Effects of the Deregulation on the Concentration of the Brazilian Air Transportation Industry

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Abstract

This paper addresses the effects of the deregulation of the Brazilian air transportation industry in terms of the concentration of the market. We will show some metrics that are commonly used to study the concentration of the industry. This paper uses the Herfindhal-Hirschman Index. This index tends to zero in the competitive scenario, with a large number of small firms, and to one in case of a monopolistic scenario. The paper analyses the dynamics of the concentration of the Brazilian domestic air transportation market, in order to evaluate the effects of deregulation. We conclude that the Brazilian market presents oligopoly characteristics and aspects in its current structure that maintain the market concentrated in spite of the Deregulation measures adopted by the aeronautical authority.

Keywords: Herfindhal-Hirschman Index , concentration, Deregulation

1. Introduction

Sales or production concentration is related to the industry market distribution among companies according to their size. For the air passenger transportation industry the product that is being offered by the air transportation companies is the seat of an aircraft. This

production plays a relevant part in the industry market structure since it should determine the behavior and development of the air transportation company.

The economical theory suggests that structural characteristics of an industry sway its behavior, as well as its prices, costs, profits and inventive activities in the market. This paper is about one of the main dimensions of the air transportation industry, the production concentration. It assumes that the number and size distribution of companies influence the expectations related to the behavior of the competitors. For example, in an industry scenario with a small number of companies, each one playing an important role in a market that is not coming to any growth, the increase in sales of one company will mean failure for the others. The companies soon discover why they lost market share and probably react trying to get back their participation. A company usually cannot take aggressive initiative in a market without consideration of the probable reaction of the competitors. Besides, the number of companies and their participation in the market can influence the possibility of collusions. Collusions will surely be successful if the number of companies in the industry is small.

So, the reader can notice that the concentration level of an industry can determine the dynamics of the playing companies and, indirectly, the industry own development. In a detailed analysis, Industrial Concentration is understood as a process of growth of the market power of the larger companies on the economical activity. The concentration level is a measurement that expresses the structure of the industry.

One of the first studies in Brazil about concentration of an air transportation industry is the paper developed by Espírito Santo (2000). It contains an analysis about the quality of the national industry concentration and identifies reasons that may increase the industry concentration. In the author's own words:

"... in 1998, VASP and Transbrasil started a code-share agreement in several domestic connections. Although it was finished in some months, this was the beginning of new domestic alliances. Practicing the code-share, the companies can commercialize their flights together, as if they were one company. This way, the partner companies can cut

down on the expenses related to giving information about flights, can come to the reduction
of frequency in the constant connections in the agreement – and this way, cut down on the
offering of seats and schedule – and can reduce the passenger's service level and the
straight competition. This competition, from contestant companies, can become seriously
involved."

In Oliveira's study (2001) we're able to notice the importance of studying the concentration
in the air transportation market:

"... Although there has been much criticism upon what we call Behavior-Structure-
Paradigm – that consists in the relation between the concentration level in a market (its
structure) and the power of the companies (behavior structure) – the writings on air
transportation have become even more emphatic in pointing that the predominant
strategies all over the world have been emphasized. Besides, the evidences of domestic
alliances creations have been sufficiently concrete to assure that the market power in the
industry has increased more and more. That way, we've come to the conclusion that the
control of the concentration levels and of market power in sections like the air
transportation has become one of the most important attributes of the authorities, looking
forward to promoting their own good."

Our next section will discuss the possible ways to measure the concentration, as well as we
intend to justify the index chosen to calculate the concentration level in the Brazilian Air
Transportation Industry.

2. Concentration measurements

There are several alternative indexes to measure concentration. At first we've got to know
however what are the desirable properties required from a concentration measurement. Hall
and Tideman (1967) suggested the following desirable properties:

(I) a concentration index should have only one dimension,

(II) the measurement shouldn't depend on the size of the industry, but it should consist in a measurement worked out among the group of companies present in the industry, that is, each company contribution answers for its participation in the industry or in the economy,

(III) the concentration measure must increase if the participation of a company in the market increase upon another – a smaller one. It means that the principle of transfers must be used, if necessary. The principle of transfers will be defined here as the process in which the efficient companies get part in the market because of the inefficient ones

(IV) if all the companies are divided in similar parts, the concentration measurement must decrease accordingly. For example, if two companies are divided in two equal parts, then the concentration will have to decrease by half

(V) the concentration measurement must be decreasing when related to the number of companies

(VI) a concentration measurement should be between zero and one

A more understandable series of properties is determined by Hannah and Kay (1977):

(I) the adhesion of new companies of some relevant size must reduce concentration

(II) unions must increase concentration

(III) costumers changing at random for a specific brand must decrease concentration

(IV) if P_i represents the participation of a new company, when it becomes progressively smaller, the effect on the concentration index must also be like that

(V) random factors in the growth of companies should increase concentration

Next, some of the most commonly used concentration measures will be shown, as well as the theory about them.

2.1. Concentration index (C)

It's the most frequently used measure. It measures the participation of the n biggest companies, that is:

$$C = \sum_{i=1}^{n} P_i \qquad (1)$$

P_i - participation of company i in the market

n – number of companies

All the companies that are included in the measurement are equally treated; in other words, they receive net weight 1. The concentration index only provides limited information about the distribution of companies through number and size. Picture 1 shows the concentration of two markets in the Brazilian air transportation industry, the connections:

Altamira (SBHT) – Belém (SBBE),

and Belo Horizonte (Pampulha – SBBH) – Brasília (SBBR).
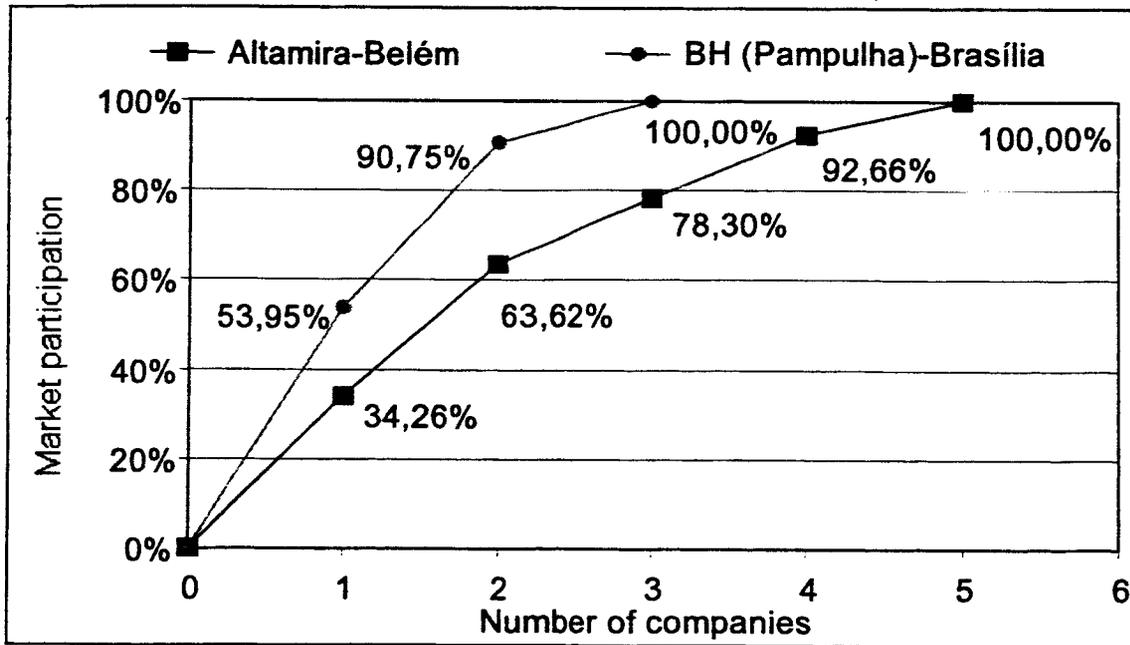
Picture 1

The information on picture 1 can be used to find the minimum number of companies that represents some specific participation of market. In SBHT – SBBE, two companies

represent 63,62% of the market, while in SBBH – SBBR this number goes up to 90,75%. It's possible to see through picture 1 that the lines do not touch each other, in any place. This fact implies that the organization of the connections will not be affected by the choice of *n* companies. In cases like that, for any number of chosen companies, the SBBH – SBBR connection will always be the most concentrated among the two analyzed.

Picture 2 shows the concentration at two other connections in the Brazilian national air transportation market:

Rio de Janeiro (Galeão) – Salvador
and São Paulo (Guarulhos) – Curitiba.
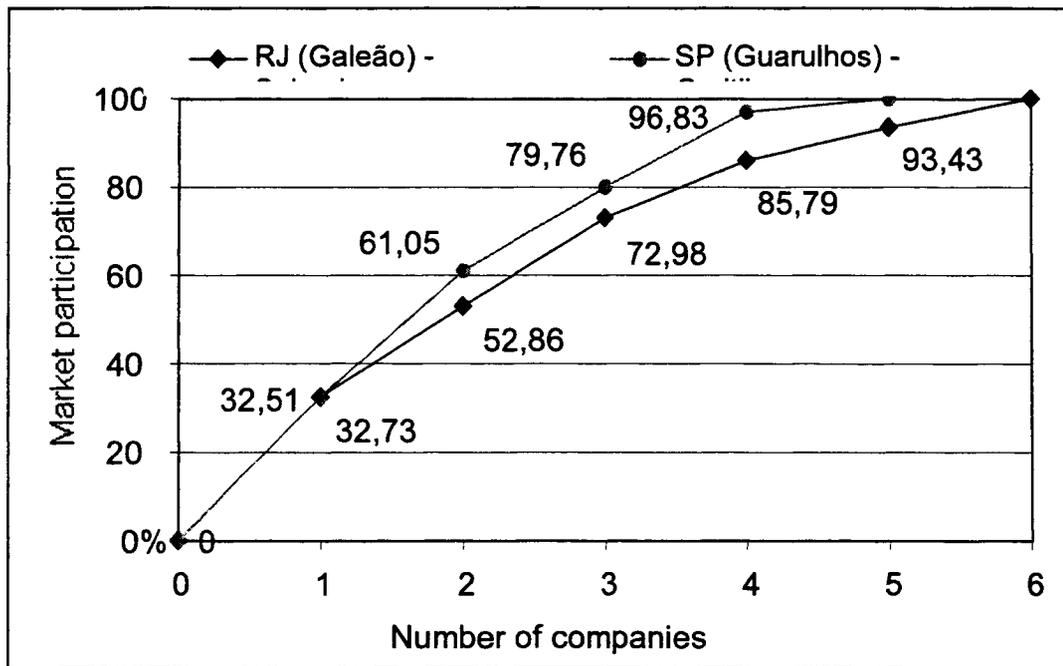
Picture 2

On picture 2, the concentration index for two companies shows that SP (Guarulhos) – Curitiba market is more concentrated than RJ (Galeão) – Salvador one. But for comparisons, the concentration index considering only one company is inverted, that means, RJ (Galeão) – Salvador connection is more concentrated.

Literally, this concentration index is, many times, presented in a different way:

$$CR_m = \frac{\sum_{i=1}^{m} X_i}{\sum_{i=1}^{n} X_i} = \sum_{i=1}^{m} P_i \qquad (2)$$

X_i – represents what the interest is

P_i - indicates the part of market of the company on the total amount

n – total number of companies in the market

m – represents the biggest companies in the market, and m is smaller than n, or similar to it

Generally, the values used are CR4 (or C12), and these measurements can be defined as a variable number of concentration that indicates the percentage of the correspondent industry related to the four (or twelve) biggest companies in the industry. Actually, what's considered is the participation of the biggest companies, that means, it's the result of concentrating the m biggest companies in a market with n companies.

According to Feijo *et al.* (2001), the economical literature suggests concentration zones to classify the markets. These indicators can be seen next:

Grid 1 – Concentration zones according to C and CRM indexes

Concentration zones	Definitions
Not concentrated at all	Markets in which the biggest companies have a participation of 25% or less
A little concentrated	Markets in which the participation of the biggest companies results between 25% and 50%

Concentrated	Those with a market participation varying from 50% to 75%
Very concentrated	The market participation of the biggest companies is 75% or more

Source: Feijo et al. (2001)

2.2. Herfindhal-Hirschman Index (HHI)

It can be defined as:

$$HHI_i = \sum_{i=1}^{n} P_i^2 \quad (3)$$

P_i – participation of the company

n - total number of companies in the industry

The highest value an index can reach equals to 1, and this is possible when there's one only company in the market. The minimum value (in which the companies are all the same size) depends on the number of companies. That way, when $n = 100$, the minimum index is 0.01. For example, if two air companies have, each one, a percentage of 50% of market participation, the Herfindhal-Hirschman index is $0.50^2 + 0.50^2 = $ ½.The index gets near to zero, in a competitive case, with a great number of small companies, and it is equals to one in a monopoly case – it means, companies generally present great power of market in this situation, and that can bring loss to the costumers. We can find, in some cases, HHI values calculated in absolute numbers. For example, the same last situation, two companies with 50% of market participation were considered. Their HHI value would be 5000 points ($50^2 + 50^2 = 5000$). The square measure means that the smaller companies contribute less than proportionally for the index value. A simple example can illustrate the different orders varying according to the measurements:

Grid 2 – Comparison between concentration index (C) and Herfindhal-Hirschman index (HHI)

	Industry A		Industry B	
n	P_i (%)	P_i^2	P_i (%)	P_i^2
1	50	0,25	80	0,64
2	40	0,16	10	0,01
3	10	0,01	10	0,01
	100	0,42	100	0,66

Both scenarios bring the concentration index (C) of two companies presented in 90%, but the Herfindhal-Hirschman index (HHI) is of 0.41 for Industry A and 0.65 for Industry B. The concentration index (C) does not consider the relative size of the two biggest companies, while the Herfindhal-Hirschman index (HHI) does. HHI satisfies all the desirable conditions identified by Hall Tideman and Hannah-Kay and mentioned before in this paper. Besides, this index has received increasing theoretical support. Carlton and Perloff (1998) assure that there is a relationship between HHI and the Market Power. The market structure can be classified according to the HHI value. Some books propose the following classification:

Grid 3: Market structure classified according to the Herfindhal-Hirschman index

Structure	HHI	Price competition intensity
Perfect competition	Usually less than 0.2	Hard
Monopolized competition	Usually less than 0.2	Depends on how much different the products are
Oligopoly	From 0.2 to 0.6	Depends on the competition among the companies
Monopoly	More than 0.6	Soft, unless there's the possibility of new competitors

2.2.1. Comments

As we could see through the studies and comparisons, there are many writings in The United States that verify the concentration effects on fees among cities served by air lines, once the industry was deregulated. Carlton and Perloff (1998) quote some papers where

they noticed that the fees are higher where the concentration is also higher. These papers are from Call and Keeler (1985), Bailey, Graham and Kaplan (1985) and Graham, Kaplan and Sibley (1983). And they could also notice there's a relevant statistics effect of concentration upon development, even though it's got a modest size. The researches concluded by Borenstein (1992), Brueckner, Dye and Spiller (1992), Evans and Kessides (1993) discussed the concentration on the American market. In these writings, the most used measure was HHI, and that's because it respects all the desirable properties and is easy to be handled.

The United States Justice Department provides the following concentration zones to measure the concentration level of an industry:

Grid 4: Placing zones

HHI	Classification
0.00 – 0.10	Low concentration
0.10 – 0.18	Controlled concentration
0.18 – 1.00	High concentration

According to these zones, the American department uses the verified changes on the HHI to decide if a company fusion can be allowed or not. The agency analyses the situation carefully: if the intended transaction happens in a controlled concentration market, and provokes more than 0.01 of addition on the HHI, or 0.005 in high concentration markets, the agency will understand that this transaction probably wants to create, or emphasize, the market power (or make its functioning easier). That way, the proposal goes through a hard analysis to identify the possible impacts on the competition and the needy solutions to approve the fusion.

In Brazil the usage of concentration measurements (HHI) in the fusion of two beer companies: Brahma and Antártica, could be notice

This paper uses the Herfindhal-Hirschman Index (HHI) to analyze the concentration in the Brazilian National Air Transportation Industry.

3. Concentration analysis: Brazilian National Air Transportation Industry – from 1982 to 2000

This section aims to verify the possible impacts on the concentration due to the deregulation rules the Brazilian government has adopted for the last few years. To do so, we'll show the procedures used to calculate the Herfindhal-Hirschman Index (HHI), and its development throughout the years chosen for the present study.

We use the concept of *Aggregated* and *Disaggregated Concentration*. The *Aggregated Concentration* considers the HHI index calculated over the market participation of the commercial groups of air companies, not over the individual participations of each company. For example, VARIG Organization is formed by four companies: VARIG, Rio-Sul, Nordeste (since 1995) and Cruzeiro (1991/92). The *Aggregated Concentration* considers the participation of the four companies as one commercial group. The *Disaggregated Concentration* on the other hand determines the HHI index for each company using the individual participation of each company *i*, as if it were an independent company.

To calculate HHI, a database was created, with the yearly market share of each company from 1982 to 2000. The primary source of information was the Annual Statistics Report of the Brazilian Air Transportation Industry, a yearly publication of the Civil Aviation Department. The market participation of the national companies was measured by means of the offered seat.kilometers.

Having the market participation of each company, HHI was calculated through formula 3 (*Aggregated* and *Disaggregated Concentration*). For a better and clearer understanding picture 3 shows the progress of concentration levels in the national market throughout the years, measured in HHI.
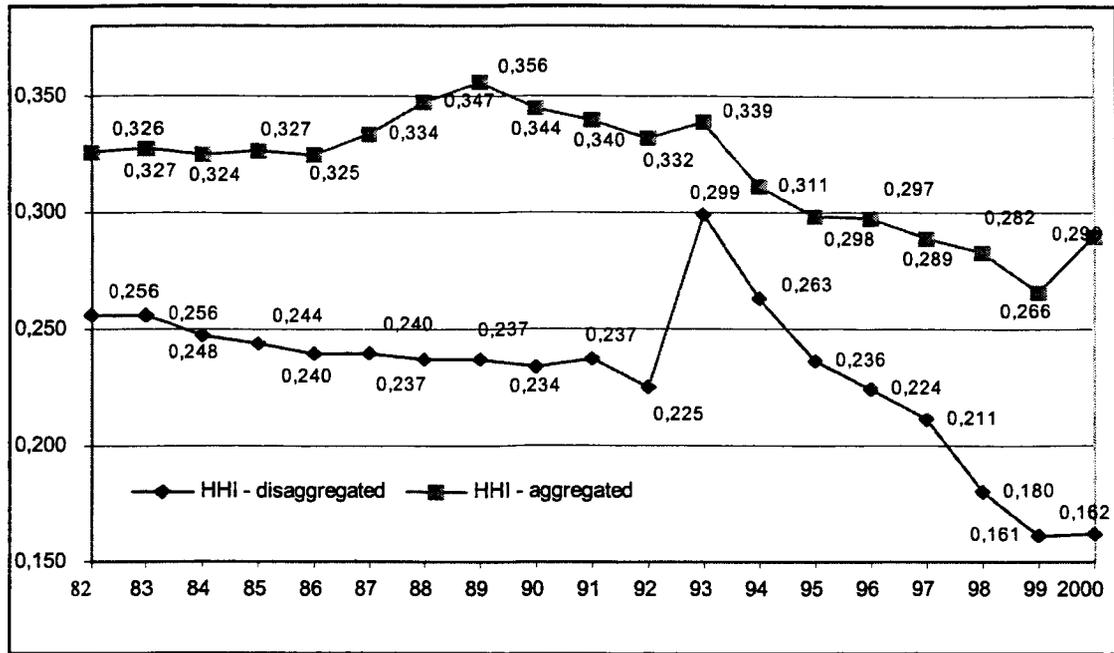
Picture 3

The reader can notice in picture 3 that from 1982 to 1991 the aggregated concentration kept high levels – as considered by the economical theory. According to grid 3, we can classify the market structure of that time as an oligopoly. And we know that in this market, a few companies are responsible for the biggest part or for the total of the production. In some markets, some of or all companies get profits in long terms, once there are obstacles to the entrance of new companies in the market (that makes more difficult the joining of new companies). In this specific case, there was an oligopoly controlled by the government until 1991. The fees were controlled by the public power, aiming to cover costs and expenses of minimum wages. The policies in use from 1982 to 1991 were in great part the responsible for the high concentration levels of the national industry. The controlled competition was adopted because the authorities believed that the free competition among companies could make them grow weak, technically, operationally and financially.

Other reasons that helped the achievement of high market concentration were:

(I) <u>entrance obstacle</u>: the joining of a new company in the market needed government authorization, and what could be noticed was that, in general, it didn't allow the joining,

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aiming to "avoid great competition". From 1982 to 1991, there weren't new companies' joining the industry, but in 1986. One thing that contributed to this situation was that there were great economics of scale (Silva e Lopes, 1994). So, if one company wanted to join the market, it would have to produce in smaller scale and get higher costs than the established ones. At this time, the Department of Civil Aviation divided the country in five areas, and chose, for each one of these regions, one local company to monopolize routes between countryside and capitals. One needy aspect for a competitive market to exist is the possibility of companies freely coming and going in the market, and that wasn't exactly happening.

According to several authors, the control air companies have upon computer reservation systems is considered the main obstacle when new companies want to join the market. In Brazil, till the end of the 80's, each one of the national companies had its own reservation system. From 1990 on computer reservation systems started to be more diffused. These systems were widely known, and the Brazilian companies had to change their old and poor systems for one of the most known systems throughout the world – not to harm their internal sales (Nishime, 1996). That's why there isn't reservation systems controlled by national companies anymore nowadays; almost all of them use systems controlled by foreign companies. In late 80's and early 90's, if a new company wanted to join the market, it would find difficulties in having its flights presented in similar conditions of those already in the market. And if by chance, it chose a new system, it would have to make it popular – it was an expensive procedure and yet, it would face the opposition of the ones already in place. If it chose to join one of the most known systems in Brazil, it would have to share places with a big company, what, for sure, would put the beginner in disadvantage when using or presenting flight information. Yet, a beginner would have to face the preference for the companies with higher market share.

Hall and Tidman (1967) assured that the concentration must decrease when related to the number of companies, and that way, the obstacles that didn't permit new companies to get in the market contributed to high concentration in the national air transportation market, from 1982 to 1991.

(II) <u>route and frequencies</u>: the regulated market did not allow companies to compete on fees; so, one alternative instrument that could have been used was the increase in routes and frequencies. But these possibilities were also controlled by the Department of Civil Aviation, the institution practically imposed its progress factors. These limits controlled any kind of competition among air companies, leading to stronger companies (the big ones) and stronger groups formed by companies with objectives in common. The increase in concentration happened because the big companies had their participation in the market higher at the expense of the smaller ones.

Another reason that led the market to a high concentration was VARIG group. It presented a superior growth when related to the others. At that time the group was formed by two national companies (Cruzeiro and VARIG) and two other regional companies (Rio-Sul and Nordeste). Besides, TAM started to get its group together, with Brasil Central from 1986 on.

The reader must have come to the conclusion that the government ruled the concentration of the companies from 1982 to 1991. This instrument can be useful in promoting the economic efficiency of the companies, however, we have to consider its effects on the passenger, yet. This high level of concentration in the industry brought losses to the users, as we can see: high fees, decrease in routes and frequencies and smaller number of served cities – everything because there was no competition in the area.

But from 1992 on, this situation started to change, and there was an opening process controlled by the air transportation section in the Department of Civil Aviation. Once again, if we observe picture 3, we'll see that the aggregated concentration of the industry started to diminish in 1990. This decrease was interrupted in 1993, when Cruzeiro left VARIG group. Therefore, the new rules set for the air transportation were efficient, when considering the effect on the concentration.

This way, we'll display our analysis to check if this low concentration level was enough to bring any new competition to the market. First of all, it's possible to see that the number of companies in the market grew – more air companies in the market means less concentration measurement. As it's known, the concentration is decreasing when related to the number of companies acting in the market. Again the policy in place played important role in the process of making the number of companies in the market grow. In 1992, the government banished some obstacles for the regional companies. Article of number 688/GM5/92 set the so called Special Air Lines (connecting some downtown airports: Congonhas, Santos Dumont and Pampulha among themselves and with Brasília's airport). Then, these regional companies started to have more possibilities of competing, and counting on the advantage of being in the central airports, with the greatest volume routes of traffic. Another important factor was that they could start being used from any region.

In the end of 1997 and beginning of 1998, the institution sent two important management writings to emphasize the competition among the companies of air transportation. 986/DGAC provided the companies with fees and discounts of 65% on the steady value, and 05/GM05, that freed "any Brazilian air company to use the special lines". These two new happenings provoked immediate impacts on the section's competition, once in March / 1998 a real war of fees was started.

The direct reflexes of this deregulation can be summarized in two main aspects:

(I) air fares reduction and
(II) multi air fares instroduction

As the Department of Civil Aviation stopped controlling the concentration of the national company, the air transportation companies started to set different strategies to act in the market. That way, some national companies began to use more efficient instruments in management. The so called *Yield Management* techniques, already in use in many countries all over the world (Oliveira, 2000). Using these techniques, even only in part, can be considered a good indicator that the market presents a greater sense of competition if

compared to the years when the concentration level was controlled by the government. So, the industry opening led the national companies to set new goals to their organizations, and to search ways for a better participation in the market.

Even with this market opening, there still are several obstacles blocking new companies to join Brazilian market. These obstacles make the industry even more concentrated, and there's loss if competing. We have:

(I) *access to a basic infrastructure*: a company that would like to start air service would face a big difficulty: get space at the airports, because almost all of them are totally busy with the companies that already exists. The situation gets even harder if the "candidate company" tries to enter the market using the airports with more traffic – where it's more difficult to get space, not only related to physical conditions of the airport, but also to to the limitations of frequency that the new company could have. There's also the fact that the noble timetables can be totally filled, and only the periods of less movement would rest. The space given to each company is determined by Infraero, the company that manages the most important airports in the country, according to their respective market participation. On the last few years, problems of traffic started to appear in airports, mainly in Congonhas (SP). They blocked the taking off and landing of the companies, and due to that, any company, new or not, that doesn't operate in Congonhas will face obstacles – physical dependences and windows, taking off in noble timetables totally busy. Most of the main Brazilian airports on the other hand do not hava any serious problem of space for new eventual companies. But this does happen due to the efforts of Infraero, that appears to take the appropriate actions to maintain the capacity of these main airports. As we see, the situation is comfortable, however, in the future Infraero's decisions related to airport spaces will be seen as if they were a market institution. So, we must include the decisions that refer to the management of airports on the political acting of the government, related to the air transportation market (mainly subjects about spaces in the airports).

(II) *market strategies for the companies that already exist*: some market strategies used by air companies can make things even more difficult if a new company wants to join the

market. We can emphasize the existence of programs that try to create loyalty to a certain company or group through prizes.

In 1996, VASP, VARIG and TAM started to such programs, stimulating passengers to be loyal to the airline. This has made passengers to elect to use the service of one company – at least the ones who use it frequently – and it makes more difficult for smaller companies to participate in the market (they have less participation in routes determined in the market as a group).

Júnior *et al.* (1998) conclude that a negative fact coming from the deregulation was that it facilitated the acquisition of smaller companies by the large national or regional companies. Therefore, although the concentration level decreased because of the measures adopted, the market today could be a lot less concentrated if the authority had used instruments to control the concentration. We can check it through picture 3, where we have the concentration measured without thinking about group influence (disaggregated concentration). We come to the conclusion that the authority made a mistake in this aspect, because it allowed comercial group formation. This situation in the future can provoke a decrease in competition in this section, once as time goes by, there's a greater chance for these groups to use their market power.

4. Final considerations

The Brazilian market, even after the deregulation measures adopted, keeps several characteristics of an oligopoly. The opening process of the Brazilian industry is recent, and that's why it's going through some adjustments according to the new policies in the market. Some corrections and adjustments on number of companies working on the deeper routes of the Brazilian market probably will come to happen according to the great number of companies offering services for any of these routes. That emphasizes one fact: the industry has tended to concentrate, it means, the Brazilian market has followed trends from other countries with similar markets, and that makes the number of air companies offering the air transportation service small. So, a few companies have relevant parts of the domestic market, leading to a control of market not desired, when it comes to competition. The

sections that control the air transportation market could take some initiatives, so that the market would be more competitive, like trying to avoid abuses when using reservation systems, coordinate decisions about routes and spaces in the airports, check and control alliances and agreements that can result in excessive control of routes and frequencies of an airport on an only group's hand. Just to control fees of an activity does not mean a decrease in prices because of competition, it's also necessary a proper environment to exist competition. Following trends noticed in other countries, the Brazilian market has a small number of companies, what means a concentrated market. Even in markets like the American one, totally free, the number of companies is proportionally small, and there's also the case of one only company operating in an airport.

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