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Transportation Cost Modeling of International Containerized Soybean Exports in the United States (Summary)

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This is a summary of "Transportation Cost Modeling of International Containerized Soybean Exports in the United States," by Bai, Yun, at Rutgers University. Funding for this paper came from the Agricultural Marketing Service (AMS) through cooperative agreement number 15-TMXXX-NJ-0008. The full paper is available at: http://cait.rutgers.edu/cait/research/transportation-cost-modeling-international-containerized-soybean-exports-united-states.

What is the Issue?

The landscape of the intermodal shipping industry is ever-changing. Agricultural exporters are sensitive to marginal changes in the cost of transportation and are always on the lookout for newer and better information regarding changes in costs and market behavior. This new report by researchers at Rutgers University quantitatively details the costs and transportation options for U.S. containerized soybean exporters.

Containerized shipping is a small but growing niche for grain and oilseed exports. Intermodal container shipments offer multiple advantages, particularly in terms of quality assurance, and can increase the attractiveness of U.S. exports in an increasingly competitive global market. However, the ability to maintain competitiveness largely relies on the management of transportation costs, a particularly complex task for soybeans and other domestic agricultural commodities due to multiple transportation modes, complex networks, and various stakeholders.

To help identify optimal transportation strategies for improving the United States' economic competitiveness in containerized soybean exports, the researchers developed a multi-modal transportation cost analysis modeling framework.

How was the Study Conducted?

The researchers used two models. Using modal-specific transportation network and cost information, the researchers employed a Least Cost Market Analysis (LCMA) model to estimate and compare "point-to-point" transportation costs of alternative shipment routes from a domestic production site to a foreign port. For each candidate route, the analysis estimates the transportation time, distance, and the cost for each modal segment. The researchers also developed Geospatial Intermodal Freight Transportation (GIFT), an optimization

model for the transportation network aimed at improving the national flow of containerized soybeans. This study uses these models to perform a cost analysis on Iowa soybeans outbound for Shanghai and Rotterdam. Furthermore, the report applies the GIFT model to simulate the optimal flow from high production counties across the United States to various markets in Asia under two cost scenarios, low and high port-to-port ocean rate scenarios.

The study used various sources of data to characterize the domestic soybean supply chain. The researchers determined soybean production and transportation trends using databases and reports from the U.S. Department of Agriculture's National Agriculture Statistical Service (NASS) and Agricultural Marketing Service (AMS). The researchers acquired data for transportation network and intermodal facility representations from the U.S. Army Corps of Engineers' National Transportation Atlas Database and the U.S. Department of Transportation's Bureau of Transportation Statistics. AMS datasets from the Grain Transportation Report and the Grain Truck and Ocean Rate Advisory provided researchers with truck and barge transport rates. To analyze rail moves, the researchers used the Surface Transportation Board's (STB) Uniform Rail Costing System Phase 3 Railroad Cost Program. Because first-hand data for ocean moves is proprietary contract data and difficult to obtain, this research crosschecked data from multiple online resources in order to estimate cost values within reasonable ranges.

What did the Study Find?

When considering transportation costs alone, the research showed shipments from Iowa to the Port of New Orleans, via inland waterway (barge mode), as the least expensive solution per metric ton. However, this route is also the longest in terms of travel time when compared to the other itineraries that use rail to transport soybeans from intermodal facilities in Iowa to domestic seaports.

Research using the GIFT model with market demand and U.S. domestic supply figures showed, in theory, where different sources of domestically produced soybeans should pair optimally with various foreign markets, and by which transport modes. In scenarios with low port-to-port ocean shipping rates, the model minimized the usage of rail, instead favoring transport by barge or transport to ports that are closer in proximity. In scenarios with high port-to-port ocean shipping rates, the model favored shipping some soybeans through the

Port of Long Beach/Los Angeles via rail instead of through the Port of New Orleans.
For researchers, this work can serve as a long-term reference to aid in a better understanding of transportation costs in rail, barge, roadway, and ocean shipping, and support other research efforts related to agricultural transportation and logistics. For shippers, the researchers at Rutgers are currently developing the cost-analysis methodology and geographic information system (GIS)-based routing into a computer-based model that can automate route selection, cost calculation, route cost comparison, and visualization.

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