	2022	Introduction of Export Controls on Advanced Chips	Restrictive	(Federal Register of the US, 2022a)
USA	2022	Addition of multiple Chinese semiconductor companies to the US entity list (e.g. YMTC)	Restictive	(Federal Register of the US, 2022b)
USA	2023	Trilateral Agreement between US, Japan, & Netherlands on Chip Equipment Export Controls	Restictive	(Congress of the US, 2023)
China	2023	Ban of Micron products for key infrastructure	Restrictive	(DigiChina, 2023)

Table 7

Policy Measures Conducted in Phase 3 of the Chip War (2023-2025)

Country	Year	Policy and Measure	Policy Type	Sources
China	2023	Export Controls on Gallium and Germanium	Restrictive	(Ministry of Commerce, 2023a)
USA	2023	Verified End-User Authorisation for Samsung & SK Hynix in China	Restrictive	(Federal Register of the US, 2023a)
China	2023	Export Controls on Graphite	Restrictive	(Ministry of Commerce of the PRC, 2023b)
USA	2023	Advanced-Computing & Semiconductor End-Use Controls	Restrictive	(Federal Register of the US, 2023b)
USA	2023	Export Controls on Semiconductor Manufacturing Equipment	Restrictive	(Federal Register of the US, 2023c)
China	2024	National IC Investment Fund - Phase III -	Financial	(State Council of the PRC, 2024a)
China	2024	Rare Earth Management Rules	Instructive	(State Council of the PRC, 2024b)
China	2024	Dual-Use Export Control	Structural	(State Council of the PRC, 2024c)
USA	2024	Outbound Investment Rules	Structural	(Federal Register of the US, 2024a)
China	2024	Extension of Export Controls on Dual-Use Items & Metals	Restrictive	(Ministry of Commerce of the PRC, 2024)
USA	2024	Foreign Direct Product Controls on Advanced Computing & Semiconductor Manufacturing Equipment	Restrictive	(Federal Register of the US, 2024b)
USA	2024	Addition of over 100 Chinese Semiconductor Companies to the US Entity List	Restrictive	(Federal Register of the US, 2024c)
USA	2025	Additions of Advanced Computing Chips to the Entity List	Restrictive	(Federal Register of the US, 2025a)
China	2025	Anti-Dumping Investigation against Imported Analogue Chips from the US	Instructive	(Ministry of Commerce of the PRC, 2025a)
USA	2025	Addition of multiple Chinese Semiconductor Manufacturing Companies to the US Entity List	Restrictive	(Federal Register, 2025b)
USA	2025	Affiliates 50%-Rule for End-User Controls	Restrictive	(Federal Register of the US, 2025c)
China	2025	Extension of Export Controls on Rare Earths	Restrictive	(Ministry of Commerce of the PRC, 2025b)
USA & China	2025	Kuala-Lumpur-Agreement for a temporary restrictive ceasefire	Descalation	(Ministry of Commerce, 2025c; White House, 2025)

4) Chapter 4 Derivations and Proofs

Proof of h6:

When offering a pooling proposal x_{AS6} in the current period, U continues in h2 offering a pooling proposal x_{AS2} to C. For a strongly resilient C to accept this offer, the value C receives must be equal to or greater than the expected value from decisive restriction. This is given when:

$$x_{AS6} + \delta \frac{x_{AS2}}{1-\delta} \geq \frac{p}{1-\delta} - rC_T + \varphi g \Leftrightarrow x_{AS6} \geq \frac{p-\delta x_{AS2}}{1-\delta} - rC_T + \varphi g$$

Given this condition, U chooses the offer that gives C the largest admissible share while still satisfying acceptance, because any more generous offer would unnecessarily reduce U's own payoff. Accordingly, the optimal pooling offer that remains on the equilibrium path is:

$$x_{AS6} = \max\left\{\frac{p - \delta x_{AS2}}{1 - \delta} - rC_T + \varphi g, \varphi g\right\}$$

Under this condition, C receives at least its autarky share φg, which is the smallest possible offer U can make to C. As in prior histories, the pooling proposal preserves the uncertainty about C's resilience type. The game, therefore, continues under incomplete information, and the interaction moves into the post-shift continuation.

By contrast, a separating proposal x_{AW6} must be high enough that the weakly resilient type prefers acceptance to rejection, while being unattractive to the C with strong resilience. Since the separating proposal leads to the identification of C's resilience type, the equilibrium path continues in h1. Therefore, a separating proposal in h6 which leads to h1 is being preferred to restriction when:

$$x_{AW6} + \delta \frac{x_{AW1}}{1 - \delta} \geq \frac{p}{1 - \delta} - rC_W + \varphi g$$

$$x_{AW6} \geq \frac{1}{1 - \delta}(\mathrm{p} - \delta x_{AW1}) - rC_W + \varphi g$$

This denotes the upper bound for the separating proposal, while the lower bound is defined as:

$$\frac{p}{1 - \delta} - rC_S + \varphi g > x_{AW6} + \delta\left(\frac{p}{(1 + \varDelta)(1 - \delta)} + (\varphi g - rC_S)\right)$$

$$\frac{1}{1-\delta}\left(p-\delta\left(\frac{p}{(1+\Delta)}\right)\right)+(1-\ \delta)(\varphi g-rC_S)>x_{AW6}$$

Taken together, both inequalities define the separating range within which screening is possible, as:

$$\frac{1}{1-\delta}\left(p-\delta\left(\frac{p}{(1+\Delta)}\right)\right)+(1-\ \delta)(\varphi g-rC_S)>x_{AW6}\geq\frac{1}{1-\delta}(\mathrm{p}-\delta x_{AW1})-rC_W+\varphi g$$

If the interval is non-empty, U can choose a separating offer that induces type-revealing behaviour by C. Since U aims to maximise its own payoff, it chooses the smallest offer that still satisfies the relevant incentive constraint. Since it offers at least the autarky share φg, U offers the as the optimal x_{AW6}:

$$x_{AW6}=\max\left\{\frac{1}{1-\delta}(\mathrm{p}-\delta x_{AW1})-rC_W+\varphi g,\varphi g\ \right\}$$

Whether U chooses decisive restriction, a pooling proposal, or a separating proposal as its next action depends on the magnitude of the capability shift as well as its belief about C's resilience $\theta=q$. Since in h6 the ideal pooling proposal leads to h2 on the continuation path, the equilibrium path diverges depending on whether the belief about C's resilience type $q<\bar{q}$ or $q\geq\bar{q}$. When $q<\bar{q}$ in h2, then only separating proposals are offered, while $q\geq\bar{q}$ leads to pooling proposals.

The condition of U restricting C rather than offering a separating proposal is given, when it assumes to face a strong C. Therefore, U's expected value from making a separating proposal is:

$$\frac{1-p}{1-\delta}-rU+\ \varphi(1-\mathrm{g})>1-x_{AW6}+\delta\frac{1-x_{AW1}}{1-\delta}$$

Like in h5, C has an incentive to offer an interior solution to U, in order to enjoy a power shift in its favour. By C giving up a share of its payoff, U receives instead of $1-x_{AW6}$, $1-\varphi g$ in the first period of h6. Hence, the condition that must be fulfilled for U preferring a separating proposal over restricting is:

$$\frac{1-p}{1-\delta}-rU+\ \varphi(1-\mathrm{g})>1-\varphi g+\delta\frac{1-x_{AW1}}{1-\delta}$$

This denotes the condition that U restricts C, over the most generous feasible offer in h6. Solving for the power shift which fulfills this condition leads to:

$$\Delta > \frac{\delta(1-p)}{\delta - \mathrm{p} + (1-\delta)[\varphi - \mathrm{rU} + \delta(\varphi\mathrm{g} - rC_W)]} - 1 = \hat{\Delta}$$

This leads to the same lower bound for the capability shift as in history h5. Therefore, when the belief $q \geq \bar{q}$ and the shift $\Delta > \hat{\Delta}$, U prefers to attack instead of offering a separating proposal to an assumably strong C.

When applying the same logic to a pooling proposal, the magnitude of $\theta = q$ has to be considered. For $q \geq \bar{q}$, a pooling proposal leads to h2 where U assumes to face a strong C. Therefore, U has an incentive to restrict when:

$$\frac{1-p}{1-\delta} - rU + \varphi(1-\mathrm{g}) > 1 - x_{AS6} + \delta\frac{1-x_{AS2}}{1-\delta}$$

Under the most generous offer of the interior solution $1 - \varphi\mathrm{g}$, U's condition to attack becomes:

$$\frac{1-p}{1-\delta} - rU + \varphi(1-\mathrm{g}) > 1 - \varphi\mathrm{g} + \delta\frac{1-x_{AS2}}{1-\delta}$$

Solving again for the capability shift Δ which fulfills the restriction condition leads to:

$$\Delta > \frac{\delta(1-p)}{\delta - \mathrm{p} + (1-\delta)[\varphi - \mathrm{rU} + \delta(\varphi\mathrm{g} - rC_S)]} - 1 = \underline{\Delta}$$

Again, the shift frontier for U restricting C instead of offering a pooling proposal is the same as in history h5. Consequently, U does not prefer restriction to the most generous pooling proposal when $\Delta < \underline{\Delta}$. Whether U prefers a separating or a pooling proposal for the capability shift interval of $\hat{\Delta} > \Delta \geq \underline{\Delta}$ depends on which payoff is bigger. The payoff of a separating proposal $P_U(x_{AW6})$ is defined as:

$$P_U(x_{AW6}) = q\left(\frac{1-p}{1-\delta} - rU + \varphi(1-\mathrm{g})\right) + (1-q)\left(1 - x_{AW6} + \delta\frac{1-x_{AW1}}{1-\delta}\right)$$

While U's value for a pooling proposal $P_U(x_{AS6})$ is defined as:

$$P_U(x_{AS6}) = 1 - x_{AS6} + \delta\frac{1-x_{AS2}}{1-\delta}$$

After substitution of x_{AS6} and x_{AW6} with their optimal proposals, the payoff of a pooling proposal exceeds the separating proposal's $P_U(x_{AS6}) > P_U(x_{AW6})$, when:

$$q \geq \frac{rC_W - rC_S}{rC_W + rU + \varphi} = \bar{q}$$

Therefore, at history h6 when $q > \bar{q}$, U strictly prefers to offer a pooling proposal when the shift condition allows it. This leads to U offering a pooling proposal x_{AS6} for $\Delta \leq \underline{\Delta}$, offering a separating proposal x_{AW6} for $\underline{\Delta} < \Delta \leq \hat{\Delta}$, and restricting C when $\Delta > \hat{\Delta}$.

While the payoffs for restriction and offering a separating proposal do not change with different beliefs $\theta = q$, the payoff of a pooling proposal changes. For $q < \bar{q}$, the pooling proposal leads from history h6 to h2, where U is assumed to be of weak resilience. Therefore, U faces the possibility of final restriction in the next period if C turns out to be of strong resilience. For $q < \bar{q}$, U's payoff $P_U(x_{AS6})$ is therefore defined as:

$$U_U(x_{AS6}) = x_{AS6} + \delta\left[q\left(\frac{1-p}{(1-\delta)(1+\Delta)} - rU + \varphi(1-\text{g})\right) + (1-q)\left(1 - x_{AW2} + \delta\frac{1-x_{AW1}}{1-\delta}\right)\right]$$

As C has an incentive to offer U the best possible share of the overall payoffs, U's shift frontier to restrict C under the interior solution is defined as:

$$\frac{1-p}{1-\delta} - rU + \varphi(1-g) > 1 - \varphi\text{g} + \delta\left[q\left(\frac{1-p}{(1-\delta)(1+\Delta)} - rU + \varphi(1-\text{g})\right) + (1-q)\left(1 - x_{AW2} + \delta\frac{1-x_{AW1}}{1-\delta}\right)\right]$$

The resulting condition for a shift that leads to restriction despite C's most generous concession is:

$$\Delta > \frac{(1-\delta)[p + (\varphi - rU)(\delta\text{q} - 1) + \delta(rC_W(1-q) - \varphi\text{g})]}{\delta - p + (1-\delta)[(rU - \varphi)(\delta\text{q} - 1) + \delta(rC_W(q-1) + \varphi\text{g})]}$$

This shift is smaller than $\hat{\Delta}$ (Wolford, Reiter, & Carrubba, 2011b), therefore, a shift fulfilling this condition is not large enough to trigger immediate restriction. Whether U restricts or not thus depends on the type of proposal U makes to C. As in the previous case, U prefers to offer a separating proposal to C when $\underline{\Delta} < \Delta < \hat{\Delta}$. What changes in this sub-case is that a separation is also offered for $\Delta \leq \underline{\Delta}$, as the equilibrium path moves on to h2, where a separating proposal is preferred since $q < \bar{q}$.