# BRAZILIAN INTERSTATE PASSENGER TRANSPORTATION INDUSTRY: CONCENTRATION AND RETURNS

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## 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).

Martins et al (2004) have shown that Brazilian interstate passenger transportation (BIPT) industry is highly concentrated, albeit such industry is government regulated. Certainly, as a price taker, firms in the BIPT industry are making horizontal mergers in order to reduce common costs and so to boost profit.

This research paper investigates if the BIPT industry concentrating strategy is leading to a higher return on the investment made. The investigation will be done through the OLS method (see Gujarati, 1995; and Maddala, 1992).

The plan of paper is as follows. In the next section we present an overview on BIPT industry. Section 3 provides the framework to be tested. Section 4 discusses the empirical results while section 5 concludes.

## 2. BIPT INDUSTRY: AN 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 et al (2004) used the Concentration Ratio (CR) index to measure the extent to which concentration is present in the BIPT 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 Chart 1, and do not account for the existence of interconnections among licensees.

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[1] From Brasília University, UnB.

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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 et al (2004).

Chart 1- Classification of companies regarding

their pass/km production (period: 2000-2001)

| Passengers/kilometres | | |
|---|---|---|
| Position of companies | Periods | |
| | 2000 | 2001 |
| | Empresas | |
| 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 et al (2004).

Chart 1 shows that seven companies are listed among the eight main companies during the 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 ventures2 formed by 46 companies, as shown on Table 2, which indicates that horizontal integration takes place in the industry.

Table 2 – 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 no. of companies | | 46 |

Source: Adapted from Martins et al (2004).

Those 46 companies represent not more than 22% of the total number of operators in the BIPT 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

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[2]  NT The way these firms ("grupos societários") operate is very similar to the way joint ventures operate, though there are a few differences between them.

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 et al (2004) obtained new figures for the concentration levels in the BIPT industry between 2000-2001, according to the passenger/km production, as can be seen in Table 3.

Table 3 - $CR_4$ 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 et al (2004).

Table 3 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.

## 3. THE MODEL TO BE TESTED

Because data availability, we estimate a cross-section equation given by:

[1] $\qquad Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i, \quad i = 1, 2, ..., N$

where $Y_i$ is a measure of return on investments, $X_i$ is a concentration measure, $\varepsilon$ is an error-terms, $\beta_0$ and $\beta_1$ are parameters to be estimated and $N$ is the number of cross-section units (firms in the BIPT industry).

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):

[2] $\qquad \lambda_i = \dfrac{S_i}{\sum\limits_{i=1}^{N} S_i}$

where $S_i$ is the number of passengers transported by kilometre by firm *i*.

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As firms' financial statements in the BIPT 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 ($\Delta B_i$).

Therefore, equation [1] becomes:

[3]  $\Delta B_i = \beta_0 + \beta_1 \lambda_i + \varepsilon_i, \quad i = 1,2,...,N$

Accordingly to economic literature it is expected that $\beta_1$ is statistically greater than zero. In other words, a higher concentration ratio a bigger return on invested capital.

## 4.  EMPIRICAL ANALYSIS

There is data availability for 2000 and 2001 years. The number of firms in the BIPT industry in 2000 is 190 (N = 190) and 2001 is 214 (N=214). The sources of variables are the National Inland Transport Regulatory Agency (ANTT), annual report 2002.

We have regressed equation [3] for two sample sets. The first one, takes 2000 with N=190 and next takes 2001 with N=214 (Table 4). The second one, takes 2000 with N=166 and 2001 with N=185, because there are in such industry 17 holdings compounding by 46 firms, as a whole (Table 5). $R^2$ is the coefficient of determination – a measure of goodness of fit. $\eta_1$ is White test for heteroscedasticity.

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Table 4 -  $\Delta B_i = b_0 + b_1 \lambda_i$

**(without holdings)**

| Year | $b_0$ | $b_1$ | $R^2$ | $\eta_1$ |
|---|---|---|---|---|
| 2000 (N=190) | 9552.81 (48.19) | 17.32 (5.79) | 0.92469 | 220.99 Q(0.05,188) |
| 2001 (N=214) | 10525.26 (50.26) | 13.52 (4.96) | 0.92219 | 246.97 Q(0.05,212) |

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*t* ratios (Student statistics) in brackets. $\eta_1$ is $\chi^2$ with n-2 degrees of freedom.

Table 5 - $\Delta B_i = b_0 + b_1\lambda_i$

**(with holdings)**

| Year | $b_0$ | $b_1$ | $R^2$ | $\eta_1$ |
|------|-------|-------|-------|----------|
| 2000 (N=166) | 9980.09 (46.15) | 17.25 (4.25) | 0.92806 | 194.88 Q(0.05,188) |
| 2001 (N=185) | 10863.36 (50.64) | 13.74 (3.82) | 0.93302 | 215.56 Q(0.05,183) |

*t* ratios (Student statistics) in brackets. $\eta_1$ is $\chi^2$ with n-2 degrees of freedom.

The statistics in Table 4 and 5 suggest that the model is well specified, since no diagnostic test was significant at the 5% level of significance. The results show that indeed the concentration ratio has accounted for increasing returns on invested capital in BIPT industry. It is noteworthy that the results have improved when we regressed equation [3] with N = 166 for 2000 and N=185 for 2001, that is, when we put together firms which belong to a holding.

Finally, notice that we have also run equation [3] for the 2000 data set and the results were similar to 2001 ones – supported by the *F* test of structural stability (see below). So, it may be said the results are robust.

Table 6 - The *F* Test of Structural Stability Results

| Without Holdings N = 404 | With Holdings N = 351 |
|--------------------------|------------------------|
| $F_{(2,400)} = 0.4431$ | $F_{(2,347)} = 0.2327$ |

## 5. CONCLUSIONS

The central focus of the paper is on the relationship between returns on investments and concentration ratio in Brazilian interstate passenger transportation industry. A cross-section model was estimated in order to verify such relationship. The empirical evidence reported here show that firms with higher concentration ratio present higher returns on invested capital.

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