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The impacts of time of day pricing on the behavior of freight carriers in a congested urban area: Implications to road pricing

José Holguín-Veras [a,*], Qian Wang [a,1], Ning Xu [a,1], Kaan Ozbay [b,2], Mecit Cetin [c,3], John Polimeni [d,4]

[a] Department of Civil and Environmental Engineering, Rensselaer Polytechnic Institute, JEC 4030, 110 8th Street, Troy, NY 12180, USA
[b] Department of Civil and Environmental Engineering, Rutgers University, P.O. Box 909, Piscataway, NJ 07855-0909, USA
[c] Department of Civil and Environmental Engineering, University of South Carolina, Room C115, 300 Main Street, Columbia, SC 29208, USA
[d] Albany College of Pharmacy, 106 New Scotland Avenue, Albany, NY 12208-3492, USA

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Abstract

This paper describes the key findings from a major research project aimed at assessing the impacts of the Port Authority of New York and New Jersey's time of day pricing initiative on the behavior of commercial carriers. The paper, believed by the authors to be the first comprehensive study on the subject, highlights key implications for road pricing policy.

One of the most interesting findings is that carriers respond to time of day pricing by implementing multi-dimensional responses involving *Productivity increases*, *Cost transfers*, and *Change in facility usage*. This implies a more nuanced response than suggested by micro-economic theory, which would only predict a change in facility usage. In fact, no carrier was found to have responded by implementing only changes in facility usage, which leads to the authors to believe that this is a last resort alternative.

In terms of numerical importance, three combinations of strategy groups represent almost 90% of the cases: *Productivity increases* (42.79%), followed by *Changes in facility usage* and *Cost transfers* (27.60%) and *Productivity increases* and *Changes in facility usage* and *Cost transfers* (19.32%). The fact that some of these responses impact only the carrier (i.e., *Productivity increases*) while others mostly impact the receivers (*Changes in facility usage* and *Cost transfers*) lead the authors to believe that the nature of the response is determined by the balance of power between carriers and receivers. If carriers dominate the relationship, then it is likely that policies that mostly impact receivers are implemented; otherwise, the carriers have no choice but implementing strategies that help them cope with the impacts of pricing without impacting their customers, i.e., productivity increases. In this context, the authors' conjecture is that carriers consider changes in

* Corresponding author. Tel.: +1 518 276 6221; fax: +1 518 276 4833.
E-mail addresses: jhv@rpi.edu (J. Holguín-Veras), wangq4@rpi.edu (Q. Wang), xun@rpi.edu (N. Xu), kaan@rci.rutgers.edu (K. Ozbay), cetin@engr.sc.edu (M. Cetin), polimenj@acp.edu (J. Polimeni).
[1] Tel.: +1 518 276 3121; fax: +1 518 276 4833.
[2] Tel.: +1 732 445 2792; fax: +1 732 445 0577.
[3] Tel.: +1 803 777 8952; fax: +1 803 777 0670.
[4] Tel.: +1 518 445 7384; fax: +1 518 445 7382.

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facility usage to be a very disruptive alternative that forces them—and more importantly their customers—to alter their shipping/delivery patterns. It should be pointed out that, although carriers stand to benefit from working during the off-peak hours, they could only do so if their customers are willing to work during the off-peak hours.

The data indicate that 36 carriers (20.2%) changed behavior because of the time of day pricing initiative. This number includes 17 carriers (9.0%) that reacted by increasing shipping charges to receivers, which illustrates the need to find out more about how receivers reacted to the time of day pricing initiative. If the carriers that only increased shipment charges are excluded, 15.3% of carriers changed behavior because of time of day pricing.

Keywords: Road pricing; Behavioral impacts; Freight carriers; Trucking

1. Introduction

Road pricing is a subject that, since its inception in the 1960s (Vickrey, 1961, 1969) has elicited strong responses both against and in favor. Supporters argue that optimal (marginal) road pricing is the key to an optimal allocation of resources and flexible and sustainable demand management; while opponents counter that road pricing is nothing more than another form of taxation, and that it is inherently unfair to low income individuals. Although some of these criticisms have not been found to be correct (Sullivan and El Harake, 1998), general public's opposition to road pricing still remains strong. The abundance of misconceptions, both in favor and against road pricing stresses the importance of documenting the impacts of actual road pricing implementations on the behavior of the different user segments, in the hope that the rise of an objective picture of road pricing's impacts help develop an accurate picture of the impacts of road pricing.

Although there have been numerous publications describing the impacts of road pricing on the behavior of passenger car users (e.g., Sullivan and El Harake, 1998; Golob and Supernak, 1998; Supernak et al., 2003), the literature review conducted for this paper revealed no previous publication dealing with the impacts on freight carriers. The reasons seem to be two-fold. First, the number of road pricing implementations with a freight component is very small. Second, no follow-up study has been conducted to assess behavioral changes in those few cases where the road pricing implementation has included a commercial vehicles component. The latter is easy to understand: collecting behavioral data from freight carrier is notoriously difficult; designing the corresponding survey instruments, defining the sampling frames and sampling plan requires a priori knowledge of who and where are the users (which could be extremely difficult in cases where there are large numbers of interstate and international freight carriers using the toll facilities to make thru trips), among other factors. As a result of all of this, not much is known about how freight carriers react to road pricing. This lack of knowledge, in turn, prevents the definition of suitable transportation policies and to answer the fundamental question: is road pricing effective in moving freight traffic to the off peak periods?

The main objective of this paper is to help fill this void by conducting a comprehensive analysis of the impacts of time of day pricing on the behavior of freight carriers, in the context of an actual implementation. The project used as a case study is the Port Authority of New York and New Jersey (PANYNJ)'s time of day pricing initiative. Due to the fact that this analysis seems to be the first comprehensive examination of the impacts of pricing on carrier behavior, the authors decided to discuss the data in great detail, in the hope that the analyses prove useful to future researchers and practitioners interested in this important subject.

The remainder of the paper includes five sections. Section 2 provides the reader with an overview of the PANYNJ and its time of day pricing initiative. Section 3 briefly describes the survey methodology used and data collected. Section 4 discusses company characteristics and operational patterns. Section 5 analyzes the impacts of the time of day pricing initiative. Section 6 discusses the policy implications, and Section 7 highlights the key conclusions from the research.

2. The port authority of New York and New Jersey and its time of day pricing initiative

The Port of New York Authority (PNYA) was created in 1921 with broad responsibility to solve regional transportation problems, as a bi-state agency in charge of "Port District" a bi-state area of approximately