

A Game-Theoretic Assessment of Optimal Strategies in Artificial Intelligence Competition Between the United States and China

Samuel Ding

9212 Woodstone Cir, Princeton, NJ 08540 West Windsor-Plainsboro High School South

ABSTRACT	ARTICLE DETAILS
Semiquantitative analysis was done to ascertain the extent of the difference between the United States and China. This paper analyzes the competition between the United States(US) and China in artificial intelligence(AI) and uses game theory to examine its impact on US-China economic relations. As China-US AI competition heats up, this paper analyzes six factors of current AI competition between China and the US – AI models, semiconductors, researcher talent, AI patents, AI investment, and infrastructure – using time-series graphs to diagnose differences in overall capability. We hypothesized that, owing to the US leading, the US’s best strategy was to restrict China, and China’s best strategy was to not restrict the US. Using the framework of a normal-form game and looking at past and current strategic moves from both sides, this paper created a model to predict future moves from both sides. The paper also incorporates a Stackelberg model to evaluate strategic interactions in AI competition. By combining current AI competition data with game-theoretic analysis, this paper evaluates the likely effects of AI competition on future US-China economic relations and attempts to predict future behavior from both actors’ governments using mathematical modeling. This analysis reveals that Chinese and US decisions to de-escalate from mutual restriction were rational in the context of long-term relations, and that neither side has a stable strategy, with the hypothesis only being supported when both sides are cooperating. KEYWORDS: Artificial Intelligence, Game Theory, Strategy, Normal-Form Game, Stackelberg Game	Published On: 11 August, 2026 Available on: https://ijmir.com

INTRODUCTION

The United States and China share a long-standing trade relationship while simultaneously engaging in intense competition in artificial intelligence, semiconductors, talent, patents, investment, and other strategic technologies. As the world's two largest economies, the two countries remain highly interconnected through trade and investment, even though their political stances differ in many ways, because the connections and trade currently present between them are unlikely to completely disappear without significant disruption. For example, the US imported 71% of its rare-earth metals from China between 2021-2024 (Johnston 2026). Thus, it remains relevant to analyze the evolution of US-China relations.

A significant aspect of the current relationship between the US and China is the technological race in the field of artificial intelligence. Both the US and China have directed significant resources towards developing better artificial intelligence (AI), specifically large language models (LLMs). Both countries’ models have improved very quickly, and models from the US and China make up the entirety of the top 10 models on the market in most categories, as measured by Arena AI (Arena AI). In addition, the gap between the best US and Chinese models is closing, and China and the US are very close in strength (Figure 1).



Figure 1. Strength of Best Chinese Model against other top models. Other top models faded out. Adapted from “Arena AI Model Elo History” by Erwin Mayer on 15 June 2026, mayerwin.github.io/AI-Arena-History/.

Also, LLMs are at the forefront of computer science development for both countries. Therefore, artificial intelligence represents a significant dimension of economic competition. Furthermore, competition with China is a key policy point for the US. A Politico article mentions Trump cancelling his signing of an executive order and citing wanting to keep the US’s lead over China in AI (Wendler et. al. 2026). However, the US also wants to avoid conflict with China (Ali et. al. 2025), so US policy on AI competition is also affected by overarching US goals on US-China relations.

This paper undertakes a unification of multiple factors due to a lack of unified comparisons of the US and China. For example, an article published by Kyle Chan in 2026 provides a strong overview of the competition between the US and China and compiles many factors, such as AI efficiency, AI integration, semiconductors, and patents (Kyle Chan 2026). The article uses many pieces of data to support each inference. However, it lacks any integration between these factors, and oftentimes does not try to quantify on a national level.

Previous studies discuss the effects of non-cooperation on both China and the US (Guo et. al. 2024). However, these papers do not consider play in terms of the others’ actions, and these impacts are often not quantified or unified.

The power of cutting-edge AI, such as Large Language Models (LLMs), also relies on a country’s ability to implement it on a wide scale, support it with existing infrastructure, and continue to refine it. Thus, we measure strength in the field of AI by LLM text-producing model strength, AI supercomputer processing power, extant talent, patents, funding, and energy infrastructure. Model strength is measured by using a website called Arena AI. The top US model in text generation, Claude Opus 4.6 Thinking (which is the best model in the world) has a score of 1504, compared to the top Chinese model, GLM 5.1, which has a score of 1475, resulting in a difference of 29 (Arena AI). According to their evaluation system, this translates to Claude Opus 4.6 Thinking being evaluated better than GLM 5.1, 54.2% of the time. In terms of development, China’s best model is roughly 3-6 months behind the US’s best model (Figure 1, Mayer 2026).

We measure infrastructure by computing capacity and energy infrastructure (Figure 2). By computing capacity, the US has more than twice the computing capacity of China (Haag 2025).

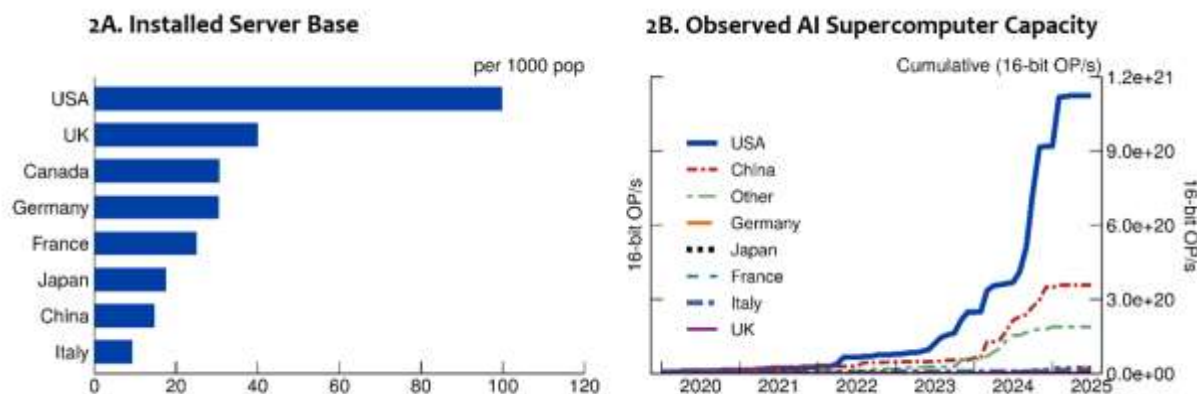


Figure 2. US AI supercomputer capacity significantly exceeds China's. Installed server base and observed AI supercomputer capacity for top countries. Adapted from Alex Haag. "The State of AI Competition in Advanced Economies." The Fed - The State of AI Competition in Advanced Economies, 6 Oct. 2025, www.federalreserve.gov/econres/notes/feds-notes/the-state-of-ai-competition-in-advanced-economies-20251006.html. Accessed 15 June 2026.

However, in terms of electricity to support datacenters, China is leading significantly, with over twice the energy production than the US. In addition, China's energy capabilities are growing much quicker than in the US (Figure 3).

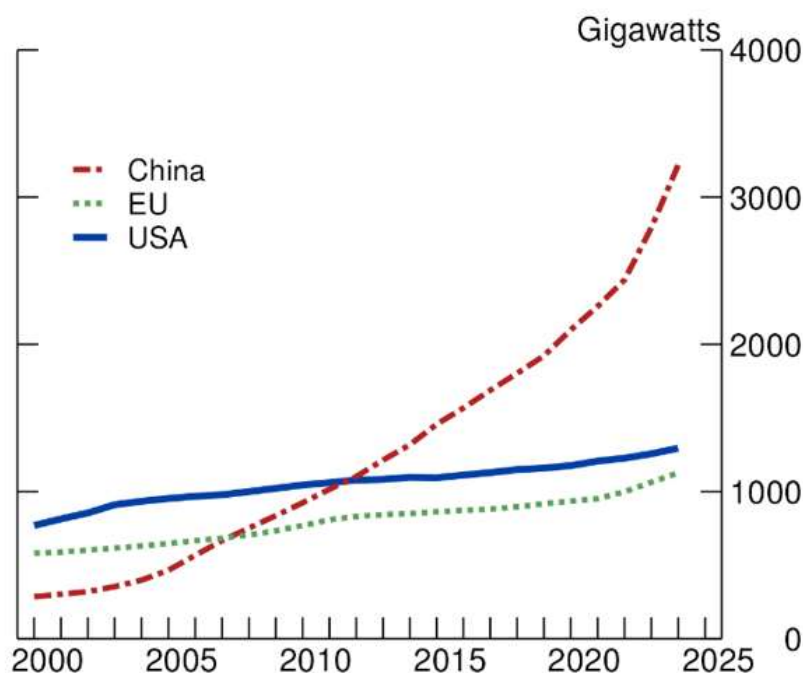


Figure 3. Chinese electricity production has grown extremely rapidly and significantly exceeds the US's. Installed electric generation capacity of China, the EU and the USA. Adapted from Alex Haag. "The State of AI Competition in Advanced Economies." The Fed - The State of AI Competition in Advanced Economies, 6 Oct. 2025, www.federalreserve.gov/econres/notes/feds-notes/the-state-of-ai-competition-in-advanced-economies-20251006.html. Accessed 15 June 2026.

In terms of workers in AI-relevant fields, the US is experiencing weaker growth than China from workers earning degrees in AI-related fields such as engineering and computer science. Additionally, the US relies on international talent. Two-thirds of students in US AI-related graduate programs are international students (Zwetsloot et. al. 2021). These programs have not seen growth in the number of domestic students attending. Also, from the same document, between forty percent and sixty percent of

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AI-related master's degrees were awarded to non-US citizens between 2014 and 2019 (Zwetsloot et. al. 2021). With recent policies making requirements for immigration more strict (Spitalniak 2026), the inflow of international students will likely shrink in the future.

On the other hand, China has seen a rapid increase in STEM graduates, reaching 3,570,000 STEM degrees in 2020, compared to the US's 820,000 (Cheng 2025). This likely indicates that China will soon, if not already, have a strong domestic base of AI talent to draw on. Consequently, China also has a large base of PhD graduates, a significant amount of which came from top universities in China. China graduated 51,000 STEM (Science, Technology, Engineering, and Mathematics) PhD students in 2022, whereas the US graduated 33,800 STEM PhD students (Irwin-Hunt 2025).

This significant gap between China and the US in STEM PhDs indicates that China will have a large domestic base of very skilled STEM workers to draw on, whereas the US talent base is likely to experience much less growth (Figure 4). The US currently leads in AI talent, but that lead is likely to quickly shrink soon.

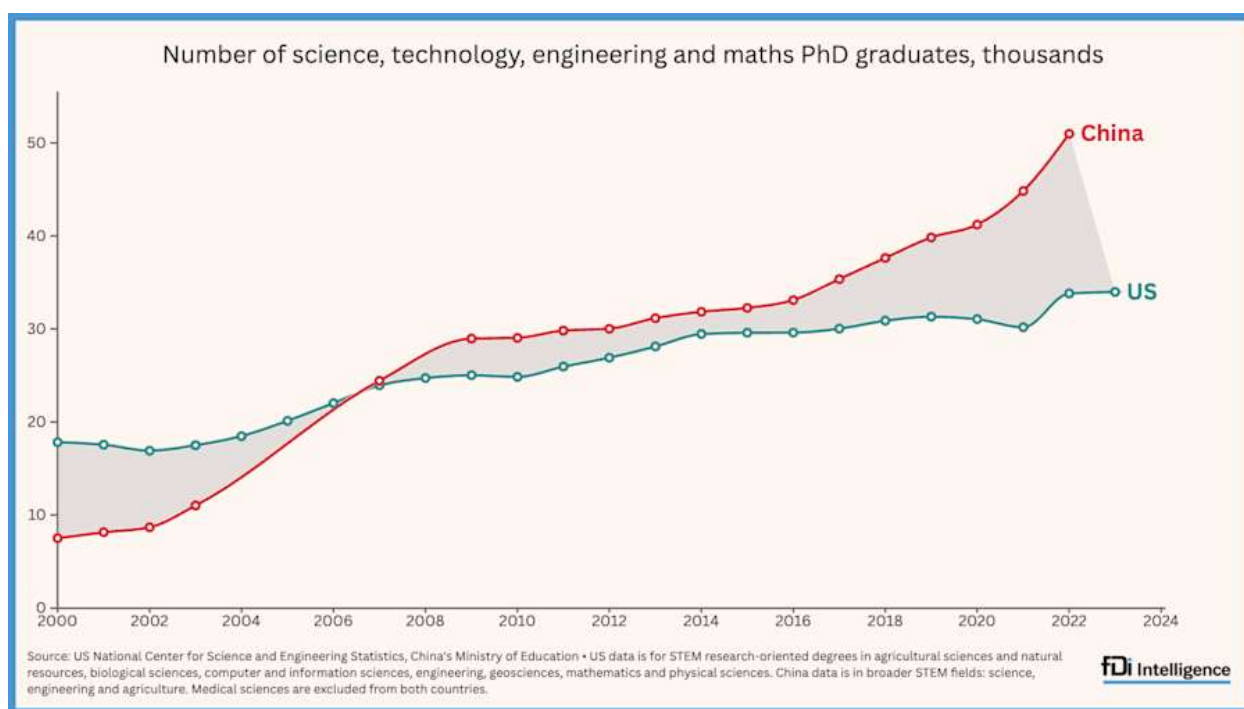


Figure 4. China graduates significantly more science, technology, engineering, and maths PhDs than the US. Number of science, technology, engineering and maths PHD graduates. Adapted from Alex Irwin-Hunt. “China’s Universities Outpace US Peers amid Tech Competition.” FDI Intelligence, 30 Apr. 2025, www.fdiintelligence.com/content/d0a58f39-0ed0-4b58-8c51-477133b6d9e1. Accessed 15 June 2026.

On AI patents, China holds 25,177 AI-related patents, versus the US 17,307, and the number of Chinese AI-related patents has skyrocketed in recent years (Figure 5, Fang et. al. 2026). Also, the percentage of Chinese patents that are AI-related has increased significantly (Fang et. al. 2026).

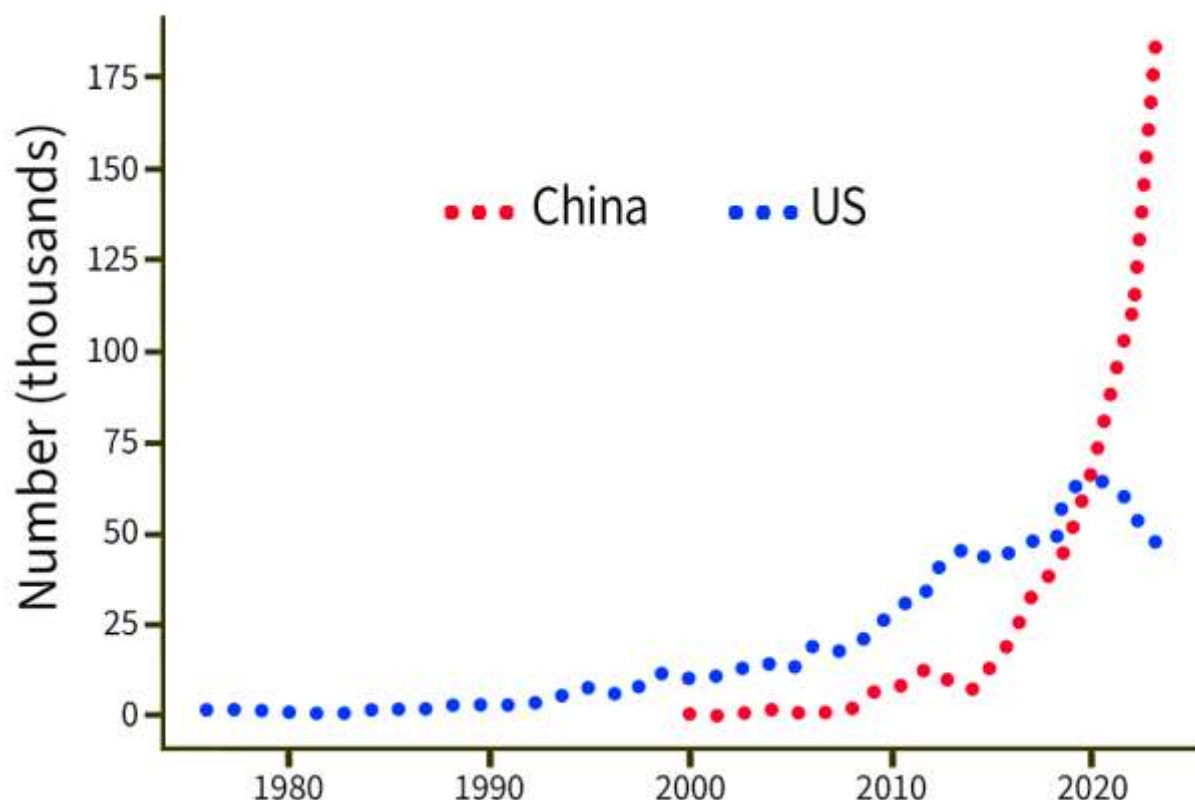


Figure 5. China's number of granted AI related patents has skyrocketed, now significantly exceeding the US's. Number of AI-Related patents granted to China versus the US. Adapted from Hanming Fang et al. "AI patents in the United States and China: Measurement, organization, and knowledge flows." *National Bureau of Economic Research*, Apr. 2026, <https://doi.org/10.3386/w35022>.

In terms of investment, China lags behind the US in private investment. According to Stanford's ninth edition of the Artificial Intelligence Index, the US had \$285.9 billion in private investment for AI firms in 2025, whereas China only had \$12.4 billion (Gil, Perault 2026). However, China has invested in significant federal funding for AI firms, reaching over \$200 billion in venture capital in 2023 (Figure 6, Beraja et. al. 2024).

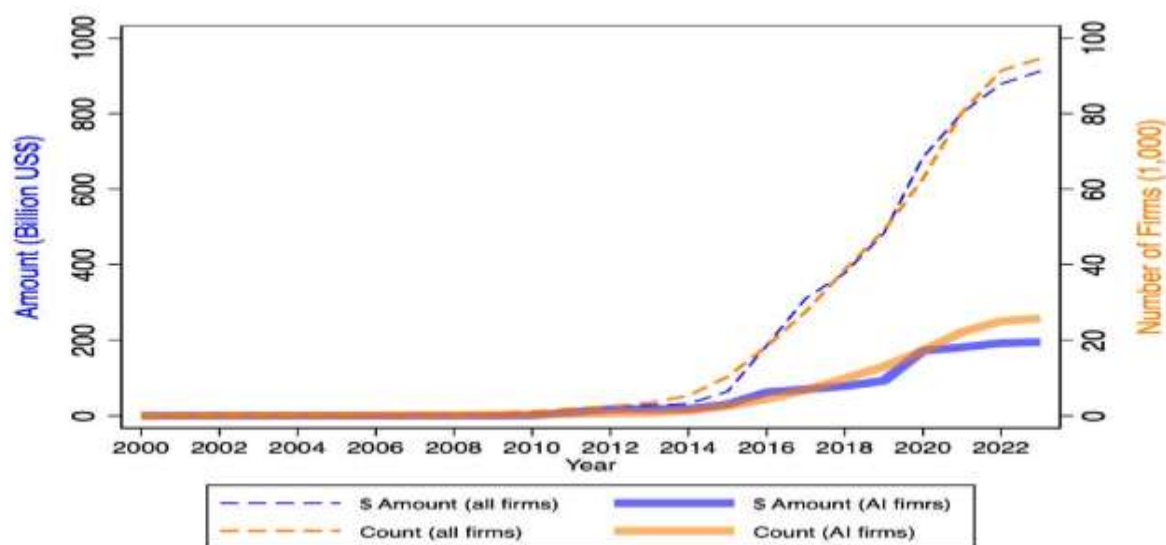


Figure 6.

Figure 6. China has funded AI firms significantly through federal venture capital funds. The evolution of artificial intelligence venture capital from the Chinese government. Adapted from Martin Beraja et. al. “Government as venture capitalists in AI.” *National Bureau of Economic Research*, July 2024, <https://doi.org/10.3386/w32701>.

We hypothesized that the US is ahead of China in AI development, and that, due to that imbalance, the US’s best strategy was to restrict China, whereas China’s best strategy was to cooperate with the US. This paper utilized quantitative analysis to more precisely estimate the gap between the US and China. This quantitative analysis supported the hypothesis that the US was ahead of China. Using that assumption, this paper found, using game-theoretic analysis, that neither the US nor China has a strategy that is better no matter what the other party does, which did not support the hypothesis.

RESULTS

For each factor, time-series graphs of each party’s strength in that factor were used to estimate the lead that a party has in terms of months of development. Using a weighted average of comparisons in all six factors, the analysis evaluated that overall lead that the US has on China is about 3-6 months. The US currently leads, but that lead is relatively small.

With this understanding of the current gap between the US and China, this paper undertakes a game-theoretic analysis of future strategies through a normal-form representation, Figure 7. In a normal-form representation, payoffs depend on both sides’ strategies, with each square representing a strategy from the US – the row – and a strategy from China – the column. Each arrow depicts a certain relation: if an arrow is drawn from one square to another, then that implies that if one side were to know the other’s strategy, they would prefer the outcome in the square that contains the end of the arrow. For example, if China were to stay neutral, then the arrow from the NN square to the BN square represents the US preferring that it have restrictions on China and China not have restrictions on the US over un-restricted competition.

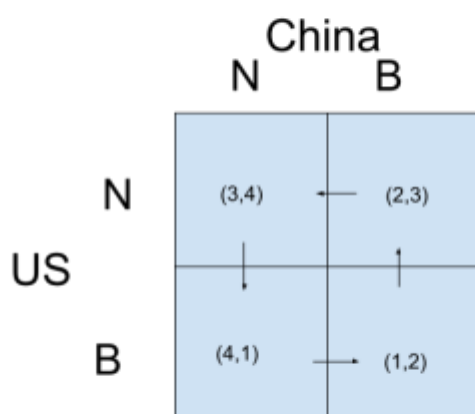


Figure 7. No single strategic outcome is stable, with one party getting better results if they change strategies in every outcome. Normal-form game representing US-China payoffs under different combinations of strategies.

1=worst outcome, 4=best outcome.

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I have used ordinals from 1 to 4 to express these priorities in Figure 7, where 1 is the worst outcome and 4 is the best and each preference is the first number in the ordered pair. These payoffs are ordinal: that is, they only represent an ordering. We derived the orderings for the US and China through analysis of geopolitical circumstances. As mentioned above, the US has made it a priority to stay ahead of China in the field of AI (Wendler et. al. 2026). Therefore, the US is best off when China is restricted and it is not. However, the US has also announced a policy directive to avoid military confrontation with China, and actively attempts to ensure that conflict with China does not escalate (Ali et. al. 2025). Therefore, both sides restricting each other is worst for the United States, as it runs the risk of escalating conflict. Finally, the US imports many important resources from China, such as high-purity rare earth metals (Johnston 2026), so the US prefers that China not restrict the US.

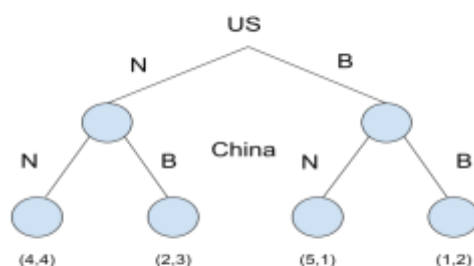
On China's side, China has different priorities, so China's payoffs are not symmetric to the US's. China most prefers a completely unrestricted competition, as it both can utilize US semiconductors and sell to the US. China is worst off if the US restricts it and China does not respond in turn, as it must develop domestic replacements for materials previously imported from the US and loses geopolitical credit as a strong player. Finally, China prefers that the US not restrict it. These preferences are represented in the second ordinal in each square.

Using comparisons of different results for the US and China, this normal-form game reveals that when China is not restricting the US, the US is better off if it can restrict China, but the US is better off avoiding mutual conflict, even if China restricts the US.

Both the US and China can either not restrict the other (neutral, N) or restrict the other (block, B). Initially, the US and China engaged in unrestricted competition, resulting in relatively good outcomes for both. However, the US wants to keep its lead in AI, so the US benefits from restricting Chinese access to US resources. Thus, the US has its best outcome when China is weaker and the US has access to Chinese semiconductors, etc. However, China is better off retaliating if the US restricts China, because China will gain geopolitical credit. When both are restricting the other, the US risks war, which will be disastrous for the US. Therefore, the US will retreat when both are restricting each other. When the US is not restricting China, China is actually better off also not restricting the US, because the US is a significant consumer of Chinese products, and China can expand its reach if it allows the US to buy from it. These interactions create a cycle, where the US leads in restricting, but cannot afford to stay in continual conflict with China. This competition is dynamic, in that no pair of actions from both sides is a Nash equilibrium, so one side can always benefit from changing strategies. Also, because the US and China have been competing for a long time and likely will continue to compete for years, this cycle will continue going unless the geopolitical landscape significantly changes – i.e. the US and China go to war, the US and China completely decouple etc. I call this Ding's dynamic competition cycle model.

The US has typically made the first move, so under a Stackelberg model, the US makes the first move, and China responds. In this case, once the US has made the first move, China's best response is to make the same move. Therefore, under this model, the US should not restrict China, as the final result of the US restricting China is mutual restriction, which is worse overall for the US. This reflects that initially; both the US and China engaged in unrestricted competition (Figure 8)

Figure 8: Under a sequential game theory model, mutual cooperation is rational. Stackelberg Model of the US and China's Moves. Tree structure created with the assumption that the US makes the first move, with ordinal rankings filled in from analysis for both parties.



MATERIALS AND METHODS

This paper analyzes the competition between the US and China in the field of Artificial Intelligence through multiple factors. Then, using game-theoretic analysis, this paper expounds on the rationality of the US and China's policies. Using a Stackelberg framework, backward induction was used to reveal that China's best move is to use the same strategy as the US. Using a dynamic normal-form game, an analysis of payoffs from either party reveals that the US was still incentivized to restrict China, as the US would obtain a better outcome from restriction in the short term, even though it would be rational for China to retaliate. These game-theoretic analyses reveal that the structure of events and payoffs leads to a cyclic result, where the US and China alternate between restriction and non-restriction. Considering the potential outcome of war, both the US and China are incentivized to avoid extended mutual conflict, and thus, policymakers should expect a cyclic playout like the one predicted in this paper in broader US-China relations, where restriction is beneficial in the short-term, but likely leads to worse outcomes if both sides engage in extended conflict.

Comparisons in each field were combined to create a weighted average. Each comparison was done in terms of time due to relative strength, not absolute strength, being important. Each factor will be factored in in terms of time for the weaker party to reach the (previous) strength of the stronger party.

On AI model capability: Trends on Arena AI indicate that China is about 3-6 months behind the US in terms of top models.

On Semiconductor or chip capability: The US reached China's total 2025 AI supercomputer capacity in about 2024, so the US is about a year ahead of China.

On AI labor and talent capability: Hard numbers are difficult to find on this statistic, so a rough estimation is used. Given China's increasing rate of STEM graduates, the US is likely to only lead by 1-2 years in terms of total talent.

On AI patent capability: The US's AI patents don't follow a clean increasing trend, but China is almost certainly at least 2 years ahead in terms of volume.

On AI private investment and venture funding: China holds significant federal funding, but the US also invests significant federal funds into AI. Overall, because China doesn't have nearly as much private investment, the US is roughly a year ahead of China.

On Infrastructure capability, especially electricity generation and power-grid support for AI data centers: China is far ahead of the US in terms of total power output, but is constrained by location and building of data centers, so a rough estimation is 2 years for the US to reach the same level of coverage and usage that China has today.

AI talent, semiconductors, investment, and model strength are weighted highest, at 20%, as those are most directly correlated with current and future strength. AI patent capability is 10%, owing to the importance of patents, but volume of patents is not as cleanly associated with overall AI strength. Finally, infrastructure is weighted lowest, at 10%, since heavy investment into creating or improving existing infrastructure is underway and will likely change the scene quickly.

In determining the upper and lower bounds for the amount the US was leading China, a weighted average was used on the upper and lower bounds for each factor – i.e. using a 6 months US lead for a 3-6 month estimation and a 1 year Chinese lead for a 1-2 year Chinese lead.

CONCLUSION

In summary, the model that best fits actual events is the dynamic cycle model. Under this model, the US is incentivized to restrict China, even though China responded by restricting the US, and this reflects the actual process that occurred. Initially, the US and China engaged in unrestricted competition. However, the US saw that it would benefit from restricting China, as it would maintain a larger lead. This is supported by US policymakers discussing the increasing strength of China and citing national security in justifying putting restrictions on Chinese imports of high-end US chips. The end result was that both sides eventually became relatively non-restrictive after a period of high restrictions, as the US's economy benefited from more unrestricted competition. However, the model predicts that this situation is unstable, as the US is still incentivized to restrict China when both sides are engaging in relatively unrestricted competition.

The Stackelberg model indicates that the US should not restrict China, but that does not reflect actual policymaking from both sides. In the future, proceedings will likely be the US and China de-escalating, then the US again restricting China after a period of unrestricted competition.

The structure of the payoffs for the US and China makes it so that under any scenario where the US and China have declared strategies, one party would benefit from switching strategies. This is likely a key factor in the speed at which the US and China change political strategies, as both sides benefit from changing strategies. Both the US and China have made many significant moves over the last year (16), an extremely short period of time, and this paper partially explains the volatility of US-China economic relations.

In the future, the payoffs for the US and China will likely shift, especially as current competition is already very volatile. This model can be extended to evaluate these future strategic landscapes. An avenue for future research is creating a model for the way that current moves affect future payoffs for the US and China, or extending the calculation of the payoffs to include some form of representation for signaling before policy is made.

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