DRISI
Caltrans Division of Research, Innovation and System Information

Research Results

Development of an Economic Framework to Evaluate Resilience in Recovering from Major Port Disruptions

This study develops an operational framework to evaluate the effectiveness of a comprehensive list of potential resilience tactics that can help ports and related businesses in the supply-chain recover more rapidly from port disruptions.

Geotech/ Structures

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Project Title:
Development of an Economic Framework to Evaluate Resilience in Recovering from Major Port Disruptions

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WHAT IS THE NEED?

Ports play a vital role in a nation's economic well-being. Serving as a critical element of the nation's supply-chain, a disruption of a major port can reverberate throughout the entire economy.

An increasing number of port disruptions have taken place in recent years, stemming from various causes such as labor dispute, natural disasters, and technological accidents. Moreover, ports are a prime target for terrorist attacks, which can be fine-tuned to yield the maximum disruption at the port site and beyond.

Many studies have estimated the direct and indirect impacts of port disruptions and found them to be quite significant. However, very few studies have adequately factored in all of the possible forms of resilience that could mute these losses by using remaining resources more efficiently or by recovering more rapidly. Even fewer studies have focused on the development of an operational framework to facilitate the evaluation of the relative contributions of various potential resilience options at both the supplier-side and customer-side that can help reduce the potential economic impacts from port disruptions.

WHAT WAS OUR GOAL?

The objective of this proposed study is to develop an operational framework to evaluate the effectiveness of a comprehensive list of relevant resilience options that can help ports and related businesses in the supply-chain recover more rapidly from port disruptions.

WHAT DID WE DO?

The research team adapted the TERM (The Enormous Regional Model) multi-regional computable general equilibrium (CGE) model, to quantify the relative contributions of various resilience tactics in reducing potential economic impacts of major port disruptions.

Various types of resilience tactics on both the supplier-side and customer-side are formally integrated in the CGE modeling. Two port disruption scenarios caused by natural disasters that affect major seaports in California, representing lower-bound and upper-bound port disruption cases, are analyzed using the CGE model.

WHAT WAS THE OUTCOME?

For the two port disruption scenarios analyzed using the CGE model, the modeling results indicate that the lower-bound scenario could result in a Gross Domestic Product (GDP) loss of $650.1 million and an employment loss of 7,000 jobs. The combined effects of various relevant resilience tactics have the potential to reduce the economic losses by about 97%.

The upper-bound scenario could cause total GDP losses of over $12 billion in California and $16 billion at the national level. However, resilience can reduce these impacts by about 75% for California and about 89% for the nation as a whole.

Major resilience tactics on the supplier-side are ship re-routing and export diversion for import use. Major resilience tactics on the customer-side are use of inventories and production recapture. The port resilience analytical framework developed in this study is readily generalizable to port disruptions from other causes and at other geographical scales.

WHAT IS THE BENEFIT?

The evaluation and modeling framework established in this study will benefit future assessment of economic impacts and port resilience to major disruptions. The research findings also provide insights into investment decisions on protecting ports from and enhancing their resilience to natural and man-made disasters.

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IMAGE

Aerial view of Long Beach Port, California