Study shows value of dynamic forecasting in intermodal management

June 9 2016

Ting Luo is a Ph.D. candidate in operations management in the Naveen Jindal School of Management at UT Dallas. Credit: UT Dallas

Intermodal transportation—which uses a combination of transportation modes, such as trucks, trains and ships, to move everyday goods—is the backbone of many supply chains, and while the industry is seeing tremendous growth, it also faces a severe container capacity shortage.

Ting Luo, a PhD candidate in operations management in the Naveen Jindal School of Management, recently examined how managers in intermodal marketing companies should use dynamic forecasting to coordinate daily operations, enhance efficiency and improve profitability.

Published online in May in *Production and Operations Management*, the study determined the optimal container leasing and load acceptance policy under dynamic demand and supply forecasting. It also found that the value of dynamic forecasting depends on scarcity, stochasticity, or randomness, and volatility.

Luo said intermodal revenue management is different from traditional revenue management models, which do not address the supply issue.

With airlines or hotels, no capacity remains when the space is full, Luo said. In intermodal, capacity can be expanded by leasing containers from local railways. There also is a random supply of repositioned and returned containers.

"We have to first decide how many containers to borrow. The trade-off is between on-spot leasing cost and potential profit created by the borrowed container," Luo said. "Then we decide, 'Do I use this container to satisfy the current demand, or do I just keep it for the next day?' Maybe the next day, I have more profitable orders coming in, so I reserve that container. Or, if today I have a lot of very profitable orders,

I can backlog that order and fulfill it the next day when I have more containers."

Most companies have no formalized short-term forecast and only a vague idea of available container capacity, Luo said. Few have systematic leasing and acceptance policies.

"The traditional mean-value forecasting may produce misleading recommendations because it ignores the stochasticity within a period and volatility between periods," she said. "Both of these features are captured by dynamic forecasting."

The study characterized the effects of dynamic forecasting on profitability and policy choice. When it comes to profitability, dynamic forecasting reduces the need for carrying large stockpiles for an extended time, thereby saving on holding costs. It also ensures swift stock buildups for imminent shortages. With policy choice, dynamic forecasting guides policy formulation.

Luo and her co-authors also determined that dynamic forecasting should be used when customer heterogeneity is high, inventory costs are low, capacity supply is moderate and forecast accuracy is high.

"The Dallas-Fort Worth area is one of the nation's major transportation hubs and home to many railways and intermodal companies," Luo said. "Our model not only gives these firms practical operational tools but also specifies how and when to use dynamic forecasting."

Dr. Long Gao of the University of California, Riverside and Yalcin Akcay of Koc University in Istanbul are co-authors on the paper.

The trio's future research will focus on coordinating the decentralized intermodal network that consists of multiple locations.

Provided by University of Texas at Dallas