

ABSTRACT

Mesa-Arango, Rodrigo. Purdue University, Dec 2014. Algorithms for Bundling and Pricing Trucking Services: Deterministic and Stochastic Approaches. Major Professor: Satish V. Ukkusuri.

Bundling and pricing trucking services is an important strategic decision for carriers. This is helpful when carriers consider the incorporation of new businesses to their networks, look for economic and optimal operations, and develop revenue management strategies. Reverse combinatorial auctions for trucking services are real-world examples that illustrate the necessity of such strategies. In these auctions, a shipper asks carriers for quotes to serve combinations of lanes and the carriers have to bundle demand and price it properly. This dissertation explores several dimensions of the problem employing state-of-the-art analytical tools. These dimensions include: Truckload (TL) and less-than-truckload (LTL) operations, behavioral attributes driving the selection of trucking services, and consideration of deterministic and stochastic demand. Analytical tools include: advanced econometrics, network modeling, statistical network analysis, combinatorial optimization, and stochastic optimization. The dissertation is organized as follows. Chapter 1 introduces the problem and related concepts. Chapter 2 studies the attributes driving the selection of trucking services and proposes an econometric model to quantify the shipper's willingness to pay using data from a discrete choice experiment. Chapter 3 proposes an algorithm for demand clustering in freight logistics networks using historical data from TL carriers. Chapter 4 develops an algorithmic approach for pricing and demand segmentation of bids in TL combinatorial auctions. Chapter 5 expands the latter framework to consider stochastic demand. Chapter 6 uses an analytical approach to demonstrate the benefits of in-vehicle consolidation for LTL carriers. Finally, Chapter 7 proposes an algorithm for pricing and demand segmentation of bids in LTL combinatorial auctions that accounts for stochastic demand. This research provides meaningful negotiation guidance for shippers and carriers, which is supported by quantitative methods. Likewise, numerical experiments demonstrate the benefits and efficiencies of the proposed algorithms.