Available online at www.sciencedirect.com
SCIENCE DIRECT
Transportation Research Part A 40 (2006) 690–697
TRANSPORTATION RESEARCH PART A
www.elsevier.com/locate/tra

Economic analysis of collecting parking fees by a private firm

Jyh-Fa Tsai [a,*], Chih-Peng Chu [b]

[a] Department of Economics, Soochow University, 56, Sec. 1, Kuei-Yang Street, Taipei 100, Taiwan
[b] Department of Business Management, National Dong Hwa University, 1, Sec. 2, Da-Hsueh Road, Shou-Feng, Hualien 97401, Taiwan

Received 7 June 2005; accepted 15 December 2005

Abstract

The purpose of this paper is to show the possibility of a co-existence of public and private parking management systems even when all the parking spaces are owned by the government. This study focuses on the issue of collecting parking fees by a private firm that has been used by some local governments in Taiwan. We assume that the government behaves as a leader and a private firm as a follower in a Stackelberg three-stage game. At stage 1, the government selects its parking space. At stage 2, the government and the firm set their parking fees simultaneously. At the final stage, consumers (drivers) choose the parking lot between the space of the government and that of the firm by considering the full costs, consisting of the parking fee and the searching (with congestion) time cost. The objective of the government is to maximize welfare and that of the firm is to maximize profit. The model is constructed at first and a simulation analysis is then made. The result supports the strategy of adopting the franchise of collecting parking fees if the private firm is more efficient than the government. Moreover, the government may keep fewer parking spaces and release more parking spaces to the firm under the goal of maximizing welfare.

Keywords: Parking fee; Franchise; Social welfare

1. Introduction

The issue of parking is very important in urban transportation due to the high demand for parking compared to a limited parking supply in most cities. Theoretical models of parking markets explore the parking issue from several aspects. Arnott et al. (1991) show that spatially differentiated parking fees may rival time-differentiated congestion fees. Glazer and Niskanen (1992) present that using parking fees may be much less effective in the presence of through-traffic. Verhoef et al. (1995a) explore the advantage of using pricing instruments over restricting supply in the parking market. Arnott and Rowse (1999) offer a parking congestion model focusing on drivers' search for a vacant parking space and show that a parking externality arises

* Corresponding author. Tel.: +886 2 2311 1531x2898; fax: +886 2 2382 2001.
E-mail address: tsaij@scu.edu.tw (J.-F. Tsai).

0965-8564/$ - see front matter
doi:10.1016/j.tra.2005.12.001

due to individuals' behavior. On the other hand, empirical studies emphasize on the impact of parking polices on an individual's modal choice decisions using discrete-choice econometric models (see Gillen, 1977; Florian and Los, 1980; Willson, 1992; Hensher and King, 2001).

The idea of this study is generated from observing a real case in Hualien city, Taiwan. Hualien is a newly emerging city in an agricultural region of Taiwan and has been suffering from large parking demand recently. The local government has thus executed a new parking policy to lessen the burden of the parking problem by charging a certain amount per month as a franchise fee to a private firm. The private firm then can collect the parking fees from parking users. After covering the franchise fee, the private firm still obtains a positive gain due to its high efficiency on collecting parking fees by recording the parking time very quickly so as to avoid any loss on revenue that can be collected. This revenue-collecting mechanism has therefore been evaluated by some other local governments when considering whether to follow Hualien's parking policy.

The purpose of this paper is to show the possibility of a co-existence of public and private parking management systems even when all the parking spaces are owned by the government. That is, the management of a private firm with a profit-maximizing goal and the government with a welfare-maximizing goal can exist in the parking market. The co-existence can improve the inefficiency of management in a government system and the lack of a social welfare perspective in a privately monopolistic system. The result of this study supports the reason for using a franchise system of collecting parking fees.

Co-existence means that the private firm and the government compete in the parking market. Therefore, some questions might be raised. How much space should the government release to the private firm? How is the pricing by the government in competition with that of the private firm? Instead of determining the franchise fee in the study, we use the parking space as the government's choice variable to maximize welfare. That is, the franchise fee is determined after the parking spaces released to the private firm are chosen by the government.[1] The private firm and the government then compete in the parking market by setting up each price to consumers. The objective of the government is welfare-maximizing and that of firm is profit-maximizing.

The rest of this paper is organized as follows. In Section 2, we explore this topic by modeling the determination of the parking space by the government and the parking pricing of both the government and the private firm. Section 3 employs a simulation analysis to obtain insights from the model. The conclusion of this paper is summarized in Section 4.

2. The model

This model assumes that government behaves as a leader and a private firm as a follower in a Stackelberg three-stage game. At stage 1, the government selects its parking space s_1 from a total fixed parking space $\bar{s}$ and thus franchises parking spaces $s_2 = \bar{s} - s_1$ to the private firm.[2] At stage 2, the government and the firm set their parking fees f_1 and f_2 simultaneously. At stage 3, consumers consider the parking cost to decide whether to park or not. If they decide to park, then they have to choose a parking place between the private and public spaces.

We consider the elastic demand in this paper. The demand function for parking is assumed to have a linear form

$$D = D_0 - aP, \tag{1}$$

where D_0 is the potential demand or the demand when price is zero, and a denotes the decrease in demand when one unit of price increases. The behavior of consumers is to choose between private and public parking spaces while considering the individual's full costs (price of using the parking space, P_i) that consist of the parking fee (f_i) and the searching time cost (T_i), where $i = 1,2$ ($i = 1$ denotes the government, $i = 2$ the private firm).

[1] This could avoid an unrealistic situation in that the government could determine two variables, franchise fee and parking spaces, independently.

[2] The government is active in determining the parking space instead of the formulation of a firm's selection for parking space. This is in reaction to the real case in Haulien city and also guarantees the feasibility of the objective of welfare maximizing.