PASSENGER MARKET CONCENTRATION BY INTER-MUNICIPAL TRANSPORT COMPANIES

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ABSTRACT

The service sector has grown impressively in recent decades, and now has a considerable participation in the composition of the Brazilian Gross Domestic Product (GDP). Passenger transport services are among the most important and accompany the growth of other basic sectors of the economy like health, energy and education. Consequently, adequate transport planning is essential to guarantee society's right to locomotion and mobility. A factor to be considered in this planning process is the users' choice for this kind of service, which depends on the quality of its supply. Regarding the regulation, one of the parameters that might be used in the transport planning is the analysis of market concentration, which aims to establish conditions fostering competition that could enhance economic efficiency in service provision. Thus, this study makes an analysis to detect the existence of market concentration among companies operating inter-municipal passenger transport services. A case study was made of such services in the state of Goias, in the central region of Brazil, adopting the Concentration Ratio Index (CR) and the Hirschman-Herfindahl Index (HH) to measure the accumulation of passengers by the companies operating the system in the period 2005 to 2010. The results indicated the existence of a tendency to market concentration, which could reduce the intensity of competition and lead to economic inefficiency in service provision and could be avoided by bidding processes.

Key-words: market concentration, inter-municipal transport, market structure.

INTRODUCTION

During the 1970s, the Brazilian Federal Government intensified its economic reform processes by privatizing and decentralizing many public services and creating regulatory boards to supervise them. In that scenario, many institutional, legal and regulatory changes were made that reflected the way the public agencies, responsible for planning and administrating road transport services supply, performed their tasks. Transport was one of the sectors most affected by those changes.

Public transport plays an essential role in ensuring good quality of life as it offers the possibility of mobility as well as being of great importance to all economic activities. It means that the objective of regulatory activities for that sector must be to make sure it is operated in competitive conditions and to enhance the economic efficiency of service provision, acting in a way that minimizes the concentration of markets in the hands of a few companies. However, the current regulatory framework may actually be fostering concentration of the supply side of services production in this market.

Although its importance to economy has been amply demonstrated, there have been very few studies investigating the structure and functioning of inter-municipal transport. There is lack not only of the elementary information needed to describe the sector, but also of analytic studies that would enable an understanding to be gained of its relations and the factors that condition its performance.

One aspect that merits further investigation is the possibility of market failures occurring in the Road Passenger Transport sector. According to Mankiw (2009), there are significant flaws in the market that tend to produce non-optimum results engendering inefficiency and negative effects for passengers. Such flaws may originate from the absence of competition in a given market and lead eventually to an increase in the price charged for services.

A typical example of a flawed market is the oligopoly, which is established when too few companies are offering a given product or service. Analyzing the numbers of companies participating in the market and their distribution is one of the means to identifying the existence or not of market flaws, in other words, analyzing the concentration of the supply side in the hands of a few companies. The negative consequences of such flaws include price increases that are prejudicial to the service consumers' interests (Tedesco, 2012).

Modifications implemented into the regulation and regulating mechanisms, especially in the case of Road Passenger Transport, might lead to alterations in the dynamics, concentrations and formation of economic groups that dominate the offer of these services. This paper sets out to gain an understanding of the behavior of those companies engaged in the market for which the object of their commercial transactions is the transport services they provide. The identification of market concentration, as it is described in this paper, and the results obtained could provide useful support to transport regulatory policies seeking to improve the efficiency of service provision.

ROAD PASSENGER PUBLIC TRANSPORT

Transport is a public service and accordingly the State is responsible for it and for regulating, controlling and inspecting the sector. One way that enables it to ensure the adequate provision of this public service is to transfer the services to public or private companies by means of concessions. Acting this way, the government substitutes its own direct management of the services that are the objects of concessions with regulatory mechanisms that enable it to accompany the activities of the concession holder according to pre-established rules.

In Brazil, the public agency responsible for regulating and inspecting public international and interstate road transport is the National Highway Transport Agency (*Agência Nacional de Transportes Terrestres - ANTT)*. In the case of inter-municipal transport however, the regulatory responsibility is attributed to the state in question, which establishes its own regulatory body. In the state of Goias, the regulatory body is the Goias State Public Services Regulation Board (*Agência Goiana de Regulação* - AGR) which aims to ensure the provision of inter-municipal passenger transport services with adequate minimum standards of safety and quality.

Regular inter-municipal passenger transport provides connection between municipalities located in the same state (ANTT, 2012) and it can only be materialized through the process of granting concessions by means of public bidding and tendering processes duly organized by the respective regulatory body. For this purpose, financial-economic feasibility studies are conducted to analyze the real translocation needs of the population as a whole. Its importance is readily perceptible insofar as bus road transport is the form of collective transport most used for inter-municipal trips. Chart 1 sets out the main characteristics of this system:

Chart 1. Characteristics of inter-municipal road passenger transport

Definition		Connects two or more localities without crossing state or Federal District limits.
Regulations		State Legislation.
Exploitation of Services		Concession, permission or authorization
Boarding and disembarking		Takes place in terminals or at the bus stops authorized for each line.
Access control		Ticket.
Luggage		Duly identified luggage in compliance with regulations governing weight and size limits, must be accommodated free of charge in the respective luggage compartments.
Standing passengers		Prohibited.
Vehicle		Highway-type vehicle with door, luggage compartment and higher level of comfort.
Fee	Price definition	Road and Highways Department (Departamento de Estradas de Rodagem –DER) – or the regulatory boards
	Sale	The transport operating company itself or a duly accredited entity.
Inspection		DER or the Regulatory Boards

Source: Adapted from Menezes, 2004.

Transport Demand

Transport demand is the quantity of passengers that use or need to use this service. Demand basically arises from the population's living standards and lifestyles (Manheim, 1979). In other words, the demand for transport occurs to satisfy the individual's other needs which are not necessarily transport as such (Ortúzar and Willumsen,1994; Morlok, 1987).

In planning a public transport system, it is fundamental to identify the transport demand so that the system can be designed to provide efficient services with parsimonious use of financial resources and quality that can be measured by the degree of user satisfaction. According to Gifoni (2002) the demand for inter-municipal transport is typified by oscillations, seasonal fluctuations that have an effect on the need for financial resources and the way they are allocated. Each locality has characteristics that distinguish it from others and influence the pattern of its transport system users' trips. It is important to point out that the user´s choice will also be affected by the level of service offered.

Context of Inter-municipal transport system in the state of Goias

The state of Goias is situated in Brazilian Central-western macro-region and is made up of 246 municipalities occupying a total area of 304 thousand km², roughly 4% of Brazilian territory, making it the seventh largest state in terms of land area. The state has 42.7% of the entire regional population, amounting six million people. The population is overwhelmingly urban; 90.3% lives in the cities and a mere 9.71 % in rural areas. (IBGE, 2010). Figure 1 shows the evolution of the population figures for the state of Goias, in the last decades, according to demographic census figures.

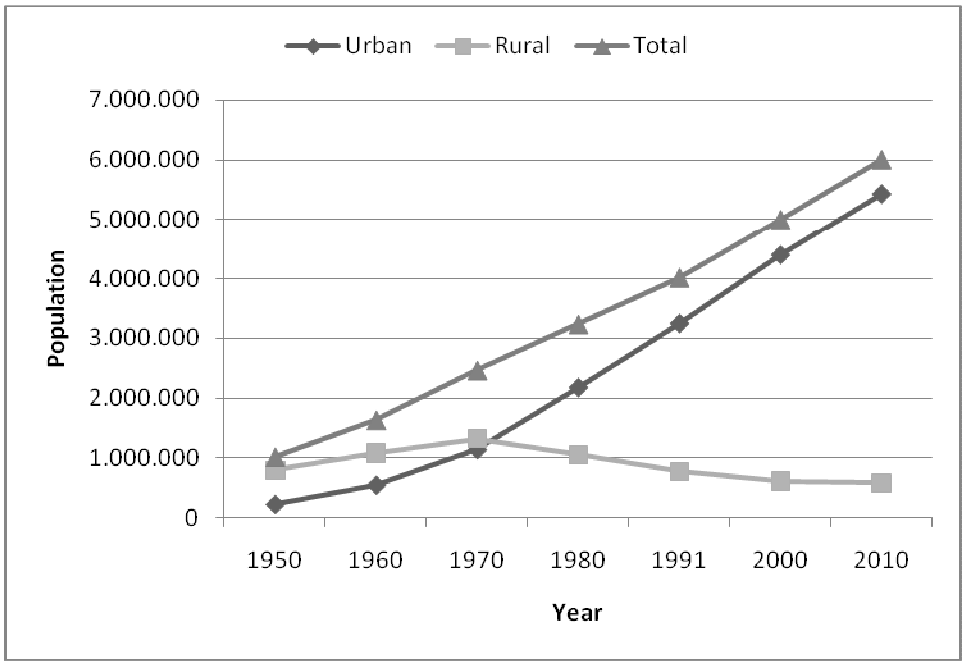

Figure 1: Evolution of the population of the state of Goias (IBGE, 2010)

Goias inter-municipal transport system has 522 lines of which 358 are active and they are being operated by 28 companies. In 2010 they transported over 12 million passengers using an effective fleet of 492 vehicles. The total extension of all the lines added together comes to 50,397 km. The figures are set out in Table 1.

Table 1: Inter-municipal Passenger Transport System in the state of Goias in the year 2010

Total number of passengers transported	12,412,754
Total number of outbound passengers transported by the system in departure trips	6,338,274
Total number of inbound passengers transported by the system in return trips:	6,074,480
Turnover (R$)	91,396,414.14
Effective Fleet	492
Extension (Km)	50,397

The chronological evolution of passenger statistics from 2005 to 2010 shows that the greatest movement took place in 2007, when over 13 million passengers were transported and the year with the least movement was 2010 with roughly 12 million passengers transported (Figure 2).

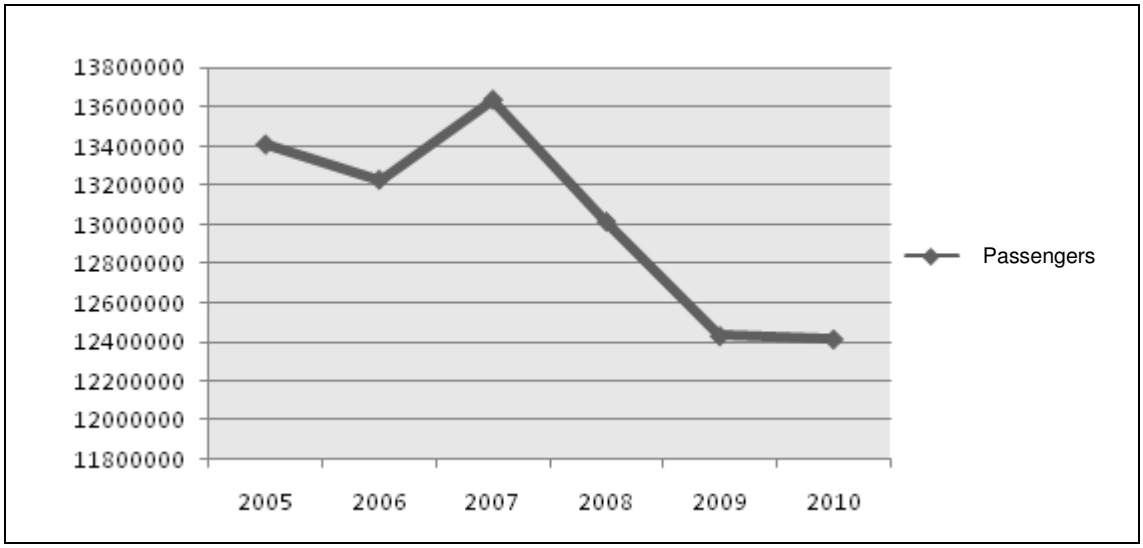

Figure 2: Chronological evolution of passenger numbers (2005-2011)

Even though the population of the state of Goais is on the increase (Figure 1), the numbers of passengers making use of public transport for trips from one municipality to another within this same state has dropped off in recent years as can be seen in the above graph (Figure 2).

According to the National Association of Urban Transport Companies (*Associação Nacional das Empresas de Transportes Urbanos* - NTU, 2004), for more than ten years conventional forms of public transport systems have been losing passengers at an accelerated rate while at the same time private transport (automobiles, motorcycles) and informal collective transport have been gaining ground.

Those two parallel phenomena actually incur a very high social cost because they represent an entirely unsustainable mobility model that generates negative externalities in the form of traffic jams, environmental pollution, excessive consumption of fuels from non-renewable sources as well as a high accident rate.

The National Association of Urban Transport Companies (NTU, 2004) has identified some of the factors that may be influencing the drop in numbers of public transport users in Brazil:

- The fact that automobile ownership among the middle classes is expanding and that consumer desire is being stimulated by direct and indirect government subsidies that reduce the cost of acquiring and maintaining a vehicle;
- Motorcycle sales have been breaking all records due to the advantages they have of being able to maneuver with agility in traffic jams, and their low maintenance costs;
- The high fares charged by public transport;
- Service quality-related issues (low frequency, delays, interrupted trips, security problems etc.);
- The advantages accruing to illegal transport due to not paying regulatory or fiscal taxes or labor dues which means lower operating costs, and high profitability all of which stimulate the entrance of other competitors into that clandestine market.

Even in places where there is tremendous traffic congestion, it is still possible to obtain gains in efficiency for transport on wheels by means of better system management. It strengthens the importance of studies that assess the dynamics of this market in order to support management and regulatory policies designed to obtain greater market efficiency and efficacy in the provision of such services.

INDUSTRIAL ORGANIZATION THEORY

The mainstream of classic economics proposes that for a market to exist there must be a demand, a supply and the encounter of the common interests of those two forces; that is to say, the price and the payment. The Theory of Industrial Organization goes beyond that however and, as Varian (2006) relates, adopts a notion of ‘industry’ as being a set of companies active in the same line of business that, together with their customers constitute a market.

In that light, an industry would be seen as a group of companies dedicated to the production of goods and services that are close substitutes of one another and that operate in the same competitive space. The focus is on the behavior of the companies that make up the market in question, and the market in turn is seen as an abstract space where supply and demand meets to for negotiations.

It must be noted that Industrial Economics (French origin) or Industrial Organization (English origin) first appeared in 1950s and their objective has been to study the relations among companies, markets, institutions and processes. In Brazil, Industrial

Organization is a relatively new form of economics seeking to develop new methodology to investigate how various industrial sectors function and all the dynamics backing them up (Kupfer and Hasenclever, 2002).

One factor that comes under scrutiny in analyses of industrial dynamics is the conditions of competitiveness in the markets, which are determined by a set of elements that includes regulatory mechanisms, the extent of market concentration, product differentiation, the diversity of activities, the characteristics of the demand side, companies' installed production capacity, market entry or exit barriers, price determination and others (Possas 1987). The degree of competition in a given industry, according to Stiglitz and Walsh (2003), is mainly related to the extent of market concentration and to product differentiation.

The Structure, Conduct, Performance Paradigm (SCP)

The Structure-Conduct-Performance Paradigm (SCP) is based on the premise that industries depend on the conduct of the agents of demand and those of supply who, in turn, depend on the market structure which involves such basic considerations as technology and the demand for products (Carlton and Perloff, 1994).

The SCP model attempts to identify a set of variables that influence the organizations' economic performance, determining the relations among those variables and the final result (Scherer and Ross, 1990). Figure 3 illustrates the flows, and the inter-relations of this model:

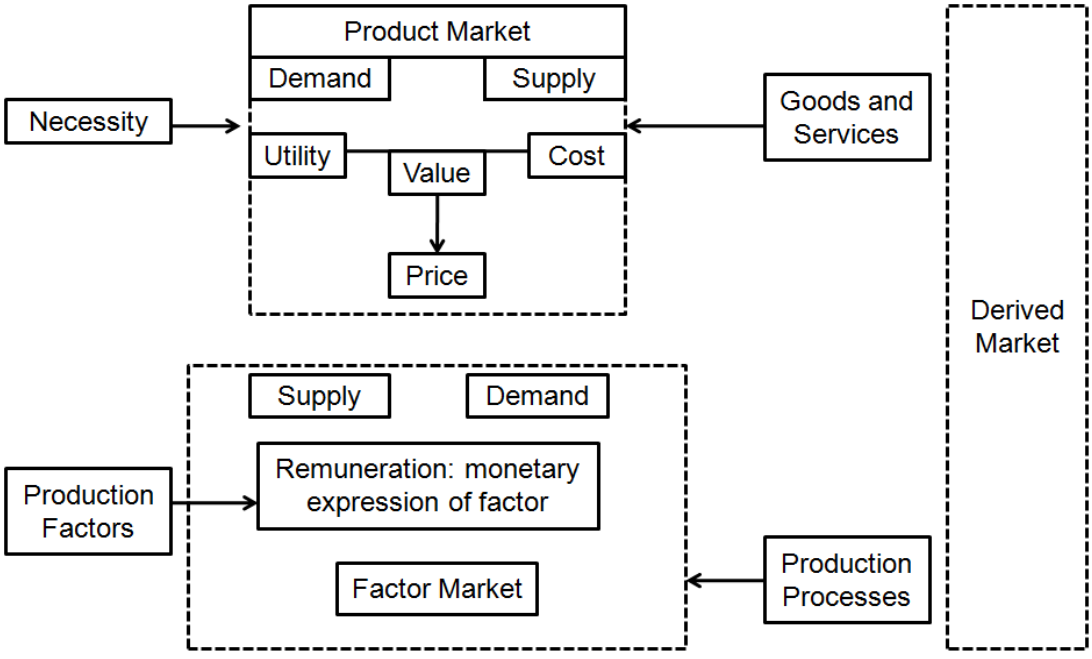

Figure 3: Dynamics of the Structure-Conduct-Performance Model
Source: adapted from Samuelson and Nordhaus, 1993.

Figure 3 shows that, in the market, the price is the monetary expression of the value of goods and services that consumers attribute to products and to the producers' costs in

such a way that both consumers and producers maximize their satisfactions (Samuelson and Nordhaus, 1993).

One of the objectives of market structure-related analyses is to measure the degree of competition in them. Rossetti (1985) believe that the various competition-related structures in predominantly imperfect markets influence the price or remuneration and may reach their highest degree of imperfection in the form of a bilateral monopoly. That means that getting to know the main structures of a market is an essential step towards gaining an understanding of the interactions between the forces of supply and demand. Chart 2 presents the characters of the main market structures:

Chart 2: Classification of the main structures of the products market

Characteristics	Market Structure			
	Perfect Competition	Monopoly	Oligopoly	Monopolistic Competition
N.º of competitors	Atomized	Unique	Usually small	large (competitiveness prevails)
Product or factor	Homogeneous and substitutable	Homogeneous and not substitutable	Homogeneous or differentiated but substitutable	Differentiated and substitutable
Control over price and remuneration	Impossible, (price limit determined by the market)	High	High (due to increasing rivalry)	Possible (due to differentiation)

Source: Rossetti, 2003 - Adapted.

Market Concentration Indexes (indicators)

Some theoreticians view concentration in markets as merely concerning economic data such as profits and returns. On the other hand, Koch (1974) states that concentration concerns the quantity and of agents involved in a given market and their outreach in regard to elements that determine the size of each agent, but he fails to specify what those elements might be. Tedesco (2012) states that concentration can be measured in the light of the means of production, the quantity being produced or the results obtained. Thus, in the case of passenger transport it would be possible to measure concentration by conducting an analysis of the vehicle fleet (means of production), the passengers (quantity produced) or the turnover (results).

Jacquemin (1979) believes that concentration can be approached in three different ways, with one of them being the degree of industrial or horizontal concentration regarding the participation of each company in the overall production of a given industry or of a specific market.

Concentration measurements, in the view of Resende and Boff (2002), can be classified as either: (i) positive; or (ii) normative. Positive measurements reflect the degree of market concentration by means of statistical analyses and so they do not depend on measuring behavior. Normative measurements on the other hand use

behavioral parameters applied to both producers and consumers. Those authors indicate another classification applicable to concentration measurements by sub-diving them into: (i) partial; or (ii) summary. Partial measurements use data referring to only a part of the total number of companies in the market and they are used to calculate what are known as concentration ratios. In contrast, the summary measurements must necessarily make use of data concerning all market participants.

The most commonly used indexes used for expressing market share and market concentration in road transport market are the Concentration Ratio (CR), and the Hirschman-Herfindah Index (HH). In general those indexes have shown that the greater degrees of concentration are associated to lesser degrees of competition.

In Brazil there have been very few studies directed specifically analyzing market concentration in the transport sector. Martins *et al*. (2007) analyzed the market concentration of road passenger transport companies using Concentration Ratios and Tedesco (2012) has proposed an analysis of road cargo transport markets based on a cross referenced evaluation between CR and HH indexes.

The Hirschman-Herfindahl Index

HH Index is widely used to measure company concentrations in markets. It can only be calculated when data available covers all participants in the market, which frequently makes it very difficult to apply in practice. Although HH Index does not directly reflect the company's market share, it nevertheless does give a much broader idea and emphasizes much more the question of company concentrations in a given market due to the fact that it considers all the participants and also that in the calculation it squares the participation values of each company which effectively attributes greater weight to companies that are relatively larger (Tedesco, 2012).

The HH index is a concentration measurement of the positive-summary type and its value varies in the interval $^{1}/_{n} \leq HH \leq 1$ being calculated by adding up the squares of proportions attributed to each company for a given variable (see equation 1).

That means that values close to zero show that the market is not very concentrated while values close to 1 indicate a much greater degree of concentration. The upper limit corresponds to a situation where there is only a single company operating in the market and the lower limit to a situation in which all the companies in the market were exactly the same size (Kupfer and Hasenclever, 2002).

The HH is defined as the sum of the squares of the participations all 'n' companies in the market:

$$HH = \sum_{i=1}^{n} s_i^2 \qquad {}^{1}/_{n} \leq HH \leq 1 \tag{1}$$

The greater the value obtained for HH the greater is the degree of concentration and consequently the less competition there will be (Kupfer and Hasenclever, 2002; Resende and Boff, 2002).

Concentration Ration

The CR(*k*) is a positive partial or summary concentration measurement of the *k* largest companies. It is obtained by adding the market shares of the biggest companies in a given industry. The higher the CR value the greater the power those companies have over the market. The Concentration Ratio CR indicates the market shares of the k biggest companies ($k = 1,2,...,n$). It can be obtained by using Equation 2:

$$CR_k = \sum_{i=1}^{k} si \quad {}^{k}/_{n} \leq CR_K < 1 \qquad (2)$$

Where *si* represents the company's percentage participation in the market, *k* is the number of the largest companies that made up the sample and *n* is the total number of companies present in the market in question. In empirical applications, values used for *k* are usually *k* =4 and *k*= 8, but other values can be chosen according to the variable being studied.

The CR(k) index does not analyze the market participation of the smaller companies, what makes it difficult for future evaluation of the consequences of eventual fusions among the small companies or of various medium sized ones that were not include in the sample number of *k* companies. The index is calculated on the basis of partial data and not summed amounts and it ignores the relative participation of the larger companies in the market as a whole and merely assesses their participation in the restricted group of companies studied (Tedesco, 2012).

STUDY METHODOLOGY

Research was divided into five stages as shown in Chart 3 below:

Chart 3: Methodology

Stage 1:	Delineating the research profile, structuring the problem, context, formulating the hypothesis and defining the objectives.
Stage 2:	Literature review, revision of main concepts, deepening theoretical knowledge of the issue.
Stage 3:	Gathering data on passenger demand associated to Inter-Municipal Road Passenger Transport in the state of Goias.
Stage 4:	Structuring the database
Stage 5:	Data processing

During Stage 1, the research was delineated, the research problem was defined, the hypothesis and the presuppositions were established. In the Stage 2, it was made a bibliographic review, containing the main concepts associated to the theme studied.

During Stage 3, data was obtained from the AGR concerning all companies' operation inter-municipal road passenger transport services in the state of Goias in the period 2005 to 2010 and in Stage 4 the same data was tabulated in Excel spreadsheets thereby constituting a database.

Stage 5 was dedicated calculating the concentration indexes. To define the number of companies, k to be evaluated by determining the concentration index $\mathbf{CR_k}$ a multivariate non-hierarchical statistical method known as K-means (Cluster Analysis) was adopted.

K-means method forms homogeneous sub-groups within the overall set based on similarities and dissimilarities among them, that is to say it transfers an individual element to whichever cluster has its centroid the shortest distance away.

The method was applied to the numbers of passengers transported by the 28 companies operating Inter-municipal Road Passenger Transport in 2010 in Goias to form four clusters and the results can be seen in Table 2, below.

Table 2: Cluster Analysis

Clusters	**N° of companies**
Cluster 1	3
Cluster 2	6
Cluster 3	7
Cluster 4	12
Total	28

Thus, the number of companies that were to be evaluated using the $\mathbf{CR_k}$ index was 3 because they were the ones that carried the highest numbers of passengers in 2010.

The HH Index was calculated by adding up the squares of the percentage participation in the total number of passengers transported by each company. Values close to zero indicated that the inter-municipal transport market was hardly concentrated at all, but very competitive and with companies holding smaller market shares whereas values close to one indicated situations of much greater concentrations (1 would be the case where all the inter-municipal transport of passengers was done by a single company).

RESULTS AND DISCUSSION

In order to characterize the structure of the Inter-municipal transport market in Goias, three sets of concentration indexes were calculated for each year of the period. The

presupposition of the analysis was that if the market share of the companies participating in that market was high then market concentration existed.

Table 3 sets out the concentration indexes (CR and HH) calculated on the basis of the numbers of passengers transported by companies operating inter-municipal road passenger transport in Goias for the period 2005 to 2010.

Table 3: Main passenger concentration indicators

Year	CR3	HH
2005	0.420721	0.086803
2006	0.416539	0.087988
2007	0.436074	0.091888
2008	0.407695	0.084812
2009	0.411783	0.083441
2010	0.429795	0.083327

Following graphs permits a better understanding of the data set out in Table 3. Figure 4 is a graph of the evolution of the CR3 over the period 2005 to 2010:

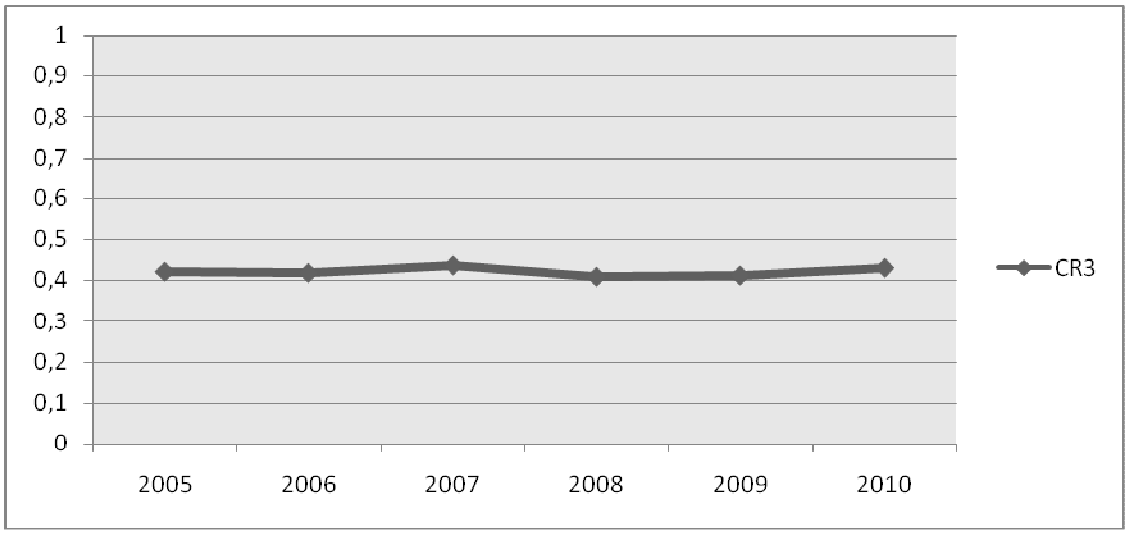

Figure 4: CR_3 index for inter-municipal road passenger transport in Goias, 2005 to 2010

Figure 4 illustrates the companies' behavior over the period. The three largest companies managed to keep their relative participation in the market practically stable over the period. Together they answer for 40% of the market share. There was a slight drop in participation in 2008 but, in the two following years their participation crept back up to 41% and 42%, respectively.

Figure 5 shows HH index values obtained for the period 2005 to 2010. The curve is very similar to that obtained for the CR index.

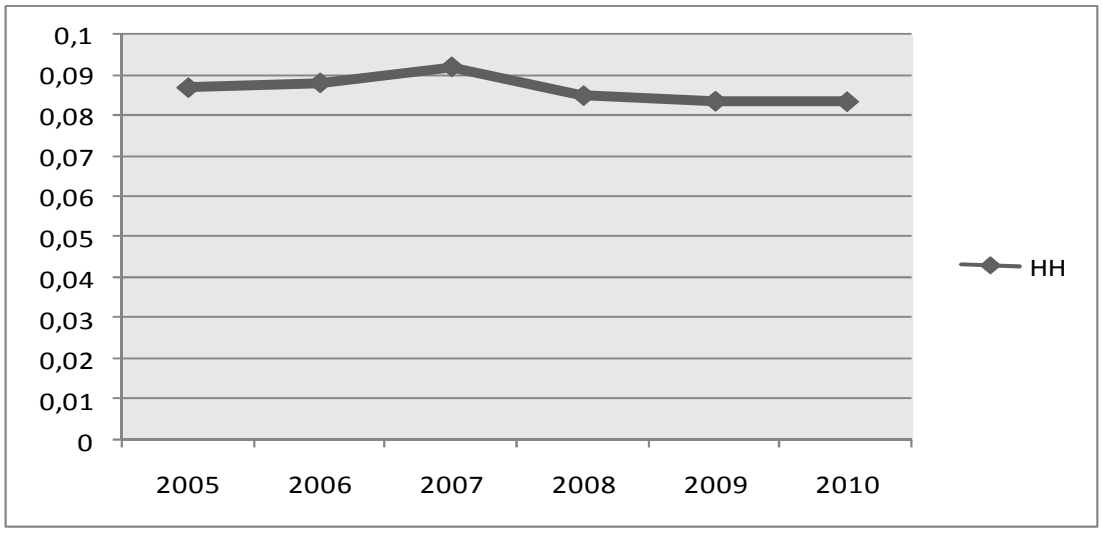

Figure 5: HH index for inter-municipal road passenger transport in Goias, 2005 to 2010

CONCLUSION

In the last decades of the 20th century, Brazilian cities grew at a rapid rate as a result of the rural exodus and an intense urbanization process. To meet new economic demands, cities were obliged to unfold adaptation processes and take competitive advantage of the returns to scale that they produce and to which they are submitted. Thus, the new urban areas found they had to centralize their production sectors and offer better conditions for accessing education, health, housing and other services.

In transport sector, to ensure the systems function more efficiently and effectively address the population's needs, planners direct their efforts at improving the access and connection conditions of many different segments, which underscores the importance of urban mobility and the connections among the cities; an essential requirement for exploiting the advantages offered by urban agglomeration particularly in regard to the distances to be traveled. Thus the question of mobility is associated to the field of citizen's rights in view of public transport's overriding importance to local and regional development, to providing access to raw materials in the case of industry, and access to products in the case of consumers.

Furthermore, transport plays a vital role in fostering the development of other sectors directly affecting the security, quality of life and economic development of a region or a country. Thus it is the responsibility public authorities to provide it, administer it and regulate it and to design planning and monitoring processes that make it possible to accompany the constant changes in population dynamics associated to land use and settlement patterns and the population's translocation needs. In that light market concentration studies can offer valuable support to Transport System planning that favors active competition in that market as one of the means to achieving efficiency in the service provision.

To investigate market concentration in passenger transport services, this research made a market share analysis of the inter-municipal road transport system in the state of Goias located in Brazil's central region. That state has a population of 6 million people and is composed of 256 municipalities. In 2010 the 385 inter-municipal lines of inter-municipal road passenger transport in operation transported over 12 million passengers.

According to the results obtained from the application of the CR and HH indexes, a slight degree of market concentration was revealed. In spite of there being 28 companies operating inter-municipal transport, over 40% of the total numbers of passengers transported is concentrated in the hands of just three companies. It is also apparent that the CR Index results are more expressive for calculating market concentration in the case of inter-municipal transport and therefore their use is more appropriate than that of the HH Index.

The results obtained can provide support for structuring public policies and regulatory processes designed to limit the participation of companies in a way that ensures that their relative sizes do not impose a concentration of the market. That would improve the population's access to the transport networks and the mobility conditions of the service users in general.

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