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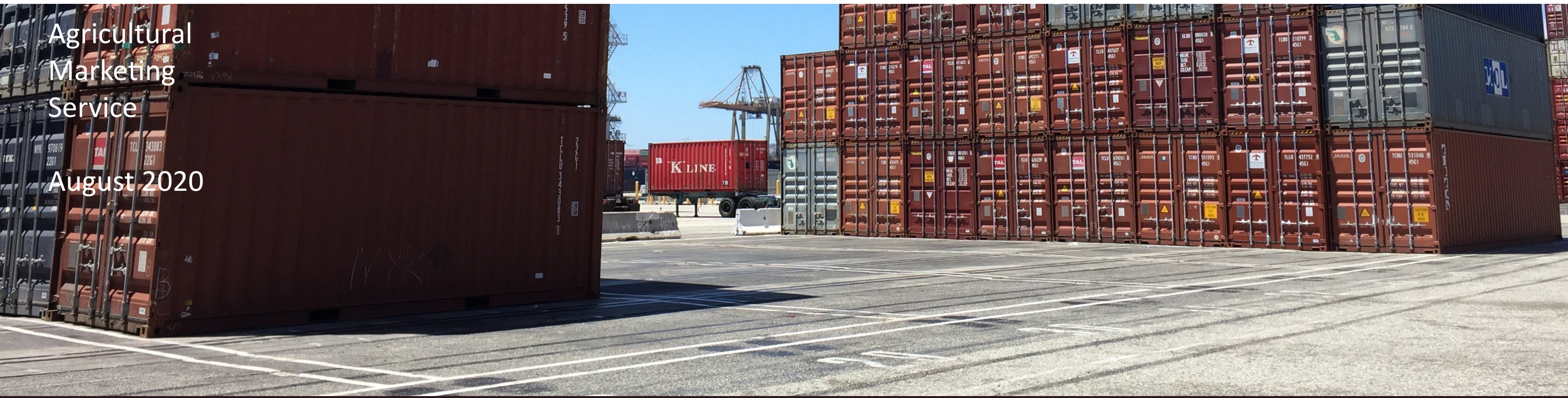

Repositioning Empty Containers for Agricultural Container Logistics (Summary)

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This is a summary of “Repositioning Empty Containers for Agricultural Container Logistics,” by Junmin Shi, an associate professor in New Jersey Institute of Technology’s Tuchman School of Management. Funding for this paper came from the Agricultural Marketing Service (AMS) through cooperative agreement number 16-TMTSD-NJ-0008. The opinions and conclusions expressed are the author’s and do not necessarily reflect the views of USDA or AMS. The full paper is available at: https://web.njit.edu/~jshi/USDA-ECR-Final-Report.pdf.

WHAT IS THE ISSUE?

U.S. exporters have a continual demand for empty containers. Yet, matching this demand—particularly for agricultural exports—with the supply created by imports presents a greater challenge than would seem at first glance. The number of containers available from U.S. imports of consumer goods far outstrips the number needed to send U.S. products overseas. In theory, this system creates a synergy for the U.S. exporter and the ocean carrier, as it affords exporters lower (backhaul) ocean freight rates. However, for many agricultural shippers, the long geographic distances between their export product and the pool of empty containers pose a significant logistical hurdle.

Destinations for import containers are typically densely populated metropolitan regions, rather than small, rural communities where most agricultural production originates. Repositioning empty containers from these populated metro areas to rural agricultural production centers is an expensive endeavor. Nevertheless, agricultural exporters do it every day to serve their overseas market, despite eroding their own profitability. These formidable obstacles and high stakes make empty container repositioning (ECR) one of the most significant and challenging issues facing the container shipping industry. A study by the New Jersey Institute of Technology (NJIT) develops effective solutions for U.S. grain shippers to leverage empty containers using ECR and transloading operations.[1]

[1] Transloading is one such strategic solution to containerized agricultural exports, as it uses inland transportation conveyances to bring grain and other agricultural products to the maritime containers. Transloading refers to the process of physically moving the cargo from one conveyance to another with the aid of transloading facilities, such as elevators and conveyers (Thomson, 2012).

WHAT DID THE STUDY FIND?

A surplus of empty containers is typical in the U.S. container shipping market, mainly because of a trade or transshipment imbalance. The study considers two ways in which exporters can respond to this surplus: (1) use rail to reposition empty containers near a production site for source loading and shipment to port, or (2) ship cargo to a port via truck, then transload the cargo into a container.[2] The study refers to the first option as 'multimodal' and the latter as 'truck-only.' With either option, exporters and carriers sustain additional costs; however, either option may be optimal, depending on circumstances.

Researchers determined several variables that affected optimal shipper strategy. Then, tipping points—the minimum value at which multimodal shipping is optimal—were calculated for volume and distance. Next, researchers conducted sensitivity analyses to determine how these critical values respond to changes in ECR cost.[3]

All else equal, total drayage distances above 204.69 miles indicate a shipper should use multimodal shipping. Alternatively, using a fixed distance, researchers find a tipping-point volume of 358.84 tons. For values of distance and volume beyond the tipping points, savings associated with multimodal transportation generally increase as distance and volume increase.

To measure how ECR costs affect exporter decision-making, the study considers two scenarios in which the drayage distance for a truck-only option is either 10 percent shorter or 10 percent longer than that of multimodal shipping. The tipping points of distance and volume for both scenarios are then integrated with ECR costs ranging from $1 per ton to $8 per ton.

Not surprisingly, tipping-point values for volume and distance are lower when truck-only drayage is longer than multimodal drayage, compared to the opposite scenario. Furthermore, tipping-point values for both distance and volume increase as ECR costs increase.

To help shippers decide whether to employ truck-only or multimodal shipping, the study includes a dynamic programming model that allows them to compute the optimal option for their situation. The model allows shippers to program distances, volume, ECR costs, transloading fees, shipping costs, storage cost, grain price, beginning stocks, and harvest quantity across multiple harvest seasons to determine their optimal shipping strategy.

HOW WAS THE STUDY CONDUCTED?

The researchers consulted several different organizations for the information included in the study. Third-party logistics companies provided shipping cost per ton-mile, while farmers and farmer cooperatives provided volume data. Furthermore, data were drawn from IHS Markit's PIERS 2016 dataset, the Public Waybill, and USDA.

Throughout the project, the researchers leveraged several quantitative methodologies, including hypothesis tests, regression analyses and forecasting, dynamic optimization and simulation, and sensitivity analyses. Once significant variables were established, static analyses were conducted to determine tipping points for volume and distance. Consequently, sensitivities were conducted with respect to ECR costs.

[2] Shippers can also ship cargo to ports for transloading by rail. For simplicity, the study only considers transloading operations which rely exclusively on truck transportation.

[3] Sensitivity analysis refers to "the study of how the uncertainty in the output of a model can be apportioned to different sources of uncertainty in the model input." (Saltelli, 2002)

The researchers also analyzed the seasonality of harvest and trading to create a dynamic model of inventory management. This model (and a description) is included in the appendices to allow shippers to customize model specifications.

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