BRAZILIAN INTERSTATE PASSENGER TRANSPORTATION INDUSTRY: CONCENTRATION, RETURNS AND FIRM'S SIZE

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RESUMO

Este artigo trata da relação entre concentração, retorno e porte da firma na indústria brasileira de transporte interestadual e internacional de passageiros (TRIP). Este assunto não tem sido alvo de atenção dos economistas, exceções são os trabalhos de Martins et al (2004) e Rocha et al (2005).Para tanto, foi testado um modelo do tipo Cobb-Douglas com dados de 2001. Dos resultados empíricos reportados aqui, pode-se dizer que a indústria TRIP tem se beneficiado da concentração econômica como previsto pela teoria econômica, obtendo altos retornos sobre o capital investido. Porém, os resultados são válidos apenas para as grandes empresas, com mais de 99 empregados.

ABSTRACT

This paper deals with the relationship amongst concentration, returns and firm's size in the Brazilian interstate passenger transportation (TRIP) industry. This theme has not receipted much attention of economists, exception are the recent studies of Martins et al (2004) and Rocha et al (2005). We have analysed such relationship through econometrics using a Cobb-Douglas type model. The estimation is based on cross-section data, i.e., for the year 2001. The empirical evidence reported here has shown that the TRIP industry is taking advantage of concentration, attaining high returns on invested capital as predicted by the economic theory. But, this is true for large firms only, with more than 99 employees.

1. INTRODUCTION

The economic literature postulates that to the extent that an industry is concentrated it will tend to exhibit relatively higher returns on invested capital (Kupfer and Hasenclever, 2002; Tirole, 1988).

There has been no much interest of economists in studying concentration in the Brazilian interstate passenger transportation (TRIP) industry, exception are the recent works of Martins et al (2004) and Rocha et al (2005). The TRIP industry has more than 200 firms, the industry's annual revenue amounts roughly R$ 2,600 millions and, yet, the industry is government regulated.

Martins et al (2004) have shown that the TRIP industry is highly concentrated, albeit such industry is government regulated. Rocha et al (2005) have studied empirically the relationship between concentration and returns on invested capital in the TRIP industry (their investigation has been done through the OLS method that is through cross-section analysis). They concluded that there is a strong relationship between concentration and returns on invested capital in the TRIP industry as predicted by theory.

Nonetheless, Rocha et al (2005) have not taken into account the firm's size in their study. It should have been addressed the following question: does such relationship verify despite of the firm's size? It is the purpose of this paper to deal with such inquiring.

The plan of paper is as follows. Section 2 provides a brief overview of the Brazilian interstate passenger transportation industry. In section 3 we address the framework to be tested. Section 4 examines the empirical results. Section 5 concludes the paper.

2. THE TRIP INDUSTRY: A BRIEF OVERVIEW

The analysis of the concentration levels of an industry should comprehend the study of the connections among the firms by cross-checking the data on the shareholder profile of the companies (Hoffmann, 2002). The literature on economic theory cites several methods to measure concentration, among which the most common are concentration ratio (CR) and the Hirschman-Herfindahl index (HHI). Measures of concentration aim to detect how economic agents dominate a given industry, taking into consideration the percentage of sales each company has, i.e. its market share, or other measures of size, such as its net assets and its production capability (Resende & Boff, 2002).

Martins (2004) used the Concentration Ratio (CR) index to measure the extent to which concentration is present in the TRIP industry, regarding the passenger-per-kilometre (pass/km) production, as it provides an estimated turnover of that industry. The initial results obtained by the author for the period 2000-2001 are shown on Table 1 and on Table 2, and do not account for the existence of interconnections among licensees.

Table 1: CR_4 and CR_8 – Period: 2000-2001

Companies' Market Share (%)			
Attribute	Position	2000	2001
Pass/km	Leader	13.7	12.1
	CR_4	33.5	29.7
	CR_8	45.1	40.6

Source: Adapted from Martins (2004) et al.

Table 2: Classification of companies regarding their pass/km production (period: 2000-2001)

Passengers/kilometres		
Position of companies	Periods	
	2000	2001
	Firms	
1st	A	A
2nd	B	B
3rd	C	C
4th	E	E
5th	D	L
6th	F	J
7th	J	F
8th	G	D

Source: Adapted from Martins (2004) et al.

Table 2 shows that seven companies are listed among the eight main companies during the given period; the top four companies maintained their positions unchanged in the period. Table 1, on the other hand, shows that the four main companies (1.87% of the 214 companies surveyed) held nearly 30% of the industries' turnover by the end of 2001.

Thereafter, on cross-checking the data concerning shareholder profile of 175 companies, the author identified the presence of 17 joint ventures formed by 46 companies (the way these firms – grupos societários – operate is very similar to the way joint ventures operate, though there are a few differences between them), as shown on Table 3, which indicates that horizontal integration takes place in the industry.

Table 3: Joint Ventures

No. of groups formed	No. of companies per group	Number of companies
10	2	20
4	3	12
2	4	8
1	6	6
	Total number of companies	46

Source: Adapted from Martins (2004) et al.

Those 46 companies represent not more than 22% of the total number of operators in the TRIP industry by the end of 2001. As regards the geographical distribution of those companies, it was discovered that 50% are based in the South-eastern Region, 33% in the Southern Region, 15% in the Mid-west, and 2% in the North-eastern region. In addition, the fact that there is a predominance of companies based in the South-eastern and Southern Regions (83%) confirms their interest in maintaining interconnections, by means of joint ventures, in order to reach out for other markets, leading to a possible geographical expansion (Martins et al, 2004).

This is due to regulatory barriers to entry, associated with the length of the contract – 15 years – for service operation. These aspects could have led to market reserve, and, consequently, to the formation of joint ventures which may act in other markets, which indicates not only geographical expansion but also an increase in both their market share and in the return on the investment.

On considering the above-mentioned joint ventures, Martins (2004) et al obtained new figures for the concentration levels in the TRIP industry between 2000 and 2001, according to the passenger/km production, as can be seen in Table 4.

Table 4: CR_4 e CR_8 – Period: 2000-2001

Market share of joint ventures (%)			
Attribute	Position	2000	2001
Pass/km	Leader	16.8	14.7
	CR_4	40.2	37.1
	CR_8	56.1	55.3

Source: Adapted from Martins (2004) et al.

Table 4 shows that the market share of the companies that formed the main joint ventures increased, for, by the end of 2001, CR4, originally at 29.7%, went up to 37% and CR8, originally at 40.6%, went up to 55%. Therefore, the horizontal integration among the companies increased their market share in the scope of the joint ventures, which may also have resulted in an increase in the return on the investment made.

One final point deserves mention. The tariff in the TRIP industry is set according to a sort of average-cost pricing model. That is, the tariff (T) is given by:

$$T_i = AVC_i + AFC_i + NPM_i$$

$$T = \frac{\sum_{i=1}^{N} T_i}{N}$$

where AVC_i is the average variable cost of firm i, AFC_i is the average fixed cost, NPM_i is the net profit margin and N is the number of firms in the TRIP industry.

Possas et al (1997) claim that such pricing model is not social fair mainly because there is no incentive to firms reduces costs – inefficient firms in terms of costs yield high prices. Given that, it can be said that efficient firms benefit from such pricing principle, obtaining a superior return on capital.

3. THE MODEL TO BE TESTED

First of all, it should be said that the definition of firm's size was taken from the Brazilian Institute of Geography and Statistics, as can be seen in Table 5.

Table 5: Classification of firm's size

Small Firms	Medium Firms	Large Firms
1 to 49 employees	50 to 99 employees	Greater than 99 employees

By convenience, the return on investments function of firm i in the TRIP industry is assumed to have the Cobb-Douglas type and is given by:

$$Y_i = AX_i^{\beta}, \qquad i = 1,2,...,N \tag{1}$$

where Y_i is a measure of return on investments;

X_i is a concentration measure;

β is a positive parameter;

N is the number of firms (cross-section units) in the TRIP industry; and

A represents an autonomous return on invested capital, independent of the concentration measure.

Therefore, we set out to estimate equation [1]. In econometric form and allowing for the firm's size we have:

$$Y_i = \beta_0 + \beta_1 X_i + \beta_2 D_S + \beta_3 D_M + \beta_4 D_L + \varepsilon_i, \qquad i = 1,2,...,N \tag{2}$$

where Y_i is a measure of return on investments;

X_i is a concentration measure;

β_k ($k = 0,1,2,3,4$) are parameters to be estimated;

ε_i is an error-term; and

D_j ($j = S, M, L$) are dummy variables defined as follows:

$$D_S = \begin{cases} 1 \text{ if the firm i is small} \\ 0 \text{ otherwise} \end{cases}$$

$$D_M = \begin{cases} 1 \text{ if the firm i is medium} \\ 0 \text{ otherwise} \end{cases}$$

$$D_L = \begin{cases} 1 \text{ if the firm i is large} \\ 0 \text{ otherwise} \end{cases}.$$

As far as the concentration measure is concerned we take the one most employed in the literature, i.e. (Kupfer and Hasenclever, 2002; Tirole, 1988):

$$\lambda_i = \frac{S_i}{\sum_{i=1}^{N} S_i} \tag{3}$$

where S_i is the number of passengers transported by kilometre (S_i=Passenger Transported X Kilometre) by firm *i*.

As firms' financial statements in the TRIP industry are not available we consider as a proxy for return on investments the rate of growth of the amount of buses each firm has (ΔB_i).

Therefore, equation [2] becomes:

$$\Delta B_i = \beta_0 + \beta_1 \lambda_i + \beta_2 D_S + \beta_3 D_M + \beta_4 D_L + \varepsilon_i, \qquad i = 1,2,...,N \qquad [4]$$

Accordingly to economic literature it is expected that β_1 is statistically greater than zero. In other words, a higher concentration ratio a bigger return on invested capital. Furthermore, if, for instance, D_S is statistically significant it can be said that the relationship between return on invested capital and concentration is present in small firms of the TRIP industry.

4. EMPIRICAL ANALYSIS

The analysis is based on cross-section data. The data are for the year 2001. The sources of variables are the National Inland Transport Regulatory Agency (ANTT). The number of firms in the TRIP industry is 214, splitting as follows:

Table 6: Number of firms in the TRIP Industry (Brazil)

Small Firms	Medium Firms	Large Firms
145	**26**	**43**

Table 7 reports the regression results for equation [4]; the best estimated model is linear in the variables. $\overline{R}^2$ is the coefficient of determination adjusted for the degrees of freedom – a

measure of goodness of fit. $F(4,209)$ is the classical F test and η_1 is the White test for heteroscedasticity (Gujarati, 2000; Stewart, 1991).

Table 7: Regression results for equation (4)

$$\Delta B_i = b_0 + b_1\lambda_i + b_2 D_S + b_3 D_M + b_4 D_L$$

N	b_0	b_1	b_2	b_3	b_4	$\overline{R}^2$	$F(4,209)$	η_1 $\chi^2(0.05,210)$
214	-10.56 (-0.31)	9,619.58 (40.74)	18.06 (0.52)	24.16 (0.69)	65.84 (1.90)	0.93	764.89	0.05

t ratios (Student statistics) in brackets.

The statistics in Table 7 show that the model is well specified, since no diagnostic test was significant at the 5% level of significance. For instance, the 5% critical value for the F distribution with 4 and 209 degrees of freedom is 2.37, so H_0 is rejected in favour of the alternative that one of b_k ($k = 2,3,4$) is different from zero (refer to t ratios as well). Given the White test result (η_1) the null hypothesis of no heteroscedasticity is accepted (see Gujarati, 2000).

The regression results (Table 7) demonstrate clearly that the concentration ratio has accounted for increasing returns on invested capital only in large firms in the TRIP industry since b_2 and b_3 are statiscally zero and b_4 is different from zero.

Therefore, we have re-estimated equation (4) with just large firms' data (Table 8). η_2 is the Ramsey RESET test for functional specification (Gujarati, 2000; Stewart, 1991). It can be said the model is well specified as supported by the statistics in Table 8. For example, the null hypothesis of:

a) The t test and the F test lie well outside the interval of H_0 acceptance.
b) The regression explains 89% of the variation in the dependent variable.
c) The null hypothesis of no heteroscedasticity is accepted, as given by the White test result (η_1).
d) The null hypothesis of appropriate functional form (η_2) is accepted given that the 5% critical value for the F distribution with 1 and 40 degrees of freedom is 4.08.

Table 8: Regression results for re-estimating equation (4)

$$\Delta B_i = b_0 + b_1\lambda_i$$

N	b_0	b_1	$\overline{R}^2$	$F(2,41)$	η_1 $\chi^2(0.05,41)$	η_2 $F(1,40)$
43	54.85 (3.80)	9,642.49 (19.22)	0.89	369.57	0.03	0.4

t ratios (Student statistics) in brackets.

In sum, such results are evidence for that the large firms in the Brazilian interstate passenger transportation industry have benefited from concentration, obtaining high returns on invested capital as b_1 is statiscally positive.

5. CONCLUSIONS

The central focus of the paper is on the relationship between returns on investments and concentration ratio in the Brazilian interstate passenger transportation (TRIP) industry, allowing for the firm's size. The model to be tested is a sort of Cobb-Douglas function. A cross-section model was estimated for the year 2001. The empirical evidence reported here has shown that there is a strong relationship between concentration and returns on invested capital in the TRIP industry, but only in large firms. That is, there is no proof of concentration and return on capital in small- and medium-sized firms.

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