Investigation of Carriers’ Capability of Cost Passage in Response to Toll Increases: An Empirical Analysis of Freight Agents’ Relative Market Power
Dapeng Zhang a, Xiaokun (Cara) Wang b, Holguin-Veras, José c

a Rensselaer Polytechnic Institute, zouw2@rpi.edu
b Rensselaer Polytechnic Institute, wangx18@rpi.edu
c Rensselaer Polytechnic Institute, jhv@rpi.edu

Extended abstract

Objectives and motivation
The freight system conveys the supplies needed for modern life, generating tremendous benefits as well as negative impacts on quality of life, sustainability, and environmental justice. MAP-21 explicitly indicates the importance of freight studies for public sector (U.S. Department of Transportation 2013) and calls for effective freight policies to reduce congestion, mitigate pollution, and improve supply chain efficiency.

To propose effective policies, studies first need to understand freight agents’ behavior. Unlike its passenger counterpart, where trip decisions are made solely by travelers, freight activities are determined by multiple agents, including shippers, carriers and receivers. Disregarding interactions between agents may prevent the research community from fully understanding the decision mechanism, leading to misleading assessments of policy effects on each individual decision maker, and consequently, poor predictive power. For example, peak-hour tolls aimed at congestion relief could not shift truckers’ travel patterns as intended because those routes and schedules are jointly determined by not only the truckers, but also receivers who may have conflicting preferences. It is generally agreed that the interaction between freight agents’ relative market power is critical for the freight activities. For example, Holguin-Veras (2008) suggested that carriers could not pass tolls to receivers when toll was increased, because the receivers played the dominant role in the market. Another study of Holguin-Veras et al. (2006) further found that certain types of carriers (e.g., out of the New York-New Jersey region and with small-size trucks) possessed low market power, because they were sensitive to the time of day pricing policy. Intuitively, as economic agents are in the production-consumption links, the interactions between freight agents are mainly economic via market dynamics. The key factors characterizing interactions between economic agents should be the extent of market (e.g., perfect competitive, oligopolistic, monopolistic, etc. (Reiss and Wolak 2007) and information available to the economic agents (e.g., complete, symmetrically incomplete, and asymmetrically incomplete).

Although freight agents’ market power has drawn increasing attention from the research community, empirical studies of its influence on freight behavior are still quite limited. This study explores this issue through investigating carriers’ capability of cost passage when they are subject to toll increase. This capability characterizes carriers’ market power relative to receivers: When carriers have the absolute market power, they can charge all increased operation costs to their receivers, without sacrificing any of their own profit. When receivers have dominant market power, carriers may have to absorb part or all of the increased operation costs to remain competitive. Therefore, the degree of the increased operation costs that a carrier absorbs is a reasonable indicator of a carrier’s market power relative to its receivers. In order to obtain the degree of toll passage, this study conducted a stated preference survey among carriers in the New York State (NYS). The survey asked carriers not only the indication of whether or not to pass the increased toll, but also the percentage that they can pass. The study also recognizes that carriers’ market power is potentially determined by carriers’ characteristics and market conditions. The study obtained carriers’ characteristics from the survey, including the types of goods delivered, typical delivery tours, carriers’ location, and company business information, etc. Market conditions are characterized by census statistics, such as population density and employment entropy. These influential factors are analyzed using descriptive statistics and econometric modeling to gain insights into carriers’ market power.

General description
Effective freight policies can improve supply chain efficiency and reduce freight system’s externalities. The design of effective freight policies rely on comprehensive understanding of freight agents’ decision making mechanisms, which often involve interactions between multiple stakeholders. A critical component determining the interaction mechanism is freight agents’ relative market power. However, empirical studies of agents’ relative market power are quite limited. This study explores this issue by investigating carriers’ cost passage capability using a stated preference approach, where carriers were asked to indicate their responses given hypothetical toll increase. Using the large survey dataset and behavioral-consistent models, this paper finds that large and specialized trucks are associated with high cost passage capability, suggesting their high market power. Carriers in a competitive market usually have less market power. The results of this study indicate that road pricing on carriers may propagate...
to other links of the supply chain, changing shippers’ and receivers’ current cost structure, especially for carriers with high market power.

Results and conclusions
This paper explores freight carriers’ capability of passing increased toll, using empirical data collected from New York State. Such capability is a good indicator of carriers’ market power.

Descriptive statistical analyses found that large trucks are associated with high cost passage capability, and thus high market power. Market conditions also characterize the passage capability, but most descriptive interpretation is not very clear given the small difference. Then, econometric models are used to examine the relationship between the passage capability and a variety of influential factors. Estimation results show that the type of goods carriers transport significantly affect their market power. Their relative market power can be determined by the estimated coefficients. Among them, the utility carriers have the largest market power, followed by liquids/gases, agriculture, and machinery/large objects carriers. This may result from the vehicles used by these sectors. Their vehicles are very likely to be specifically designed and cannot be easily replaced by competitors. Regional factors also characterize the market conditions and carriers generally have less market power in the competitive market.

The result of this study indicates that freight policies may target at a certain group of carriers. For example, moving delivery time to off-peak hours could target at carriers with high market power. Besides, the study shows that freight policies targeted at carriers, such as increasing tolls, may propagate to other links of the supply chain, changing shippers’ and receivers’ current cost structure. Therefore, policies targeting at trucks should be carefully investigated by considering the interaction between the freight agents.

This paper is the first study that analyzes freight agents’ behavior in terms of toll passage capability using empirical data. This innovative study adds important values to the literature on understanding the freight market condition and freight agents’ behavior.

References

Keywords: freight transportation; market power; sample selection model; stated preference survey.