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Quantifying Economic Security Risks: Geographical Simulation Analyses on Tariffs, Conflict and Logistics Disruptions

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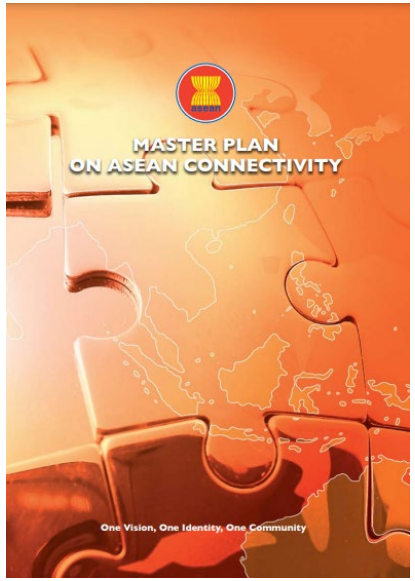
Objective

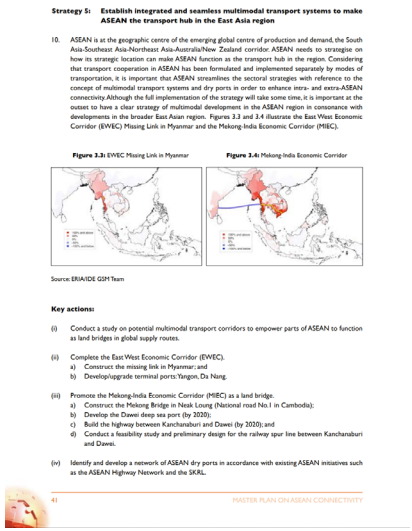
- Geopolitical shocks such as US tariff policies, recurrent regional conflicts, and the disruption of major maritime routes are increasingly shaking supply chains directly.
- These shocks are likely to bring about more serious consequences than mere fluctuations in trade volumes, including interruptions in the supply of intermediate goods, the reorganisation of corporate locations, and shifts in industrial structures.
- Although such impacts vary significantly not only at the national level but also across regions and industries, conventional analytical methods have struggled to capture them adequately.

- This analysis employs the Geographical Simulation Model (IDE-GSM) to identify economic impacts in a more granular manner by geography and industry, thereby clarifying “who is affected, where, and to what extent” — essential knowledge for policymaking.
  - US tariff hikes under the Second Trump administration,
  - Thailand-Cambodia border conflict, and
  - Disruptions at the Suez Canal crossings

Geographical Simulation Model

- The Geographical Simulation Model (IDE-GSM) is an applied general equilibrium (CGE) model based on spatial economics. It was developed in 2007 as a joint research project between Institute of Developing Economies and ERIA, and has been used by ERIA, the World Bank, ADB, and others to analyse the economic effects of international infrastructure development.




Strategy 5: Establish integrated and seamless multimodal transport systems to make ASEAN the transport hub in the East Asia region

10. ASEAN is at the geographic centre of the emerging global centre of production and demand, the South Asia-Southeast Asia-Northeast Asia-Australia/New Zealand corridor. ASEAN needs to strategise on how its strategic location can make ASEAN function as the transport hub in the region. Considering that transport cooperation in ASEAN has been formulated and implemented separately by modes of transportation, it is important that ASEAN streamlines the sectoral strategies with reference to the concept of multimodal transport systems and dry ports in order to enhance intra- and extra-ASEAN connectivity. Although the full implementation of the strategy will take some time, it is important at the outset to have a clear strategy of multimodal development in the ASEAN region in consonance with developments in the broader East Asian region. Figures 3.3 and 3.4 illustrate the East West Economic Corridor (EWEC) Missing Link in Myanmar and the Mekong-India Economic Corridor (MIEC).

Figure 3.3: EWEC Missing Link in Myanmar

Figure 3.4: Mekong-India Economic Corridor

Source: ERIA/IDE GSM Team

Key actions:

(i) Conduct a study on potential multimodal transport corridors to empower parts of ASEAN to function as land bridges in global supply routes.

(ii) Complete the East West Economic Corridor (EWEC).
a) Construct the missing link in Myanmar; and
b) Develop/upgrade terminal ports: Yangon, Da Nang.

(iii) Promote the Mekong-India Economic Corridor (MIEC) as a land bridge.
a) Construct the Mekong Bridge in Neak Loung (National road No.1 in Cambodia);
b) Develop the Dawei deep sea port (by 2020);
c) Build the highway between Kanchanaburi and Dawei (by 2020); and
d) Conduct a feasibility study and preliminary design for the railway spur line between Kanchanaburi and Dawei.

(iv) Identify and develop a network of ASEAN dry ports in accordance with existing ASEAN initiatives such as the ASEAN Highway Network and the SKRL.

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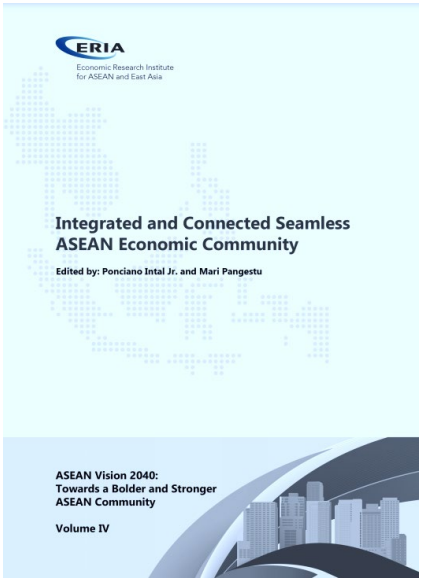

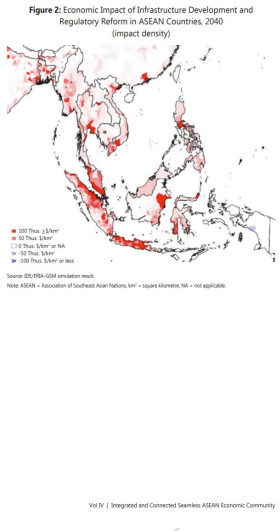
Figure 2: Economic Impact of Infrastructure Development and Regulatory Reform in ASEAN Countries, 2040 (impact density)

Source: IDE/ERIA-GSM simulation result.
Note: ASEAN = Association of Southeast Asian Nations, km² = square kilometre, NA = not applicable.

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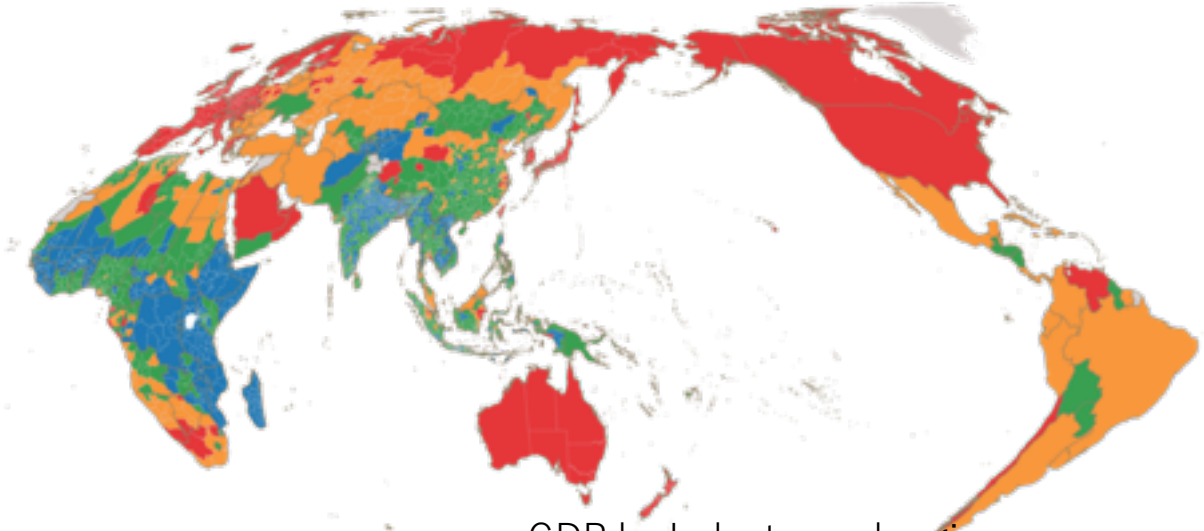
Features of IDE-GSM

- Analyses the impact by prefecture.
- Incorporates structural changes in the economy.
- Analyses the economic impact of various policy measures, including the impact of infrastructure projects (such as the construction of individual bridges and roads), the impact of tariff reductions, and the impact of trade facilitation.
- Analyses the economic impact of these combinations.

- IDE-GSM has been used to estimate the economic impact of planned infrastructure projects and to recommend combinations of projects that will achieve national economic growth and reduce regional economic disparities.

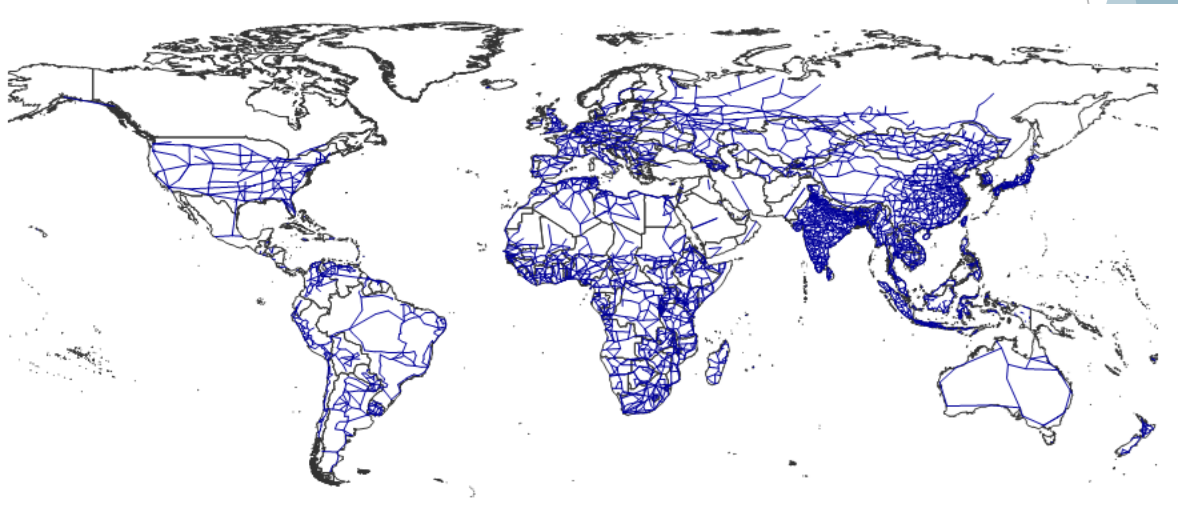
Dataset used in IDE-GSM



GDP by Industry and region

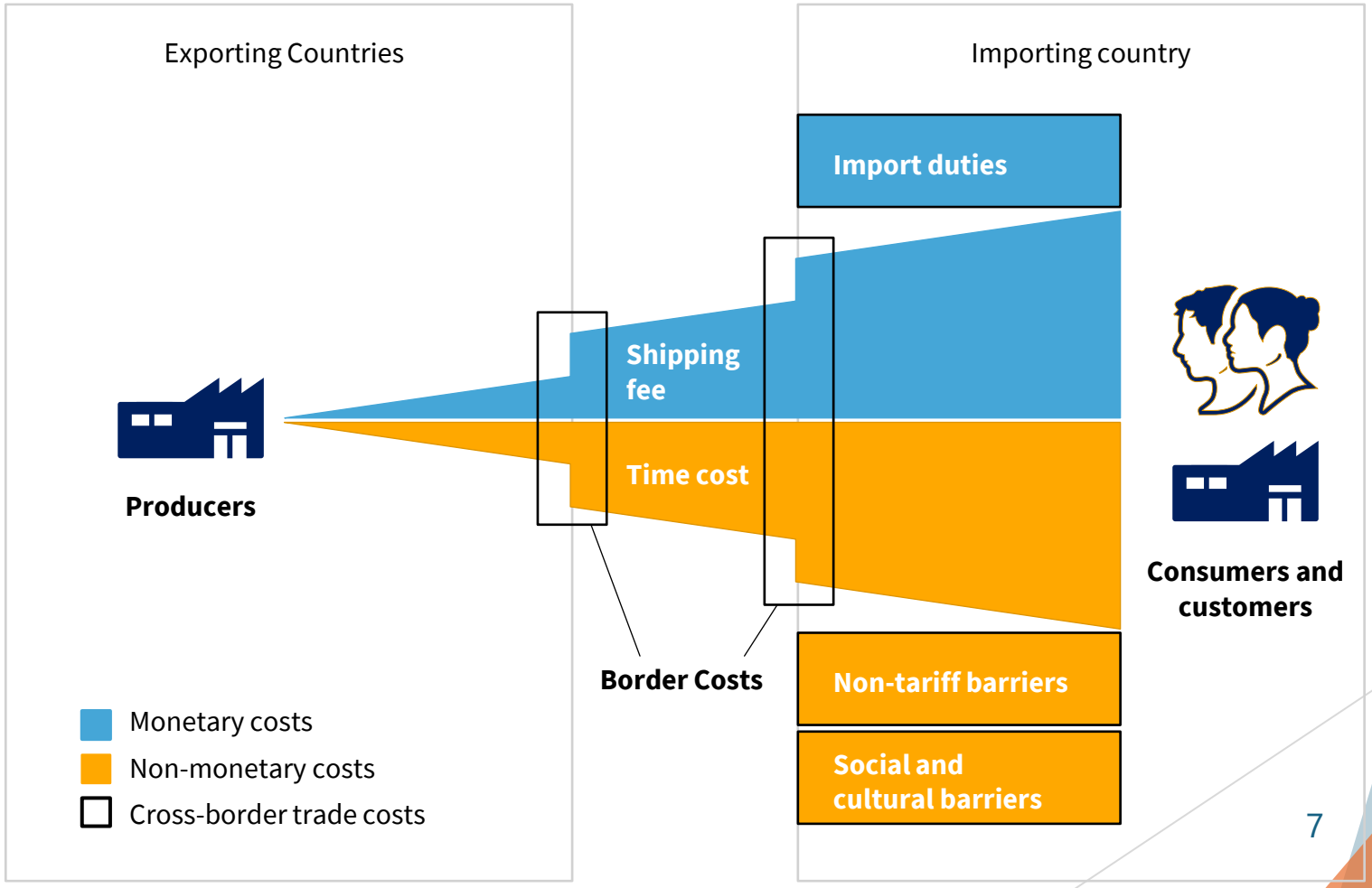
- GDP for 8 industries (agriculture, mining, manufacturing (automobiles, electronics, textiles, food processing, and others), and services)
- For regions without government statistics, such as Africa, GDP is estimated based on satellite image data such as night-time light and land cover data.

- Data on distance, mode, speed of traffic, customs clearance time, and cost at the border, etc.
- We have network data for five transport modes: road, sea, air, railway, and HSR.



Route data(land road)

Transport costs in IDE-GSM



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What IDE-GSM does not cover

- Exchange rate impact.
- Direct investment.
  - The impact is only the result of changes in the trade, production, consumption, and industrial structure of each country.
  - The impact on the performance of multinational companies needs to be examined by checking other countries' results.
- Refrain from investing, change of mindset.
- (Part of) Chinese overproduction.
  - There is no mechanism for producing at a low price because production equipment has already been set, or for subsidies to cause overproduction.

Geographical simulation analysis related to ‘Global decoupling’

- **US-China trade war** (Kumagai et al. Journal of Asian Economic Integration, 2021)
- **Sanctions on Russia** (Kumagai et al. 2022) (Japanese, April 2022)
- **Global decoupling:** ‘Simulating the decoupling world under Russia’s invasion of Ukraine: An application of IDE-GSM’ (Kumagai et al. IDE Discussion Paper 2023)
- **‘What if Trump comes again?’** Analysis (April 2024)

Common conclusions

- Countries that participate in sanctions against other camps experience negative economic impacts. This is also negative for the world economy.
- Countries that maintain neutrality, such as ASEAN and South America (Global South), will gain from the trade diversion effect.
- The more the policy division intensifies, the greater the negative impact on the Western and Eastern camps. On the other hand, for neutral countries, the benefits will be greater.
- For this reason, it is difficult for both the Western and Eastern camps to bring neutral countries into their camps, and it is also difficult to completely isolate the other camp from the world.

Second Trump Administration

- The tariff policy of the second Trump administration imposed additional duties on many countries at varying rates.
- In this context, the impact on each nation's real economy was not determined solely by the absolute level of the tariff applied to that country. It was shaped by a complex interplay of factors, including the tariff levels faced by competitors, the degree of dependence on exports to the United States, industrial structure, and supply chain linkages.
- Securing a relatively lower tariff rate than other countries proved overwhelmingly advantageous, while being subject to a higher rate alone placed a nation at a significant disadvantage. As a result, countries hastened to pursue bilateral negotiations with the United States.

‘Reciprocal tariff’ scenario (U.S. Announcement in July-November)

- Scenario: The United States will impose ‘reciprocal tariffs’ announced in July-November.
- The United States imposes a 20% tariff on China.
- This tariff will not apply to the automotive industry, and an additional tariff of 25% will be imposed (35% for China).
- Iron, steel, aluminum, copper, pharmaceuticals, semiconductors, sawn products, certain critical minerals, and energy products are exempt items (Annex II) and are subject to reciprocal tariffs as they cannot be clearly separated by the IDE-GSM industrial classification.
- There are no reciprocal tariffs on Canada and Mexico due to the USMCA agreement.

- 2025 is the evaluation year.

Results of reciprocal tariffs

	Agriculture	Automotive	E&E	Textile	Food Proc.	Oth. Mfg.	Services	Mining	GDP
US	-1.7%	-4.6%	-0.2%	0.5%	0.3%	-0.8%	-3.3%	-5.3%	-3.0%
China	-0.4%	-0.7%	-0.6%	0.0%	-1.3%	-1.3%	-0.5%	0.1%	-0.7%
Japan	-0.2%	-0.7%	0.3%	0.1%	0.0%	0.3%	0.0%	0.2%	0.0%
Indonesia	0.0%	-0.4%	-0.1%	-0.4%	-1.4%	0.0%	-0.1%	0.2%	-0.1%
Singapore	-0.3%	0.1%	0.3%	0.0%	0.0%	0.8%	0.2%	0.2%	0.3%
Thailand	-0.2%	0.0%	-2.1%	-0.1%	-0.7%	-0.6%	-0.3%	0.1%	-0.5%
Vietnam	-0.4%	-0.6%	-0.4%	0.1%	-1.5%	-1.5%	-0.5%	0.3%	-0.6%
India	0.0%	-0.2%	0.2%	0.1%	-0.1%	-0.3%	-0.1%	0.1%	-0.1%
Taiwan	-0.1%	0.0%	-1.3%	0.1%	-0.3%	-0.5%	-0.2%	1.0%	-0.4%
World	-0.2%	-0.7%	-0.4%	0.0%	-0.4%	-0.5%	-1.0%	-0.2%	-0.8%

Source: IDE-GSM Simulation Result.

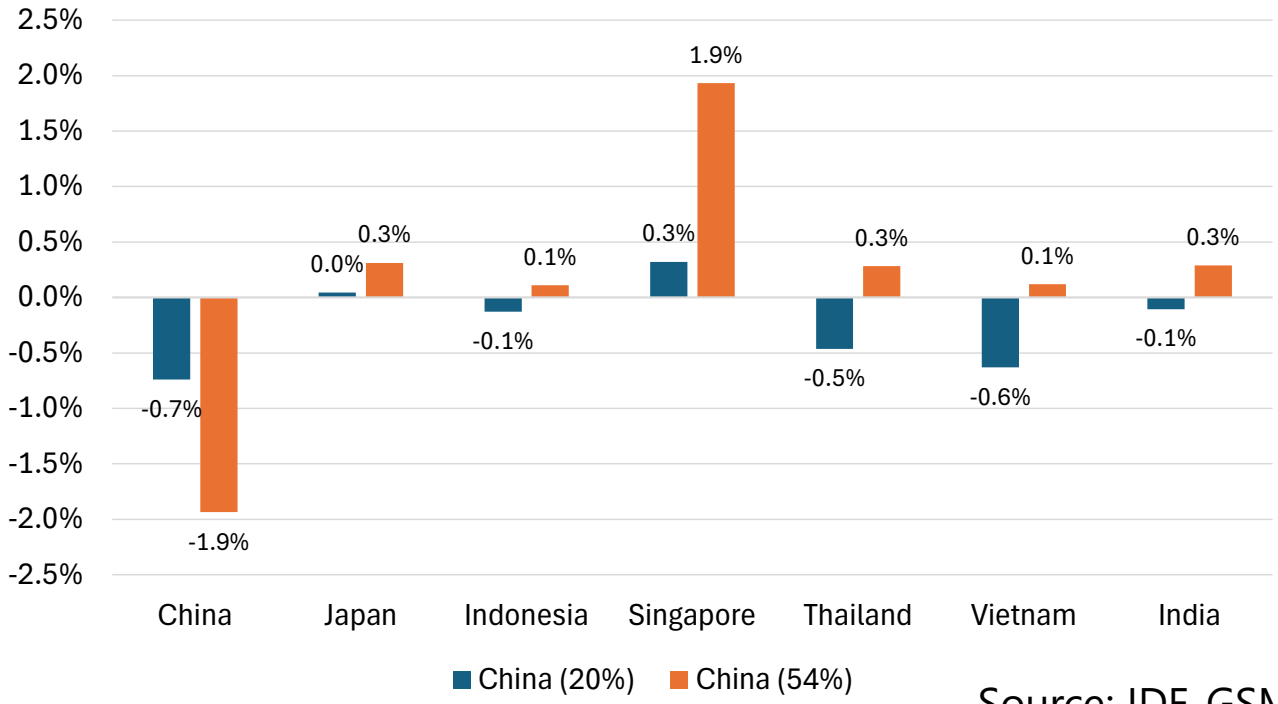
- Many countries will be negatively affected compared to the baseline, while Singapore will be positively affected by the trade diversion effect.

Impact on the United States

The United States suffered the greatest negative impact at -3.0%. The effects include the following three effects.

- The negative impact of having consumers in the United States buy goods at high prices.
- The negative impact of having producers in the United States buy components and services at high prices.
- The positive impact on producers in the U.S. from U.S. citizens and companies increasing the purchase of domestic goods and services.

The outcome depends on the tariff rate applied to China



Source: IDE-GSM Simulation Result.

- The imposition of a 20% tariff on China has dismantled the structure in which US tariff policies benefited the Global South.

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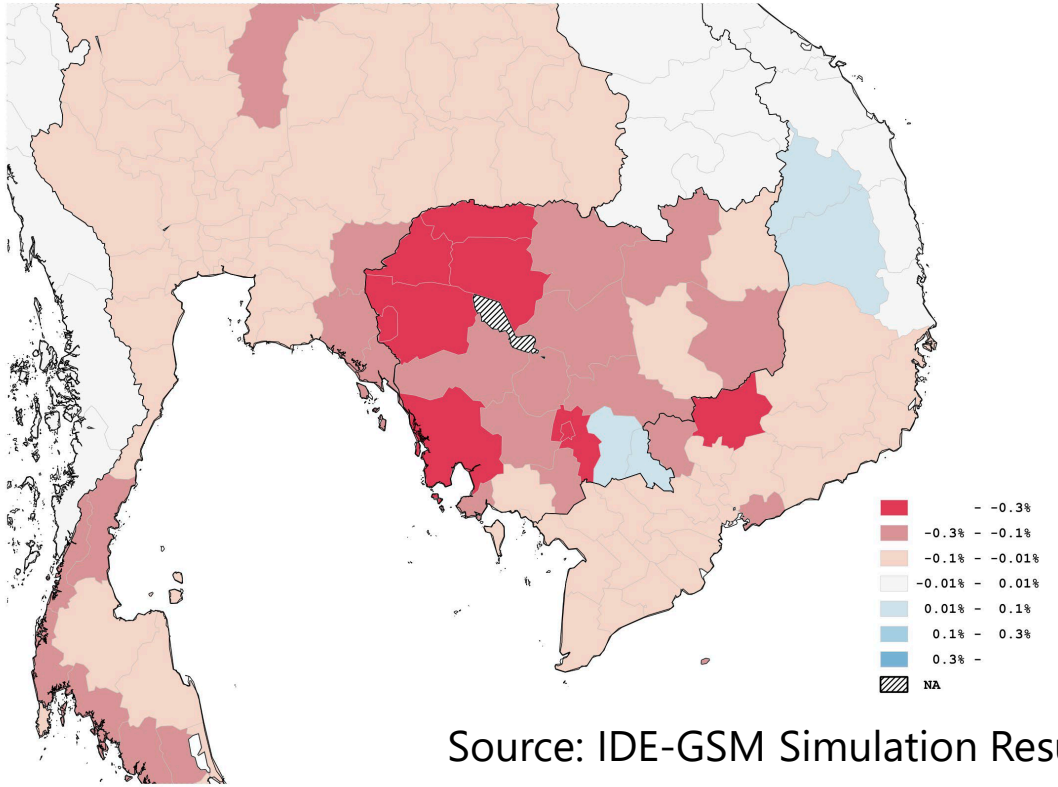
Cambodia–Thailand border disruption

- Assume the land border between Cambodia and Thailand is closed for one year in 2025 due to the conflict between them. The change in GDP for each region is calculated as the economic impact for that year.
- Depending on industry and location, companies may switch to sea or air routes, reroute via other countries, or shift trade to other partners.

Result of the Cambodia–Thailand border disruption

Economic impacts by the Cambodia-Thailand border disruption (2025, % of Regional GDP)



Source: IDE-GSM Simulation Result.

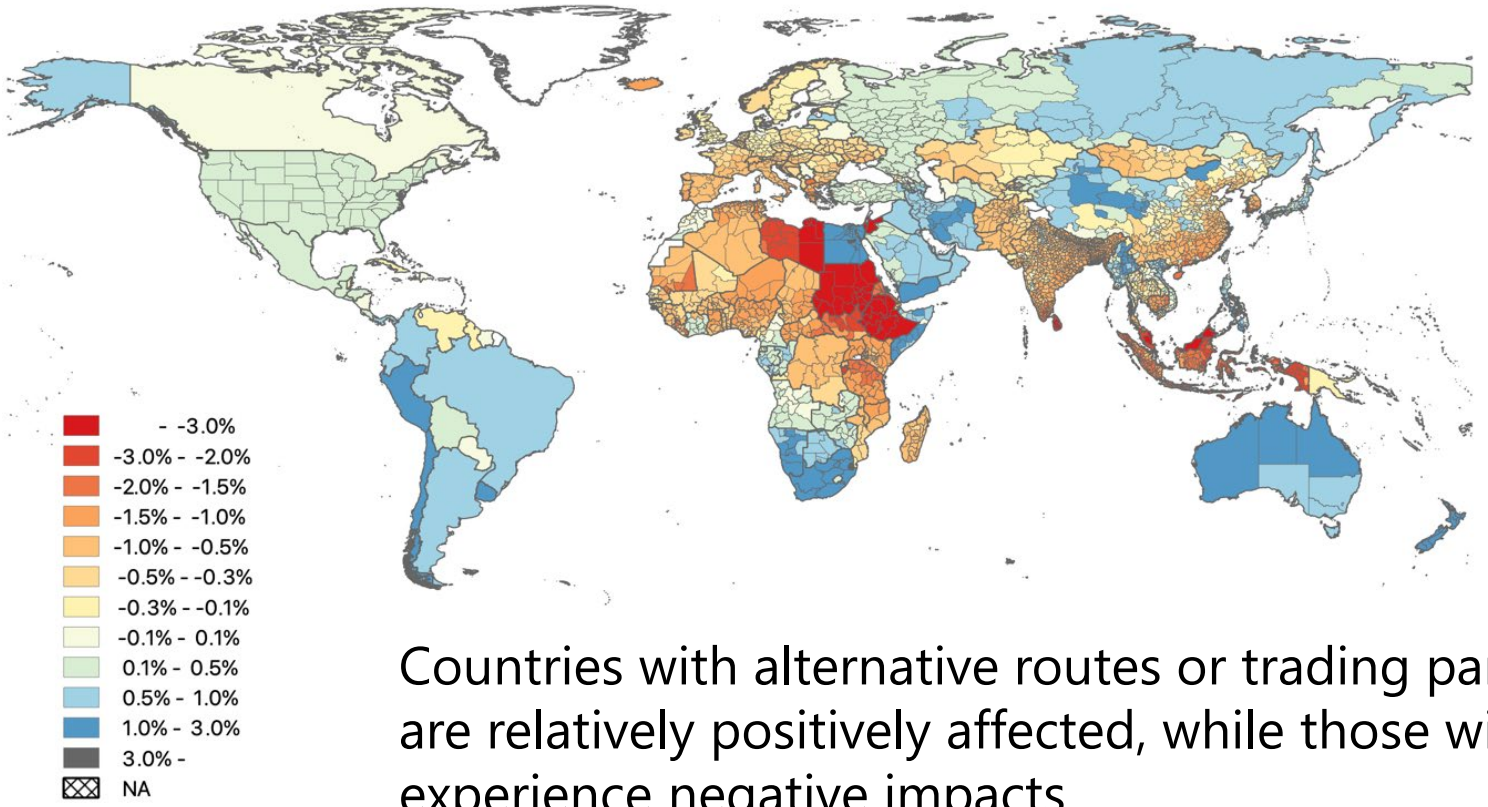
- Many provinces, especially those on the Thai side of Cambodia, experience negative impacts. In contrast, Cambodia's provinces bordering Vietnam, i.e., Svay Rieng and Prey Veng, see positive impacts.
- Sri Lanka and Bangladesh's garment industries also experience small positive impacts.

Blockage of the Suez Canal

- Assume the Suez Canal sea route was blocked for one year in 2021. The change in GDP for each region is calculated as the economic impact for that year.
- Due to the blockage, not all cargo is rerouted via the Cape; depending on the industry and the combination of origin and destination, alternatives such as the Trans-Siberian Railway or land routes (Port Said to Port Suez) may be used. The model automatically calculates the lowest-cost route and reflects changes in the logistics network.

Result of the blockage of the Suez Canal

Economic impacts by the blockage of the Suez Canal (2021, % of Regional GDP)



Source: Gokan et al. (2024).

Countries with alternative routes or trading partners are relatively positively affected, while those without experience negative impacts.

Policy implications

- Disruptions harm the profits of companies using the affected areas and negatively impact the country, while alternative route locations/countries may benefit.
- Multiple sourcing in supply chains is crucial; policy support is needed for the companies to find alternative locations.
- IDE-GSM can simulate multiple disruption scenarios with a single tool. Furthermore, it enables discussion of effective external economic policies to mitigate or overcome these negative effects, such as joining the CPTPP or an Indonesia–EU trade agreement.