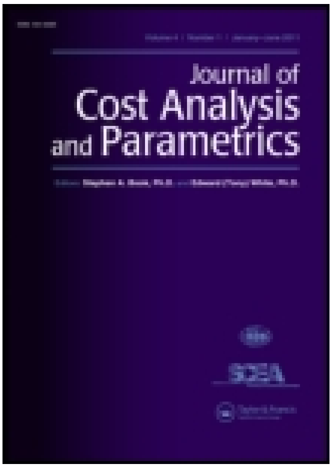

Journal of Cost Analysis and Parametrics
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/ucap20

An Economics Approach to Fixing the Fare of the Parking Lot Service in Bogotá Using Price Cap Regulation

Jorge A. Perdomo[a]
[a] Teknidata Consultants, Bogotá, Colombia
Published online: 15 Apr 2015.

To cite this article: Jorge A. Perdomo (2015) An Economics Approach to Fixing the Fare of the Parking Lot Service in Bogotá Using Price Cap Regulation, Journal of Cost Analysis and Parametrics, 8:1, 23-33, DOI: 10.1080/1941658X.2015.1016586

To link to this article: http://dx.doi.org/10.1080/1941658X.2015.1016586

Journal of Cost Analysis and Parametrics, 8:23–33, 2015

ISSN: 1941-658X print / 2160-4746 online
DOI: 10.1080/1941658X.2015.1016586

An Economics Approach to Fixing the Fare of the Parking Lot Service in Bogotá Using Price Cap Regulation

JORGE A. PERDOMO

Teknidata Consultants, Bogotá, Colombia

This article presents an application of the Ramsey Pricing approach to establish the price cap or pricing ceiling per minute for the parking lot service in Bogotá (Colombia), using the microeconomic framework for price fixing from a costs analysis (total fixed costs, total variables costs, average total cost, and marginal cost) of the provision of parking lot service in Bogotá. These results were evidenced by means of a dynamic panel data model for estimating total cost functions through generalized method of moments estimators. Also, from the econometric outcome and using the Ramsey Pricing approach and mathematical optimization (comparative statics), I obtained the maximum fare per minute that should pay the consumers of the parking lot service in Bogotá. I conclude that the current maximum fee per minute, paid by parking users, does not cover the fixed costs incurred by firms that provide legally this service in Bogotá.

Introduction

Currently in Bogotá, the size and physical development of its road infrastructure are not appropriate for the mobility needs; also, they have been one of the main causes of traffic congestion in the city (Sarmiento et al., 1999). Moreover, due to the spatial restriction the motor vehicles users are using the sidewalks to park, which hinders the free movement of pedestrians.

For this reason, the Decree 1504 (1998) was implemented to recover the public space, through the so-called "*parking bollards*," which were located in the main streets to close some parking zones (Judgment 874 from 1999 of the State Council) for clearing the sidewalks and achieving a greater pedestrian flow. Nonetheless, as a result, the number of legal and illegal parking lots in Bogotá increased considerably with fares out of control.

Therefore, Decree 268 (2009) (issued by the Mayoralty of Bogotá) was recognized to regulate the service tariff and its methodology was a legal decision without an economic criteria; hence, it is unknown whether or not this price is covering the fixed and variables costs of the firms that provide legally the parking lot service in the city and their profits are positive.

According to the above, the main aim of this article is to calculate the price cap per minute, which the parking users should pay for a legal service in Bogotá. In this way the case study was based on microeconomic framework for price fixing from a costs analysis (total fixed costs, total variables costs, average total cost, and marginal cost) of the provision of parking lot service in Bogotá.[1]

Address correspondence to Jorge A. Perdomo, Teknidata Consultants, Carrera 18 No. 86A-14, Bogotá, Colombia. E-mail: jperdomo@teknidataconsultores.com; jor-perd@uniandes.edu.co; perdomo.jorge@urosario.edu.co

These results were evidenced by means of a dynamic panel data model to estimate total cost functions through generalilzed method of moments (GMM) estimators. Also, from the econometric outcome and using the Ramsey Pricing approach and mathematical optimization (comparative statics), I obtained the maximum fare per minute that the consumers of the parking lot service in Bogotá should pay.

The remainder of the article is organized as follows. The following section provides the relevant related literature. The section after that describes the microeconomic framework and analytical methodology. The next to last section briefly describes the data I used and presents my empirical results. Finally, the last section concludes the article.

Related Literature

To my knowledge, there are few studies on the topic in Colombia (Perdomo and Ramirez, 2011; Mendieta and Perdomo, 2008; Perdomo and Rubio, 2012); whereas internationally there is a substantial amount of research on the parking regulation matter (Verhoef, Nijkamp, & Piet, 1995; Shoup, 1997; Cowan, 2002; Anderson and De Palma, 2004; Combes & Miren, 2005; Matteo, Salvatore, Ugo, & Giuseppe, 2006; De Boger, Kerstens, & Matthias, 2008; Qian, Xiao, & Zhang, 2011). Therefore, their methodologies and results are important for the present article, because the researches aforementioned show some approaches to calculate the parking tariffs for the analysis of the parking demand using stated preferences (willingness to pay) and random utility models. In a particular case in France, generalized cost (the sum of the monetary and non-monetary costs of a journey)[2] was used to calculate transport fee. As well, one of them showed the problem between land use and operation of the parking lots; its conclusion was that it is a problem of transport policy. On the other hand, in several studies on economic regulation (monopoly power at the communications market and transport market) the Ramsey Pricing approach has been applied to establish a price cap; therefore, they are important in this article (Loube, 1995; Cowan, 2002, Perdomo and Ramirez, 2011) as well.

Moreover, the methodologies of the aforementioned studies were supported by means descriptive statistics and conventional econometric techniques to determine their results. Nevertheless, unlike the reviewed literature, in this article I used Ramsey Pricing approach and GMM estimators to estimate total cost function, average total cost, and marginal cost of the provision of parking lot service in Bogota to regulate the fare paid by consumers.

Therefore, the following section describes the microeconomic framework and analytical methodology that is implicit in Ramsey Pricing to evidence whether or not the current fare of parking lot service is covering the fixed and variable costs incurred by legal private companies that are providing this service in Bogotá.

Microeconomic Framework and Analytical Methodology

Considering that in Bogotá the private parking market operates as a monopolistically competitive market,[3] the fare paid by consumers was regulated by Decree 268 of 2009, which established a pricing ceiling per minute. Due to that the tariffs were discriminated unchecked by owners of the parking lot, according to the site or address where they were located into the city.

However, for my empirical illustration in this article, for fare fixing of the parking lot service in Bogotá, the measures will be constructed using an economics approach to price fixing, cost analysis of the provision of a parking lot service (cost functions, marginal cost, and average cost), and price cap (McCarthy, 2001; Campos, De Rus, & Gustavo, 2004). As well, I used a dynamic data panel model by means of the generalized method of moments (GMM) to estimate the total cost functions.

The fare fixing for the parking lot services can be accomplished using Ramsey Pricing[4] or price cap regulation because this mechanism has been applied in companies with market power to restrict their profitability, so they are limited by the regulator, which will seek to set a tariff equal to the marginal costs of production (Campos et al., 2004, p. 263), which in turn corresponds to the socially optimal (see details in Campos et al., p. 188). Thus, the maximum fare per minute, which should impose the regulator for private market of the parking lots service (to owners and consumers) in Bogotá, will be on the intersection between marginal and average total cost, meaning that the price per minute of the service will be equal to that of producing it (Figure 1).

Figure 1 shows the relationship between the average total and marginal cost curves (*ATC* and *MC,* respectively) whose intersection at their minimum is the fare per minute adjusted (P^*, which is located on the y axis) and the optimal quantity (Q^*, in the x axis) or number of minutes (of the parking lot services) required to the sale. Also, Table 1 lists the total cost functions (linear, quadratic, and cubic, Figure 2), where β_0, β_1, α_0, α_1, α_2, γ_0, γ_1, γ_2, and γ_3 are the parameters in each model. With the information from total cost curve (Figure 2) we can construct the average and marginal cost curves shown in Figure 1.

Likewise, Figure 2 shows the relationship between the total cost and output level (*TC* and *Q,* respectively); *TC* has units of dollars ($) on the y axis (for total cost), also it is divided into two parts: total variables costs (*TVC*) and total fixed costs (*TFC*).

In this way and in accordance with Campus et al. (2004), the total costs (*TC*) of a parking lot are given by the project cost per space, the land cost, the construction cost, the

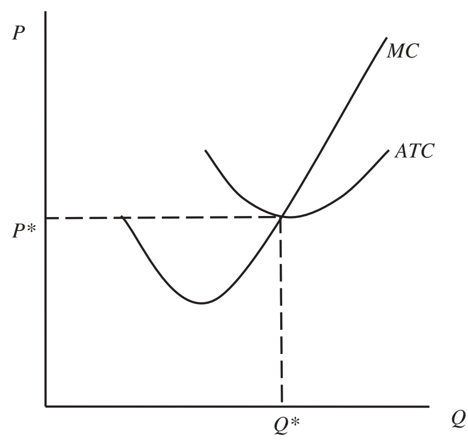

FIGURE 1 Marginal cost curve (*MC*) and average total cost (*ATC*) (Nicholson, 2002).

TABLE 1 Total, marginal, and average cost functions

Function	Equation TC Form	$MC = \frac{\partial TC}{\partial Q}$	$ATC = \frac{TC}{Q}$
Linear	$CT = \beta_0 + \beta_1 Q$	β_1	$\frac{\beta_0}{Q} + \beta_1$
Quadratic	$CT = \alpha_0 - \alpha_1 Q + \alpha_2 Q^2$	$-\alpha_1 + 2\alpha_2 Q$	$\frac{\alpha_0}{Q} - \alpha_1 + \alpha_2 Q$
Cubic	$CT = \gamma_0 + \gamma_1 Q - \gamma_2 Q^2 + \gamma_3 Q^3$	$\gamma_1 - 2\gamma_2 Q + 3\gamma_3 Q^2$	$\frac{\gamma_0}{Q} + \gamma_1 - \gamma_2 Q + \gamma_3 Q^2$

Source: Nicholson (2002) and Mendieta and Perdomo (2008).

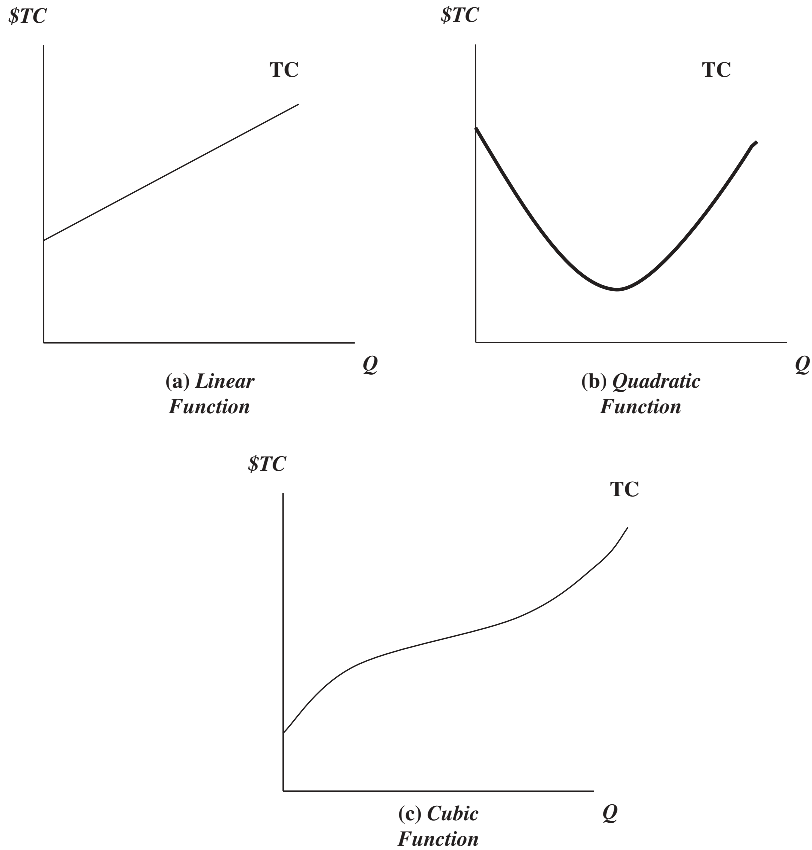

FIGURE 2 Total cost function in Table 1 (Nicholson, 2002).

maintenance costs, and the annual operating cost ($TC = TVC + TFC$).[5] Thus, from TC incurred by owners of the parking lot, it is possible to estimate the functions of Figure 2 and Table 1. In this manner, from TC function estimated, the average total cost (ATC) and marginal cost (MC) of the service can be obtained.

Therefore, the optimal output level (minutes required to sale, Q^*) to maximize the profits of the owners of the parking lot is on the intersection between ATC and MC (Figure 1). Thereby, Q^* can be substituted at Equation (1) to calculate the fare per minute (P^*), which is equal to short-run marginal cost (Equation (1)):

$$P^* = MC, \tag{1}$$

$$P^t = \left(P^* + C_F\right)\left(1 + \hat{P}\right). \tag{2}$$

Nonetheless, the price ceiling (P^t) per minute, or second best pricing (Ramsey Pricing), for regulating the private market of the parking lot service in Bogotá is given by Equation (2). As can be seen, Equation (2) has two terms; the first term represents the inflation rate ($\hat{P}$) and the second term represents the fixed costs (C_F).

Thus, P^t can be determined using micro data underlying costs (fixed costs and variable costs) of production and operation of the parking lot service. Also, the functions in

TABLE 1 can be estimated by means of the GMM[6] estimator and with this result *MC, ATC,* Q^*, P^*, and P^t can be determined through comparative statistics (Chiang, 1988, pp. 173–174).

In empirical practice of the aforementioned theoretical framework, this article makes use of data for a balanced panel[7] (a set of 10 parking lots are observed over 36 months, from January 2010 to December 2012). Thus, the cost functions in Table 1 to be estimated are as follows:

$$Y_{it}(\boldsymbol{\beta}, \boldsymbol{X}_{it}, \varepsilon_{it}) = f(\boldsymbol{\beta}, \boldsymbol{X}_{it}, \varepsilon_{it}), \tag{3}$$

$$i = \text{parking lot 1, parking lot 2}, \ldots, \text{parking lot 10 and } t = 2010{:}01, \ldots, 2012{:}12,$$

where i is the individual dimension and t is the time dimension, Y_{it} is the dependent variable (total costs of production), $\boldsymbol{X}_{it}$ is the independent variable (Q-*Mins*-, number of minutes sold) and it is a vector of K time-varying explanatory variable, $\boldsymbol{\beta}$ the parameter vector, and the error ε_{it} is independent and identically distributed (*iid*). Nonetheless, the balanced panel is a dynamic model because the number of time series observations is much larger than the number of cross-sectional data, meaning that the series are highly autoregressive and the results of the ordinary least squares (OLS) estimators would be unsatisfactory in this context.

Hence, the general approach is first-differences GMM[8] estimator because it produces more reasonable and satisfactory results (unbiased efficient estimator). Unlike OLS and maximum likelihood estimation (MLE), the approach of GMM does not require complete knowledge of the distribution of the data or of the disturbances. Only specified moments derived from an underlying model are needed for GMM estimation (Greene, 2002, p. 201). Also, the heterogeneity can be swept from the model by taking first differences in either the fixed or random effects cases, which produces:

$$Y_{it} - Y_{i,t-1} = \delta\left(Y_{i,t-1} - Y_{i,t-2}\right) + \left(\boldsymbol{X}_{it} - \boldsymbol{X}_{i,t-1}\right)'\boldsymbol{\beta} + \left(\varepsilon_{it} - \varepsilon_{i,t-1}\right). \tag{4}$$

In the context of a GMM estimator and assuming that the time series is long enough (36 months), one could use the lagged differences, $(Y_{i,t-2} - Y_{i,t-3})$, as one instrumental variable for $\left(Y_{i,t-1} - Y_{i,t-2}\right)$. Also, the time varying explanatory variable X_{it} is strictly exogenous in the sense that:

$$E\left(\Delta X'_{it}\Delta\varepsilon_{it}\right) = 0. \tag{5}$$

Therefore, the corresponding moment equations that can enter the construction of a GMM estimator are:

$$\frac{1}{n}\sum\nolimits_{i=1}^{n} Y_{is}\left[\left(Y_{it} - Y_{i,t-1}\right) - \delta\left(Y_{i,t-1} - Y_{i,t-2}\right) - \left(\boldsymbol{X}_{it} - \boldsymbol{X}_{i,t-1}\right)'\boldsymbol{\beta}\right] = 0, \tag{6}$$

$$s = 0, \ldots, t\text{ - }2;\ t = 2, \ldots, T.$$

The subscript s is the lagged differences, $(Y_{i,t-2} - Y_{i,t-3})$, that is the level of Y_{is} is uncorrelated with the differences of disturbances $\left(\varepsilon_{it} - \varepsilon_{i,t-1}\right)$ that are at least two periods subsequent. So, the $T(T\text{ - }1)/2$ orthogonality (or moment) conditions can be represented as:

$$E\left(W_i\Delta\varepsilon_{it}\right) = E\left[W_i\left(\left(Y_{it} - Y_{i,t-1}\right) - \delta\left(Y_{i,t-1} - Y_{i,t-2}\right) - \left(\boldsymbol{X}_{it} - \boldsymbol{X}_{i,t-1}\right)'\boldsymbol{\beta}\right)\right]$$
$$= E\left[W_i\left(\Delta Y_i - \Delta Y_{i,t-1}\delta - \Delta \boldsymbol{X}_{it}{}'\boldsymbol{\beta}\right)\right] = 0, \quad (7)$$

where

$$W_i = \begin{bmatrix} Y_{i0} & \cdots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & Y_{iT-2} \end{bmatrix}.$$

Based on these orthogonality conditions, a consistent GMM estimator of the parameter of interest is obtained by minimizing the following:

$$\left(\frac{1}{n}\sum\nolimits_{i=1}^{n} W_i'\Delta\varepsilon_{it}\right)'\boldsymbol{A}\left(\frac{1}{n}\sum\nolimits_{i=1}^{n} W_i'\Delta\varepsilon_{it}\right), \quad (8)$$

where $\boldsymbol{A}$ is an initial positive defined matrix and an efficient two-step version of it is obtained using:

$$\boldsymbol{A} = \left(\frac{1}{n}\sum\nolimits_{i=1}^{n} W_i'\Delta\hat{\varepsilon}_{it}\Delta\hat{\varepsilon}_{it}'W_i\right)^{-1}, \quad (9)$$

where $\Delta\hat{\varepsilon}_i$ are residuals based on initial consistent estimation of $\hat{\boldsymbol{\theta}}\left(\hat{\boldsymbol{\theta}}_{GMM} = \delta, \boldsymbol{\beta}'\right)$; therefore, total cost function in TABLE 1 will be chosen to derive *MC, ATC,* Q^*, and P^* through comparative static. Further details of the GMM estimator can be found in Blundell and Bond (1998).

Data and Empirical Results

The data that I use is a balanced panel of 10 parking lots[9] observed over 36 months, January 2010–December 2012. This data was kindly made available to me by City Parking Company. The total fixed and variables costs are measured at the end of the parking lots accounting monthly, and sales is used as a proxy for output (Q) or the amount of minutes sold monthly in these parking lots.

Table 2 presents the descriptive statistics of the variables in the model. Monthly total cost ranges from US$3,605 to US$4,526 for a parking lot and its mean monthly total cost was US$13,579. Also, we can see the mean amount monthly sold by a parking lot, which was 295,879 minutes or 9,863 minutes per day. In this way, the results in Table 2 are reasonable to apply the econometric techniques described above.

TABLE 2 Descriptive statistics

Variables	Number of Observations	Mean	Standard Deviation	Minimum	Maximum
Total cost[1] (*TC*) (Monthly)	360	13,579	6,526	3,605	44,526
Minutes (Q) (Monthly)	360	295,879	122,664	64,576	640,166

[1]Constant of June 2011 prices in US dollars.

TABLE 3 Dynamic panel data model (GMM estimator)

Dependent Variable-Total Cost (Constant of June 2011 Prices in US Dollars)	Quadratic Form	Cubic Form
Explanatory variables	Coefficient	Coefficient
Constant (fixed cost)	12,579***	10,526***
Minutes (Q)	0.47	47.13*
Minutes^2 (Q^2)	0.0000194	−0.000142*
Minutes^3 (Q^3)	—	0.00000000016**
Number of observations (*n*)	360	360

*, **, ***Significant at 0.10, 0.05, and 0.01 levels, respectively.

Therefore, generalized method of moments[10] estimates of the quadratic and cubic total cost forms are reported in Table 3. Thus, quadratic and cubic functional forms satisfy conditions to determine *MC, ATC,* Q^*, and P^* and to find the intersection between *ATC* and *MC*, due to the fact that linear function does not support a relative (or local) minimum point. In other words, the fixed cost (β_0) of this form in Table 1 is an absolute (or global) minimum because the first-order condition or *MC* (β_1) is a constant.

However, according to the results in the first and second column of Table 3, the appropriate total cost function for the parking lots in Bogotá is the cubic form. Of all of the functional forms, only their explanatory variables were significant at the 10% and 5% level. In addition, the signs (positive, negative, and positive) are the coefficients values corresponding to this theoretical functional form in Table 1, and constant value is the monthly cost fixed (US$10,526). Thus, from the result, the average total cost (*ATC*) and marginal cost (*MC*) were obtained using comparative statistics:

$$ATC = \frac{TC}{Q} = \frac{10,526}{Q} + 47.13 - 0.000142Q + 0.00000000016Q^2, \tag{10}$$

$$MC = \frac{\partial TC}{\partial Q} = 47.13 - 2 * 0.000142Q + 3 * 0.00000000016Q^2. \tag{11}$$

As shown in Figure 1, the marginal cost curve must intersect the average total cost curves at their respective minimums (Q^*). Thus, $ATC = MC$, then I have:

$$\frac{10,526}{Q} + 47.13 - 0.000142Q + 0.00000000016Q^2 = 47.13 - 2 * 0.000142Q + 3 * 0.00000000016Q^2. \tag{12}$$

Solving[11] Equation (12) for Q, the optimal (Q^*) can be found:

$$Q^* = 438,132. \tag{13}$$

Therefore, the monthly optimal sale for a parking lot in Bogotá is 438,132 minutes or 14,604 minutes per day. In other words, the owners of the parking lots in Bogotá should sell this amount per day so they do not have economic loss or it is the optimal output to maximize profit. Thereby, as shown in Equation (1) and replacing Q^* (438,132) in *MC*, the monthly variable cost is equal to P^*:

$$P^* = 47.13 - 2 * 0.000142(438, 132) + 3 * 0.00000000016(438, 132)^2, \quad (14)$$

$$P^* = 15. \quad (15)$$

Thus, the variable cost is US$15 or US$0.002 per minute,[12] the fixed cost equals US$10,526 or US$0.24 per minute,[13] and the Colombian rate of inflation in 2013 was 3% ($\hat{P}$). Therefore, as shown in Equation (2), the price ceiling (P^t) per minute for the parking lot service in Bogotá should be US$0.27:

$$P^t = (0.02 + 0.24)\,(1 + 0.03) = 0.27. \quad (16)$$

Nevertheless, according to Decree 268 of 2009, the current fare per minute for the service in Bogotá (US$0.05) does not cover the total cost incurred by legal private companies that are providing this service in Bogotá.

Conclusions

The main objective of the article was to calculate the price cap per minute, which the parking lot service users should pay for a legal service at Bogotá, based on microeconomic framework for price fixing from a costs analysis (total fixed costs, total variables costs, average total cost, and marginal cost).

These results were evidenced by means of a dynamic panel data model to estimate total cost functions through GMM estimators (generalized method of moments). Also, from the econometric outcome and using Ramsey Pricing approach and mathematical optimization (comparative statics), I obtained the maximum fare per minute that should be paid by the consumers of the parking lot service in Bogotá.

Also, these results were possible from the secondary microeconomic statistical information (provided by City Parking) on the activity of 10 parking lots in the city, collected monthly from January 2010 to December 2012. Thus, it was possible to establish a cubic total cost function estimated by means of a dynamic panel data model with generalized method of moments (GMM).

Therefore, from the estimated results of the model and using mathematical optimization (comparative statics) it was established that the minimum amount of minutes that an owner of a parking lot must sell monthly according to its capacity and to minimize costs, is approximately 438,132 minutes.

Thus, the maximum fare per minute for the service that users should pay is US$0.27, including total cost and rate of inflation under the Ramsey Pricing approach. This setting allows their earnings to be equal to zero, without incurring economic losses. Nevertheless, given the current fare per minute ($0.05) by Decree 298 of 2010 for the year 2011, it is below the estimated fare economically. These results and analysis enable the state agencies responsible for regulating these prices to establish them from a financial standpoint in order to not overvalue or undervalue them and thus be able to be impartial with consumers and service producers.

Furthermore, the results obtained in this study help us understand what should be the methodology for setting maximum prices and be able to regulate the monopoly power in the service of parking lots and other activities that maintain structures of imperfect competition and to establish prices above socially optimal prices when the product is important in the society consumption.

However, for entities in charge that can carry out the implementation of this type of analysis, a data collection microeconomic system should be created, such as the one used in this work, in the same way as performed by the regulatory companies of public services in Colombia through a unique information system utilities (ISU).

Finally, the results obtained in this study are a first approach to the implementation of economic regulation with a price cap for parking service in Bogota. Therefore, they are the first preliminary results, which should open doors to new lines of research in order to deepen the study of the problems mentioned.

Acknowledgments

The author gratefully acknowledges Eduardo Bayon and Diego Lomelín for kindly making available the data used in this article and their helpful comments concerning this study.

Notes

1. I used a secondary source of information—the data were provided by City Parking Company. It is a firm legally established in Colombia that is engaged in providing parking service at the major cities of the country.
2. See Mendieta and Perdomo (2008, pp. 13–15), for a review.
3. See Varian (1993, pp. 427–433), Nicholson (2002, pp. 537–542), Cano (2001, p. 45), and Qian et al. (2011, p. 862), for a review.
4. See Campus et al. (2004, chaps. 5 and 6), Loube (1995), Sappington and Sibley (1992), Cowan (2002), and Holguin and Jara (1999), for a review.
5. *Total fixed costs* (*TFC*) include the value of rents and commissions on share accounts, administrative costs (including staff on the payroll), liability insurance, utilities, payments for condo management and procurement; while *total variables costs* (*TVC*) relate to staff overtime, support staff, maintenance and repairs and electrical installations, adjustments, licensing paperwork, roads and signage, security and communication items, depreciation and amortization, supplies, tickets and cards, and claims incidents.
6. See Greene (2002), Gujarati (2003), Rosales, Perdomo, Morales, & Urrego (2013), Perdomo (2010, 2011), and Perdomo and Hueth (2011), for a review.
7. See Gujarati (2003), Greene (2002), Baltagi (2005), Cameron and Trivedi (2009), and Rosales et al. (2013), for a review.
8. See Arellano and Bond (1991), Chamberlain (1987), Arellano and Bover (1995), and Blundell and Bond (1998), for a review.
9. These places are located in Bogotá and their addresses are as follows: Calle 100, Calle 122, Calle 94, Calle 95, Carrera. 15, Calle 81, Calle 84, Calle 85, Calle 104, and Parque 93.
10. The generalized method of moments estimation of the models was carried out using the Stata (version 11) computer program.
11. Using Derive (version 5) computer program.
12. 15/9,863 = 0.002; 9,863 is the amount of minutes sold per month for a parking lot, it is the mean per day in Table 2 (295,879/30).
13. 10,526/43,200 = 0.24; 43,200 is the amount of minutes in a month (60 minutes * 24 hours * 30 days).

References

Anderson, S., & De Palma, A. (2004). The Economics of Pricing Parking. *Journal of Urban Economics*, *55*(1), 1–20. doi:10.1016/j.jue.2003.06.004

Arellano, M., & Bond, S. R. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an application to Employment Equations. *Review of Economic Studies*, *58*, 277–297.

Arellano, M., & Bover, O. (1995). Another Look at the Instrumental-Variable Estimation of Error-Components Models. *Journal of Econometrics*, *68*, 29–52.

Baltagi, B. H. (2005). *Econometric Analysis of Panel Data*. New York: John Wiley & Sons.

Blundell, R. W., & Bond, S. R. (1998). Initial Conditions and Moment Restriction in Dynamic Panel Data Models. *Journal of Econometrics*, *87*, 115–143.

Cameron, A., & Trivedi, P. (2009). *Microeconometrics: Methods and Applications*. Cambridge: Cambridge University Press.

Campos, J., De Rus, G., & Gustavo, N. (2004). *Economía del Transporte*. Barcelona, Spain: Antoni Bosch (Ed.) S.A.

Cano, A. (2001). *Problemas de Microeconomía*. Bogotá, Colombia: Bogotá Universidad de Los Andes.

Chamberlain, G. (1987). Asymptotic Efficiency in Estimation with Conditional Moment Restrictions. *Journal of Econometrics*, *34*, 305–334.

Chiang, A. (1988). *Métodos Fundamentales de Economía Matemática*. Naucalpan de Juárez, México: McGraw-Hill.

Combes, P. P., & Miren, L. (2005). Transport costs: Measures, determinants and regional policy implications for France. *Journal of Economic Geography*, *5*(3), 319–349.

Cowan, S. (2002). Price-Cap Regulation. *Swedish Economic Policy Review*, *9*, 167–188.

De Boger, B., Kerstens, K, & Matthias, S. (2008). Transit costs and cost efficiency: Bootstrapping non-parametric frontiers. *Research in Transportation Economics*, *23*(1), 53–64.

Decreto 1504. (1998). Alcaldía Mayor de Bogotá. Retrieved from http://www.alcaldiabogota.gov.co/sisjur/normas/Norma1.jsp?i=1259.

Decreto 268. (2009). Alcaldía Mayor de Bogotá. Retrieved from http://www.alcaldiabogota.gov.co/sisjur/normas/Norma1.jsp?i=37287.

Greene, W. (2002). *Econometric Analysis*. New York: Pearson Prentice-Hall.

Gujarati, D. (2003). *Econometría*. México, D.F., México: McGraw-Hill.

Holguín, J, & Jara, S. (1999). Optimal Pricing for Priority Service and Allocation Space in Container Port. *Transportation Research Part B: Methodological*, *33*(2), 81–106.

Loube, R. (1995). Price Cap Regulation: Problems and Solutions. *Land Economics*, *71*(3), 286–298.

Matteo, I., Salvatore, C., Ugo, G., & Giuseppe, I. (2006). Discrete Choice Model for Defining a Parking-Fee Policy on Island of Ortigia, Siracusa. *Journal of Urban Planning and Development*, *132*(3), 147–156.

McCarthy, P. (2001). *Transportation Economics. Theory and Practice: A Case Study Approach*. Oxford: Blackwell Publisher Ltd.

Mendieta, J. C., & Perdomo, J. A. (2008). *Fundamentos de Economía de Transporte: Teoría, Metodología Y Análisis de Política*. Bogotá, Colombia: Ediciones Uniandes.

Nicholson, W. (2002). *Microeconomic Theory: Basic Principle and Extensions*. United States: South-Western/ Thomson Learning.

Perdomo, J. A. (2010). Una propuesta metodológica para estimar los cambios sobre el valor de la propiedad: Estudio de caso para Bogotá aplicando Propensity Score Matching y precios hedónicos espaciales. *Lecturas de Economía*, *73*, 49–65.

Perdomo, J. A. (2011). A methodological proposal to estimate changes of residential property value: Case study developed in Bogotá. *Applied Economics Letters*, *18*(16), 1577–1581. doi:10.1080/13504851.2011.554360

Perdomo, J. A., & Hueth, D. (2011). Funciones de producción, análisis de economías a escala y eficiencia técnica en el eje cafetero colombiano: Una aproximación con estocástica. *Revista Colombiana de Estadística*, *34*(2), 377–402.

Perdomo, J. A., & Ramírez, J. A. (2011). Análisis económico sobre el tamaño óptimo del mercado y ubicación de estaciones de transferencia para el manejo de residuos sólidos en Colombia. *Lectura de Economía*, *75*, 143–162.

Perdomo, J., & Rubio, M. (2012). Regulación económica para la tarifa de parqueaderos en Bogotá mediante precios máximos. *Cuadernos de Economía*, *31*(58), 287–302.

Qian, Z., Xiao, F., & Zhang, H. (2011). The economics of parking provision for the morning commute. *Transportation Research–A*, *45*, 861–879.

Rosales, R., Perdomo, J. A., Morales, C., & Urrego, A. (2013). *Fundamentos de econometría intermedia: Teoría y aplicaciones*. Bogotá, Colombia: Ediciones Uniandes.

Sappington, D., & Sibley, D. (1992). Strategic nonlinear pricing underprice-cap regulation. *RAND Journal of Economics*, *23*(1), 1–19.

Sarmiento, E., Cuervo, D., De Silva, M., Merchán, R., & Santos, G. (1999). *La Crisis de la Infraestructura Vial*. Bogotá, Colombia: Escuela Colombiana de Ingeniería.

Shoup, D. (1997). The High Cost of Free Parking. *Journal of Planning Education and Research*, *17*(3), 3–20.

Varian, H. R. (1993) *Intermediate Microeconomics a Modern Approach* (3rd Ed.). New York: W.W. Norton & Company.

Verhoef, E. P., Nijkamp, P., & Piet, R. (1995). The economics of regulatory parking policies: The (IM) possibilities of parking policies in traffic regulation. *Transportation Research–A: Policy and Practice*, *29*(2), 144–156.

About the Author

Jorge A. Perdomo is the General Director and Deputy Director of Quantitative Analysis at Teknidata Consultants, Carrera 18 No. 86A-14, Bogotá, Colombia; Professor of Econometrics II, Principles of Mathematics and Transportation Economics at the Department of Economics of the University of the Andes; and Professor of Applied Microeconomics to Projects at the Faculty of Economics, University of Rosario.