

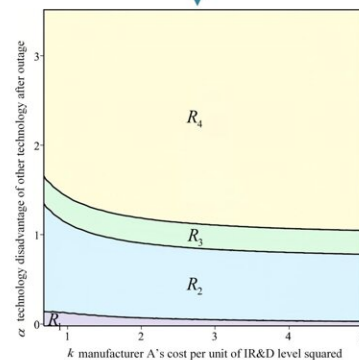
Disruption risk along global supply chains: Technology outage and IR&D investment

July 17 2023

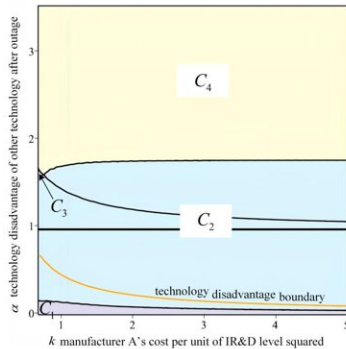


Outage risk and IR&D investment analysis

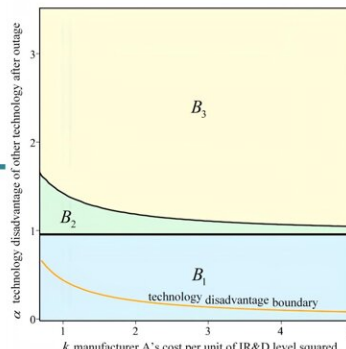
- Profit change and outage risk between two countries



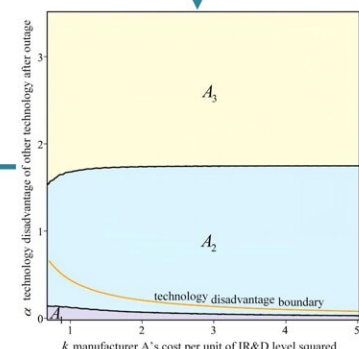
- Risk control of IR&D investment



- Country B's profit change due to IR&D under outage risk



- Country A's profit change due to IR&D under outage risk



Outage and IR&D investment simulation analysis. Credit: Xiaoxiao Chang, Southeast University

In the current global situation, global industrial and supply chains are

being reorganized, and their safe and stable operation is facing numerous risks and challenges. One important factor driving this restructuring is the development of key core technologies, which have become crucial in the global economic competition.

With that consideration, a team of researchers from the the School of Economics and Management, Southeast University, conducted a study to address the issue of how product manufacturers can mitigate the risk of losing access to these key core technologies within the context of international competition.

The team used a duopoly Hotelling model, which represents two competing products from two different countries. The study also incorporates game models that consider different scenarios, such as whether enterprises experiencing a core technology outage choose to pursue independent research and development (IR&D) or not.

"We examined four scenarios: the benchmark scenario without independent research and development (IR&D) before and after a technology outage, and the IR&D scenario before and after the technology outage," explained Lindu Zhao, corresponding author of the study. "Additionally, we evaluated the risk of outage by comparing the impact of a government-initiated outage on the profit change of firms in the initiating country and the firm whose supply was disrupted."

For enterprises that experienced a technology outage implement IR&D, the team compared the magnitude of profit changes between the two countries' enterprises and analyzed the effectiveness of IR&D investments made by firms in the country affected by the technology outage in managing the risk associated with such outages.

"Our analysis reveals several key findings. First, initiating a core technology outage may result in greater profit loss for the country

responsible for the outage, while the country possessing the core technology may experience a larger change in profits compared to the country investing in IR&D," shared Zhao. "Enterprise investments in IR&D can create a strategic advantage and influence the dynamics of the game between countries."

The team published their findings in the journal *Fundamental Research*.

"By reducing technological disadvantages, the IR&D strategy can mitigate the urgency associated with the risk of technology outages and weaken the absolute control exerted by the rival country responsible for the [outage](#). In other words, IR&D investments empower the country to establish a certain level of control and influence over the situation," Zhao added.

According to the researchers, understanding how to model and incorporate dynamic changes is a crucial challenge for the future of supply chain risk management. This aspect should be further explored to enhance our understanding and improve decision-making in this field.

"There is an old Chinese saying that goes, 'Kill one thousand enemies and self-defeat eight hundred'," Zhao quipped. "This saying emphasizes the idea that both countries face a critical decision when it comes to weighing the potential outcomes of IR&D investment. It raises the question of whether pursuing such investment would result in a 'Pyrrhic victory,' where the costs incurred outweigh the benefits gained."

More information: Xiaoxiao Chang et al, Technology outage risk and independent research and development investment decision in global supply chains, *Fundamental Research* (2023). [DOI: 10.1016/j.fmre.2023.06.004](https://doi.org/10.1016/j.fmre.2023.06.004)

Provided by KeAi Communications Co.

Citation: Disruption risk along global supply chains: Technology outage and IR&D investment (2023, July 17) retrieved 15 May 2024 from <https://phys.org/news/2023-07-disruption-global-chains-technology-outage.html>

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