ANALYSIS OF REGIONAL AIRPORTS AS A FACTOR FOR DEVELOPMENT IN BRAZIL

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Abstract
The establishment an open market policy in Brazil's airline sector in the beginning of the 1990s has brought substantial changes to the country's aviation regulatory framework. One effect of this liberalization has been a substantial decrease in the number of regional airports with regularly scheduled air service. This paper discusses both the internal and external factors that have directly affected the present scenario, based on a review of the literature. We first provide an overview of the evolution of the country's airport industry and its management concerns, and then analyze the effect of the deregulation process on air travel and the social and economic changes this has brought to smaller cities, especially those in the northern region. The overall effect has been to weaken the country's potential for national integration and political unity.

Keywords: air transport, deregulation, development, regional airports, tourism, economy.

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1. INTRODUCTION

The modern economy is characterized by intense movement of people and products on a global scale and the internationalization of goods, services and capital. In this new global context, connectivity is in important base for economic competitiveness, social reform, regional development and social interchange (Palhares & Espírito Santo Jr., 2000). The progressive elimination of borders and barriers in economic and human relations has formed a "new" society in which agile and speedy movement of people, products and information is nearly obligatory. In this scenario, few sectors are as vital as air transportation. As the importance of air transportation of people and products has increased as pillar of globalization, because of its matchless speed (Palhares & Espírito Santo Jr., 2000), airports have obviously grown in importance as well, be they regional, domestic or international.

Until fairly recently airports were seen merely as areas for intermodal transfer. But as foreign trade and tourism have expanded by leaps and bounds, these terminals have emerged as important logistics centers with a strong potential to spur business, investments and jobs, acting as multipliers of the global and local economies, besides serving to maintain national territorial integration, particularly in countries with large landmasses like Brazil (Palhares, 2001). The start of the 1990s marked a period of liberalization of Brazilian air transportation, with the creation of a more competitive setting, stimulated by the opening of the market to new entrants and the reduction of government interference in the economy as a whole and the airline industry in particular. These changes caused a radical shift, with lower fares and more carriers, prompting a sharp increase in the number of passengers and aircraft (Salgado & Oliveira, 2008).

However, despite this strengthening of the nation's air transportation achieved against a backdrop of deregulation of the sector, the number of airports with regular service has declined drastically in the same period, as carriers have centralized their operations at busier airports in detriment to regional ones. This greater concentration of air operations at a declining number of airports in a country of continental dimensions like Brazil, besides meaning less connectivity between flights (whether domestic or international), also hinders national integration and socioeconomic development. Many remote cities, such as in frontier regions of the Amazon, have wound up being isolated, especially because of the country's generally precarious infrastructure of land, maritime and river-borne transportation.

Another relevant aspect is the current airport management model in Brazil. While for over a decade airlines have operated in a free market encouraged by the federal government, the airport sector is almost entirely under the control of a state-owned company, Empresa Brasileira de Infra-estrutura Aeroportuária (Infraero). Indeed, 97% of the passengers and cargo circulate through airports controlled by Infraero. This model and the practices it engenders have been the target of constant questioning and criticism by specialists and industry decision-makers, who see it as retrograde, dirigiste and hampering the competitiveness of the nation's airports (Palhares, 2001; Palhares & Espírito Santo Jr., 2000).

Because of the relevance of this theme, we have three objectives in this paper: (1) to identify the factors that are leading Brazilian air carriers to restrict their flights in terms of airports served, in sharp contrast to the significant expansion of the country's overall commercial aviation market; (2) to investigate the socioeconomic effects on the country of the centralization of airport operations, to see to what extent the loss of capillarity of air service undermines the potential for regional integration and balanced development; and (3) to analyze the current airport administration model and its consequences for the market. We do this through a wide-ranging review of the literature, consisting of books, periodicals and other sources.

The article is organized into three sections besides this introduction. In the first section we examine the role of air transportation as an inducer of socioeconomic development, focusing particularly of Brazilian airport infrastructure. In the second section, we describe the characteristics of regional airports. In the last section we analyze the most important aspects of the regulatory reforms of civil aviation in Brazil and present a diagnosis of air operations in the country in the period after deregulation.

2. AIR TRANSPORT AS AN INDUCER OF SOCIOECONOMIC DEVELOPMENT

Many authors have studied the need to universalize access to air transport and its potential to induce and leverage economic growth in various countries. Consequently, the literature on these subjects is extensive and rich. Rodrigues (2007), for example, stressed the importance of the civil aviation sector in spurring international trade, while Doganis (2001) examined the global impacts of liberalization of commercial aviation, mainly in the European Union and United States, while also projecting future trends for the sector this century.

The power of air transport to leverage economic growth is highlighted in studies by Palhares (2002) and Palhares & Espírito Santo Jr. (2000), for whom various other sectors depend directly on the regularity and reliability of this service, especially tourism. Espirito Santo Jr. (2010) makes a study on the relation between air transport and tourism in Brazil, through the analisys of domestic and international air transport demand and concluded that the aviation market is growing because of the outstanding social and economical situation of the country.

Demand for air transport will always be derived from and influenced by the economic setting of the places where air services exist. Hence, this sector will always be subject to various macro and microeconomic factors. And because of the civil aviation industry's use of a common asset, consisting of the public airways, it will always depend directly on political decisions for continuity of its operations. In this respect, Graham & Guyer (2000) discussed the political aspects of stimulus to and development of air transport in regions of the United Kingdom after the establishment of specific public policies. With human development as a focus, Graham (1997) and Oliveira & Salgado (2008) stressed the fundamental role played by aviation sector, mainly by regional air transport, in promoting sustainable development, reducing socioeconomic inequalities within a country or region and establishing territorial integration. Likewise, Bettini (2007) emphasized the role of commercial aviation in remote regions, by supporting the economic activities that can be carried out in these places. If aviation is important for the multiple reasons noted above, airports are equally important by providing the essential structures for travelers and goods to reach their destinations safely, thus enabling air transport to achieve its political and social potential. As such, they have an important leveraging effect not only on their areas of direct influence, but also on world trade in general.

2.1 THE INFLUENCE OF AIRPORT TERMINALS ON THE ECONOMY

Starting in the mid-twentieth century, with the process of expansion of highway and airway infrastructure and the rise to importance of information technology and the services sector, making economies less centralized and reliant on material resources, land and airport terminals have understandably taken on greater importance as well. Airport terminals have the particular advantages of being less subject to geographic limitations, such as the existence or not of oceans, lakes and navigable rivers, and of serving to link any area of the globe in a short time frame (Palhares, 2002).

In this light, Vasconcelos (2007) indicated that in our current era of globalization and the information economy, airports have assumed a more sophisticated role, becoming entrepots for trade and business, competing among themselves just as do the cities they serve. In his study of the influence of airport terminals on the economy, Kasarda (2006) used the term "aerotropolis" to designate the interaction between these facilities and their surrounding areas. Further according to him, besides offering fast travel to any part of the world, airports can, because of their growing physical size, provide a multiplicity of services and a wide variety of commercial establishments, generating a natural integration in relation to their area of influence. In this sense, Palhares (2001) stated that as airports benefit from the movement of people and goods, the nearby population gains access to markets and tourists that would not be possible without air transport.

Airports always play a major role in the development of cities. The way they interact with and integrate the places where they are located, their dynamic and the physical area they occupy affect urban development by promoting a series of negative and positive externalities. This makes them constant targets of public pressure (Palhares & Espírito Santo Jr., 2000). Among the positive externalities, Palhares (2001) mentioned their potential to promote the local economy and generate direct and indirect jobs and their function as entryways for tourists. But their negative externalities are also undeniable: noise pollution, risk of accidents, traffic congestion on access roads, expropriation of property and restrictions on building heights and land use. All of these positive and negative factors must be considered by urban planners. Palhares & Espírito Santo Jr. (2000) also stressed the criticism airports often attract because of their huge cost for construction and maintenance. Despite their negative impacts, airports act as strategic partners for the productive chain of any society. They play a key role not only in maintaining the aviation industry itself, but in supporting all the economic activities directly or indirectly connected to it. Thus, any limitation of an economic or technical nature imposed on their operations, such as the impossibility of expanding their capacity, winds up restricting the growth of all activities that depend on them, as observed by Palhares & Espírito Santo Jr. (2000).

2.2 AIRPORT INFRASTRUCTURE IN BRAZIL

In Brazil the expansion of airport infrastructure did not really get under way until the 1950s, accompanying the postwar trend for expansion of the entire aviation sector. This period was marked by vigorous growth of the country's economy, and the spread and expansion of

airports served to catalyze the industrialization of many small and medium cities in the interior of the country and even the occupation of formerly inhospitable regions, such as the Amazon. While highways and railways also expanded, land transport in general did not keep pace with the growth of the nation's economy (CECIA, 1981). The spread of development to interior regions of the country that extended through the following decades prompted the government to take measures to reduce the mismatch between demand and supply of infrastructure.

To smooth out these distortions and stimulate the growth of airport activities in cities and towns in the interior, or other than the state capitals[4], and consequently to leverage the economies of these regions, the Air Force Ministry, acting through the Civil Aviation Department (DAC in the Portuguese initials)[5], created the Commission to Study and Coordinate Aeronautical Infrastructure (CECIA) and the Amazon Airports Commission (COMARA). The former had the task of decentralizing airport operations, by passing them to the control of the state governments (which were to create their own state airway plans), while the latter was charged with overseeing the construction of new airports and paving existing airstrips in the Amazon region (Gregori Jr., 1984).

Besides this, the development and improvement of new techniques to open runways and landing fields acquired during World War II favored the expansion of small airports and airdromes, especially in remote regions not easily served by other means of transportation. This guaranteed the presence of regular, safe and fast transport to serve these areas (Gregori Jr., 1984). The spread and expansion of these regional airports also spurred the economies of the cities and hinterlands they served and integrated them with the rest of the country. This not only affected remote regions, such in the Amazon, but also outlying areas nearer the capital cities.

2.2.1. Empresa Brasileira de Infraestrutura Aeroportuária (INFRAERO)

With the arrival of commercial jet aviation at the end of the 1950s, and particularly after the introduction of wide-body airplanes in later decades, airports throughout the world had to

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[4] In Brazil, the state capital is in virtually all cases the largest cities in the state also.
[5] The Civil Aviation Department was linked to the Air Force Ministry, and later to the Defense Ministry when the various armed service ministries were folded into one. For many decades it was the civil aviation regulator in Brazil, as observed by Palhares (2001). Finally, after growing pressure for demilitarization of the country's aviation sector, it was extinguished in 2005 and its duties were assumed by the newly created National Civil Aviation Agency (ANAC).

remodel their infrastructure of runways, taxiways, aprons and terminals to keep up with this technological progress (Palhares & Espírito Santo Jr., 2000). In the mid-1960s the Brazilian government created the Committee to Coordinate the International Airport Project (CCPAI), with the objective of coordinating and developing studies to build a new international airport for the country in Rio de Janeiro As the project that would eventually become Rio de Janeiro/Galeão International Airport grew in size, on May 25, 1970 the CCPAI was transformed into a government-owned corporation, Empresa Aeroportos do Rio de Janeiro S/A (ARSA). Two years later, Law 5862 was enacted (December 12, 1972), transforming ARSA into Empresa Brasileira de Infraestrutura Aeroportuária (Infraero), with responsibility for managing the main airports throughout the country (Palhares & Espírito Santo Jr., 2000).

2.2.2 The Centralized Management Model of Infraero

Infraero[6] has headquarters in the national capital, Brasília and its remit covers construction, management, operation and industrial and commercial exploitation of airport infrastructure throughout the country. Currently it controls 67 airports, accounting for 97% of the country's scheduled passenger traffic, along with 80 navigational stations and 33 cargo terminals (Infraero, 2010). It is divided into six regional offices (*superintendências regionais* - SRs)[7], each directly overseeing the airports and other infrastructure in the particular region. Despite this regional structure, Infraero remains highly centralized in Brasília.

This structure works in two ways (table 1): while each regional office has a certain degree of autonomy to establish particular policies for the airports under its responsibility, this independence is limited, for example, not extending to discretion to set boarding taxes and landing fees (Palhares,2001). According to Palhares e Espírito Santo (2000) while in the past the centralized administrative philosophy was important to the development of the country's airport infrastructure, currently this model prevents local airport administrations from forging their own management strategies to take better advantage of business opportunities. One important feature of this centralized administration is the policy of cross-subsidies, whereby revenues from profitable airports are channeled to loss-making ones. For example, revenues from the profitable Guarulhos Airport (São Paulo) are redirected to airports that would

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[6] Infraero was subordinated to the Air Force Ministry until the creation of the Defense Ministry in 1999.
[7] Since Infraero adopted the name "*superintendência "regional*" for its regional offices in 2001, they have undergone various changes with respect to their staffing, configuration, regional coverage and the airports under their control.

otherwise operate in the red, such as Plácido de Castro (Rio Branco) and Brigadeiro Lysias Rodrigues (Palmas) airports. This management model winds up discouraging new management ideas and efforts to attract new businesses to these airports (Palhares & Espírito Santo Jr., 2000; Palhares, 2001).

Table 1: Administrative Division of Infraero and Regional Share of Passengers

Regional Office (February -2010)	Headquarters	Share of Passengers[***] (2009)
South Region	Porto Alegre	39,11%
Northeast Region	Recife	19,61%
Midwest Region	Brasília*	14,65%
Rio de Janeiro Region	Rio de Janeiro	12,84%
Southeast Region	Belo Horizonte	7,86%
North Region	Manaus	5,9%
São Paulo Region	São Paulo **	---------

Source: Infraero
* Brasília is also the national headquarters, to which all the regional offices are subordinated.
** The São Paulo regional office was established in April 2010. Until then the airports in that state had been subordinated to the South Region office.
*** Figures refer to January through November 2009: 103,424,088 passengers nationwide.

On the other hand, this policy of centralization and redistribution of resources undeniably helps maintain airports in isolated regions with low demand, for which air transport in many cases represents virtually the only form of access. This is important in a country with the physical characteristics of Brazil.

3. CLASSIFICATION OF REGIONAL AIRPORTS

Although the operational concept of regional airports varies according to the country or technical criteria, in very general terms the reasons for their existence are related to integration of marginal regions off the axes of great commercial and industrial centers; development of more socioeconomically backward regions; provision of access to areas that are remote or hard to reach by land or water routes; and/or their role as feeders to large hub airports. But irrespective of the particular elements involved, the international literature is unanimous about their importance. Their function as providers of access to regions where geography or distance are natural obstacles has been a frequent theme among researchers around the world. According to Amoroso & Caruso (2009), regional airports serve an irreplaceable role in modern economic life, mainly by connecting places that because of geography are difficult to reach through other means of transport, or where demand is not

large enough to justify continental or international air services. Therefore, these airports occupy an essential strategic position, serving the public interest in regions where economic relations require fast and efficient connections but land or water transport is too slow.

Malina, Schwab & Wollersheim (2008) pointed out that many studies only focus on the economic effects caused by the demand generated by airport terminals, and wind up overlooking other commercial opportunities they can provide. The aim of their work was to quantify the catalyzing effects of these terminals, to get a better idea of their potential influence on a regional economy. Access to the vast expanse of the Amazon region[8] has also been the subject of various works, focusing on its geographic characteristics[9] and precarious land and river transportation system[10]. These factors increase the importance of airports as a way to serve the basic needs of the region's inhabitants[11], such as health, education and travel (Bettini, 2007).

A study carried out by Graham & Guyer (2000) stressed the importance of regional airports in Great Britain. According to the authors, besides contributing to local economies, they also alleviate the pressure on congested central airports and reduce the need for long trips by road to hub airports by passengers living in smaller cities. Despite the existence of an extensive bibliography on regional airports, in practice pinning down the concept and identifying the particularities that characterize these airports is a complicated task, with little agreement in the international literature. This is due to the absence of any methodological model that establishes criteria and technical parameters to identify them, or even a scientific approach that can delineate this segment of aviation. The subject is thus susceptible to varied interpretations and arbitrary factors, such as ranking by demand or degree of restriction of the market served, for example.

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[8] The Amazon region is part of the North region of Brazil. The country is officially divided into five regions (the others being the South, Southeast, Midwest and Northeast). The North region is the most isolated due to its geographical features, such as the Amazon Forest.

[9] The distances between Manaus, the largest city in the North region and capital of the state of Amazonas, and some of the country's other main cities are:
- Rio de Janeiro – 4,776 km by highway and 2,860 km by air
- São Paulo – 3,950 km by highway and 2,690 km by air
- Brasília – 2,316 km by highway and 1,928 km by air

[10] A trip between Tabatinga and Manaus takes 90 minutes by airplane compared to between 7 and 11 days by boat. As for roads, besides the difficulty and expense of building and maintaining them, given the long distances and intense rainfall characteristic of the Amazon region, they also open the way for further deforestation.

[11] It is the region with the lowest population density, with 3.8 people per square kilometer.

Although the International Civil Aviation Organization (ICAO) recommends that airports be categorized according to size (Palhares, 2001), this practice disregards many other pertinent criteria, because there are various ways to evaluate and rank an airport by a one or a combination of factors, such as movement of aircraft, movement of freight, flow of passengers and space occupied, as explained by Mello et al (2005). Further according to these authors, in many cases an airport can be classified in more than one category, depending on the criterion applied in the analysis. As an example, we can mention Macaé Airport (Rio de Janeiro state) and Campo de Marte Airport (São Paulo city). Both of them serve heavy helicopter traffic, putting them among the top ranked in Brazil in "movement of aircraft", but they have very low cargo and passenger flows. The same thinking is shared by Brochado & Marrana (2001), who recognized that although there are various ways to measure and classify airports only using the "passenger flow" criterion, the literature they reviewed did not provide methods that consider other complementary criteria at the same time.

The distance between the airport and its main points that generate demand is another aspect that should be taken into consideration. The time it takes to reach an airport in some circumstances can simply make flying an unworkable option from the standpoint transport cost x total travel time. This happened in Brazil in the 1950s, when the expansion of the highway system wound up economically undermining a series of air routes, especially shorter hops that became easier and cheaper to bridge by car or bus (CECIA, 1981).

The difficulty of coming up with a definition for regional airports was discussed by Graham and Guyer (2000) because even hubs serve regional markets and depend on them as feeders. Thompson (2002) in his work on the impacts of liberalization of transport in the European Union, used the term "third-level airports" to identify those with smaller scale operations than the national and international airports in Paris and the regional ones in Lyon, Marseilles and Nice, but without mentioning any indicators to base this concept, such as demand or traffic flow. Likewise,Tapiador, Mateos & Martí-Henneberg (2008),identify regional airports as "secondary airports", but again without establishing any criterion the characterize them. According to Amoroso and Caruso (2009), regional airports can be defined as those having capacity of from 1 to 5 million passengers a year. But their criterion of passengers transported to delineate the segment does not consider important aspects of a political, geographic or operational nature. Applying this yardstick to the Brazilian setting would cause all terminals with passenger flows under the range proposed (1 to 5 million

passengers/year) to be classified as "regional", even if they are located in important state capitals, and in some cases receive international flights. Examples are Campo Grande, Aracaju and São Luís airports.[12]

3.1. REGIONAL AIRPORTS IN BRAZIL: STRATEGIC CENTERS FOR NATIONAL INTEGRATION

According to figures from the Brazilian Institute of Geography and Statistics (IBGE), Brazil is the fifth largest country in the world in terms of landmass, with an area of 8,511,965 km^2 – accounting for 47.7% of South America. The country is officially divided into five regions (North, Northeast, Midwest, Southeast and South), which are further divided into 26 states and over 5,500 municipalities[13], plus the Federal District (location of the capital Brasília). Besides this, the country has an extensive coastline of 7,408 km, some 24,000 km of navigable rivers in the Amazon basin alone, and 15,179 km of borders (Rodrigues, 2007). Brazil's expansive geographic characteristics, combined with the historic underinvestment in land transport infrastructure, hugely increase the importance of regional airports to bring regular air service to outlying cities and towns and thus provide people's basic needs. Silva (2000) stressed that in many cases air transport is virtually the only way to connect distant points and to maintain regional and national integration.

Airports are obviously subject to the same fluctuations that affect the aviation market. These are largely dictated by externalities, mainly in the economic sphere, but also including terrorist threats and, more recently, volcanic eruptions. Smaller airports are particularly vulnerable to the vagaries of these outside influences because they do not have the scale of passenger and cargo movement of the large hub airports to absorb sharp oscillations in demand. Because of their often precarious situation and at the same time important role in fostering economic and social integration, it is justified to direct public policies to their survival. For a better understanding of the current situation of the regional airport market in Brazil, it is necessary to discuss the main regulatory reforms in the civil aviation sector in the country as a whole over the past 20 years. These have been decisive for the development of the current (at first glance contradictory) situation: while the flow of passengers and cargo

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[12] Campo Grande International Airport served 918,475 passengers in 2009, while Santa Maria Airport (Aracaju) handled 653,445 and Marechal Cunha Machado International Airport (São Luís) handled 880,882.
[13] The local political division in Brazil is the municipality, which is similar to a county in the United States, except a municipality has a single mayor and municipal council. There are no unincorporated areas in Brazil. The number of municipalities can increase, however, through division of existing ones.

has been expanding steadily, the number of regional airports with scheduled service has been falling.

4. DEREGULATION OF THE BRAZILIAN AVIATION SECTOR

As previously mentioned, in the past two decades the commercial aviation sector in Brazil has undergone a good deal of deregulation. But before discussing this period, it is important to know something about the regulatory framework that was built up in a previous reform period. This reform occurred between 1968 and 1986, a period that was marked by an import-substitution industrial policy and strict regulation of the overall economy. This period was characterized by direct government intervention in the aviation market, with the aim of spurring growth through developmental policy mechanisms, along with the adoption of centralized regulatory instruments (Oliveira, 2009). The second reform, starting in the early 1990s, saw the opposite movement: gradual deregulation of commercial aviation. This was carried out in three steps until 2003, but is still producing reverberations today. In the next sub-section we discuss both of these reform periods in more detail, and their effects on the aviation market and overall economy.

## 4.1 STRICT REGULATION WITH INDUSTRIAL POLICY (1968-1986)

The situation of commercial aviation in Brazil between 1940 and 1960 was chaotic, marked by an excessive number of carriers, often generating predatory competition and instability in the sector, along with expansion of the highway network, which emerged as a direct competitor, since most air routes were concentrated along the coast, with relatively short distances. According to Malagutti (2001), the low profitability and the fear of a general breakdown of the sector prompted collaborative efforts by the federal government, through the Civil Aviation Department (DAC), and the main airline companies at the time (Varig, Vasp, Transbrasil and Cruzeiro do Sul) to regulate the aviation sector and assure its profitability. As explained by Oliveira (2009), these efforts were materialized through a series of meetings under the umbrella of the National Commercial Aviation Conference (CONAC). All told there were three rounds of these discussions between 1961 and 1968, at the end of which it was determined that:

a) there would be a policy to encourage mergers and acquisitions, to reduce the number of carriers;

b) the governmental authority would dictate the frequency of flights, routes and fares; and

c) scheduled air transport would be provided solely by the four above-mentioned airlines, with the entrance of new players suspended.

In parallel with the establishment of this regulatory framework, the authorities supported the introduction of large jets into these carriers' fleets, such as, through government loans at favorable rates or government guarantees to private lenders. But since these airplanes could only operate at the largest airports, most regional airports suffered from this trend, with a sharp decline in the number of flights to these terminals. This reduction of the supply of scheduled air service particularly affected cities in the interior of the country.(on graph 1)

Figure 1: Number of Cities served by Scheduled Air Transport in Brazil
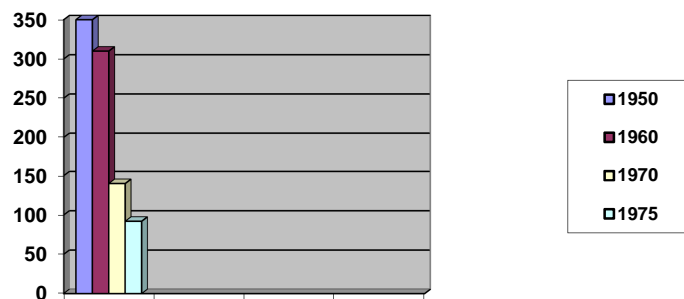
Source: Gomes et al. (2002)

The drastic retraction of coverage of the national air network, mainly at airports off the main axes of the large urban centers and state capitals, led the government to create a new modality of aviation – regional aviation – to operate routes with marginal economic feasibility and medium/low traffic potential. To stimulate these routes – most of them loss-making – the government created a cross-subsidy mechanism, by diverting part of the tax revenue from domestic airlines' tickets, and also facilitated the purchase of the Bandeirante model airplane (made by Embraer, then controlled by the federal government), which was designed to serve smaller airports[14]. Under this policy, the country was divided into five geographic zones, to be served by five regional carriers created specifically for this purpose: TAM, Nordeste, Rio Sul, Taba and Votec.

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[14] Bandeirantes are jets with capacity of 15 to 21 passengers.

4.2. THE NINETIES: DEREGULATION OF BRAZILIAN COMMERCIAL AVIATION

The decade of the nineties was marked by an international wave of liberalizing economic reforms, with a trend toward less government intervention in various economic segments. In 1992, Brazil's then president, Fernando Collor de Melo, created the "National Deregulation Program" with the aim of liberalizing and opening the economy in strategic sectors. Civil aviation was included in this policy, as observed by Oliveira (2009). The result was the establishment of the "Policy to Flexibilize Commercial Aviation", put into practice through the issuance of a series of edicts by the DAC to deregulate the country's air transportation. The overall aims of the new policy were to end the monopolies and government subsidies existing since the 1970s as part of the Integrated Regional Air Transportation System (SITAR), so as to introduce more competition in the market and stimulate fare liberalization, as observed by Oliveira (2009). This deregulation process occurred in three phases, known as rounds: First Round (1992-1997); Second Round (1998-2001); and Third Round (2001-2003). This type of phased-in deregulation also occurred in the European Union, with the same objective of allowing the market to adjust (Salgado & Oliveira, 2008).

Table 2: Aircraft Registered in Brazil

Year	Number of Aircraft Registered
1996	9,768
1997	9,962
1998	10,178
1999	10,274
2000	10,364
2001	10,527
2002	10,641
2003	10,699
2004	10,831
2005	10,995
2006	11,113
2007	11,351
2008	11,857
2009	12,178

Source: ANAC (2010)

The results expected of the deregulation process were attained satisfactorily. According to Salgado & Oliveira (2008) the second round touched off a "price war" and a race to add more flights, in a competitive movement without parallel in the market since the 1960s. These actions brought gains to the Brazilian aviation sector, such as lower prices, greater

operating efficiency and sharper competition among carriers, allowing substantial expansion of the market, as reflected in the number of airplanes registered in the country.

Table 2 gives an idea of the expansion of aviation in the country, starting in 1996 when the deregulation process was still incipient. Between that year and 2009 the number of registered aircraft rose 19.79%, in response to growing demand, which can be seen in Table 3 below. In fact, the number of domestic passengers and flights through airports managed by Infraero in the period from 2003 to 2009 increased by 14.79% and 40.76%, respectively.

Table 3: Movement at Airports Managed by Infraero

Year	Domestic Airplanes[*]	Domestic Passengers
2003	1,649,312	61,268,864
2004	1,655,757	71,489,102
2005	1,698,641	83,483,534
2006	1,781,786	90,005,151
2007	1,884,142	97,974,794
2008	1,965,206	99,974,794
2009 (through November)	1,935,490	103,424,088

Source: Infraero (2010).
*Airplanes whose origin and destination are within the Brazilian territory.

Even with the global crisis, which has affected nearly all markets since 2008, the Brazilian domestic airline sector has continued growing strongly: the number of passengers grew 17.65% in 2009, the greatest expansion since 2005, when the figure was 22%. The average seat occupancy grew even more, by 66.75%. According to the National Airline Association (*Sindicato Nacional das Empresas Aeroviárias* - SNEA), in December 2009 the number of passengers carried on domestic flights grew 37.7% in relation to the same month in 2008 (SNEA,2010). So, the deregulation effort has brought unquestionable advances to Brazilian commercial aviation. However, 20 years after its start, some central problems still need to be resolved, which have taken some of the sheen off these advances and cast doubt on the prospects for future gains. Among these are the failure to apply the same economic liberalization in other sectors that compose the air transport productive chain, such as management of airport infrastructure (discussed in the third section), and the failure to reformulate the policy on distributing slots (landing and takeoff rights) at airports. This imbalance in policies, in turn, has created certain distortions, such as the market

concentration in a restricted number of airports[15], in the hands of a shrinking number of air carriers. These problems have been prompting intense discussions about the *modus operandi* of Brazilian aviation and the negative aspects caused by deregulation (Costa, Lohmann & Oliveira, 2008).

4.2.1 Redistribution of Slots

In contrast to the freer regulatory climate for commercial aviation in Brazil, the allocation of slots still represents a mechanism of direct government control and has allowed favored carriers to exercise market power, with severe impacts on the supply-demand relation and the overall performance of the industry (Oliveira, 2009).

Table 4: Domestic Passenger Flow at the Five Main Brazilian Airports

Airport	City	Passenger Flow (through November 2009)	Percent of National Total
Congonhas International	São Paulo	12,414,843	12.00%
André Franco Montoro/Guarulhos International	São Paulo	11,896,076	11.50%
Juscelino Kubitschek International	Brasília	10,919,629	10.55%
Galeão/Tom Jobim International	Rio de Janeiro	8,403,414	8.12%
Santos Dumont	Rio de Janeiro	4,433,253	4.28%
National Total/Infraero: 103,424,088 (100%)			
Total share of the five main airports: 48,067,225 (46.5%)			

Source: Infraero

The absence of clear and technically justified rules in handing out slots has been preserving and prioritizing the participation of the dominant companies, which together hold 85% of the slots at the nation's airports. This forces smaller airlines to forgo operating from the larger and more profitable airports, impairing their competitiveness, besides causing concentration and congestion at a few airports, as can be seen in Tables 4 and 5 (Oliveira, 2009). These clearly show the results of the slot allocation policy and centralization of airport operations in Brazil. The five main airports (among the 67 managed by Infraero) account for 85.41% of international flights and 46.5% of domestic flights. This is not a good situation from the

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[15] Congonhas (São Paulo) and Juscelino Kubitschek (Brasília) airports accommodate roughly 22.5% of total domestic passengers in the country.

standpoints of national integration, connectivity between domestic and international flights and balanced socioeconomic development among regions, particularly if one considers the geographic location of these five main airports: all of them are in two municipalities (Tom Jobim/Galeão and Santos Dumont in Rio de Janeiro and Congonhas and Guarulhos in São Paulo) plus the Federal District (Juscelino Kubitschek in Brasília). This will be examined in more detail in the next section.

Table 5: International Passenger Flow at the Five Main Brazilian Airports

Airport	City	Passenger Flow (through November 2009)	Percent of National Total
André Franco Montoro/Guarulhos International	São Paulo	7,642,894	64.37%
Galeão/Tom Jobim International	Rio de Janeiro	2,353,368	19.82%
Juscelino Kubitschek International	Brasília	145,339	1.22%
Santos Dumont	Rio de Janeiro	166	0.001%
Congonhas International	São Paulo	0	0%
International Total/Infraero: 11,871,954 (100%)			
Total share of the five main airports: 10,141,767 (85.41%)			

Source: Infraero

4.2.2 Cost of Aviation Fuel (Jet Fuel)

Another important aspect is the cost of jet fuel at regional airports. According to the International Air Transport Association (IATA), this input accounts for between 20% and 40% of total airline operating expenses, the second largest expense item after payroll. In Brazil, the Southeast region contains the country's main airports and thus has the highest number of takeoffs and landings, both domestic and international. This region naturally is the main jet fuel consumer, responsible for 58% of total jet fuel produced in the country (Fregnani, Ferreira, Griebler & Oliveira, 2008, also see figure 2). Further according to the above authors, the government-controlled oil giant Petrobras accounts for 85% of output and sales of jet fuel in Brazil, and since the Southeast is its main market, the company has located most of its refineries in that region (see figure 3).

Figure 2: Geographic Distribution of Aviation Kerosene Consumption in Brazil

Legend:
- Southeast 58%
- Northeast 16%
- Midwest 11%
- North 9%
- South 6%
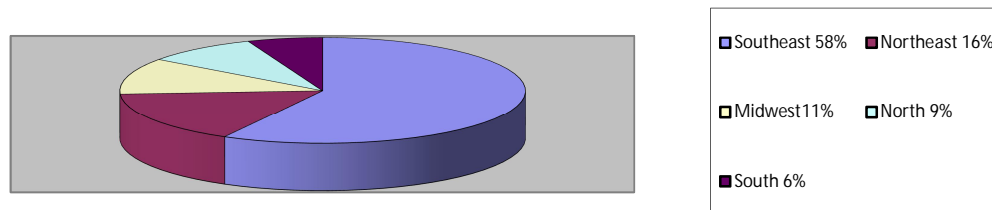
Source: Petrobras, cited in Fregnani et al (2008)

Figure 3: Regional Distribution of Refineries in Brazil

Legend:
- Southeast 6
- Northeast 2
- South 2
- North 1
- Midwest 0
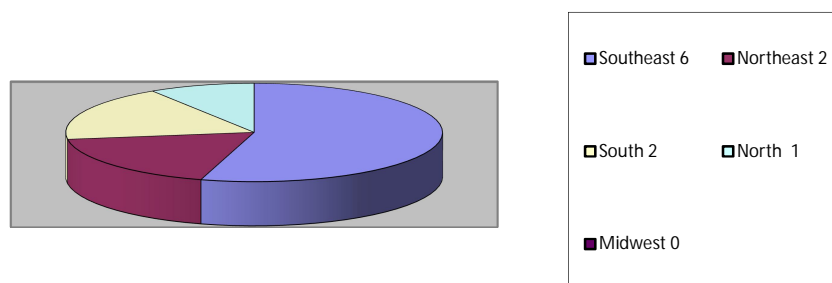
Source: Petrobras, cited in Ferreira et al.

The concentration of refineries in the Southeast region means that fuel costs tend to be higher in other regions, because of the logistics costs. Often there is a need to use several types of transport, such as tanker barges and ships and tank trucks (with capacity of 20 to 40 cubic meters). This obviously raises the final fuel cost in relation to that charged at airports in Rio de Janeiro and São Paulo, which receive their fuel directly from refineries through pipelines. Additionally, since regional carriers purchase less jet fuel, their bargaining power with distributors is weaker. As a result of these factors, they wind up paying up to 30% more for their fuel than do the large airlines (Salgado & Oliveira, 2008).

4.3 DIAGNOSIS AND ANALYSIS OF AIRLINE OPERATIONS IN BRAZIL AFTER DEREGULATION

As seen in previous section, the introduction of a more flexible policy on commercial aviation in Brazil brought a series of changes and set the stage for previously unheard of growth in the market. However, some specific aspects have implied a step back in operational terms and generated a series of distortions to the composition of the country's air coverage, mainly routes between cities in the interior parts of the North and Midwest regions. Therefore, it is important to analyze the evolution of the country's airport network since the deregulation, to:

a) understand the reasons why the number of airports has shrunk while the overall aviation market has expanded sharply;

b) shed light on the socioeconomic consequences of this reduction in the number of airports; and

c) discuss the establishment of public policies to encourage regional aviation.

The present section provides a diagnosis of the current geographic distribution of Brazilian commercial aviation, analyzing the coverage of the nation's territory. These observations are based on the study of Salgado & Oliveira (2008). This will allow clearer identification of the structural problems facing regional aviation. For this purpose, we establish the following criteria:

a) To analyze the qualitative indicators of the Brazilian civil aviation sector since deregulation, we focus on two periods for comparison, which we call the "pre-liberalization" (1998) and "post-liberalization" (2008) periods.

b) To classify airports in the country, we follow the same classification as the Federal Aviation Administration (FAA) for airports in the United States, considering "large hubs" to be those that handle more than 1% of the volume of passenger arrivals and departures in the country, "medium hubs" to be those handling between 0.25% and 1% of this volume, "small hubs" to be those moving between 0.05% and 0.25% and "non-hub" to be airports below 0.05%. Here we call these "local" airports, following Salgado & Oliveira (2008).

Table 6 shows a decline in both the number of airports and the micro-regions served throughout the country between the two periods, a trend that repeats for the other indicators observed, presented below.

Table 6: Summary of Airport Operations in Brazil (1998-2008)

Coverage	Pre-Liberalization	Post-Liberalization	Variation	Variation %
Airports Operated	199	155	-44	-22,1%
Micro-regions covered	166	131	-35	-21,1%
Municipalities Covered	1821	1437	-384	-21,1%

Source: Salgado & Oliveira (2008)

Table 7 below shows the retraction of airport coverage in the entire country, with the worst hit region being the North, where 13 airports lost regular service between the two periods. This region particularly depends on air travel because of its lack of roads and river routes. Between the two periods, 44 airports in Brazil stopped being served by scheduled flights in all five regions, a decline of 22% of the terminals.

Table 7: Airports in Brazil by Region (1998 – 2008)

Period	South Region	Midwest Region	Northeast Region	Southeast Region	North Region	Brazil
1998	32	31	35	42	59	199
2008	26	22	29	32	46	155

Source: Salgado & Oliveira (2008).

Table 8 shows the relative numbers of airports with scheduled operations according to the volume of passenger arrivals and departures, classified according to the FAA system. Of the 44 airports that lost regular service in the country, the most affected were local airports (72%). According to Salgado & Oliveira (2008), this reduction is directly related to the tendency of Congonhas Airport (São Paulo) and Juscelino Kubitschek Airport (Brasília) to concentrate more participation in the system. The breakdown of market share by type of airport in Table 9 above shows that while the participation of large and medium hubs increased after the liberalization, that of small hubs and regional airports, already tiny, declined even more. In the case of regional airports, this reduction was around 37%, as observed by Salgado and Oliveira (2008).

Table 8: Airports Served by Scheduled Flights in Brazil (1998-2008)

Period	Large Hubs	Medium Hubs	Small Hubs	Local Airports
1998	19	19	24	137
2008	16	14	20	105

Source: Salgado & Oliveira (2008).

Table 9: Market Share of Brazilian Airports by Type (1998-2008)

Period	Large Hubs	Medium Hubs	Small Hubs	Regional Airports
1998	83.3%	10.9%	4.2%	1.6%
2008	84.0%	11.8%	3.2%	1.0%

Source: Salgado & Oliveira (2008).

Table 10: National Coverage in Terms of Municipalities Served
by Scheduled Flights

Year	Population of Brazil	Number of Municpalities in Brazil	Municipalities Served by Regional Flights	% Coverage
1960	70 million	2766	Around 360	13%
2003	175 million	5561	94	1.7%

Source: Valente & Palhares (2005)

On table 10 it is possible to observe that in terms of coverage Brazilian air network is going through a considerable reduction. Finally, a comparison of the number of municipalities served by scheduled flights and the number of municipalities in the country shows a huge retraction over the past four decades.

5. CONCLUSIONS

As presented in this paper, Brazilian aviation passed through two important regulatory reforms over a period of some four decades. The first, between the mid-1960s through the 1980s, was characterized by protectionist and dirigiste measures, while the second, concentrated in the 1990s, saw growth of the sector stimulated by deregulation. During the height of the deregulation period, from 1990 to 2000, various packages of government

measures opened the market, broke down the walls between national and regional carriers, granted freedom to set fares, ended the monopolies that had existed since the 1970s, and gradually phased out government subsidies marginally profitable airports.

We now outline a diagnosis of the coverage by scheduled flights between the pre- and post-liberalization periods, to shed light on the phenomenon of strong expansion of passengers carried but apparently contradictory retraction of coverage. From the figures shown, we can state that:

a) With deregulation of the sector, airlines started to compete more strongly, forcing them to exploit their routes as efficiently as possible (Oliveira, 2009).

b) Outside a controlled and monopolistic environment, and without government subsidies to routes with low demand, airlines had to abandon these loss-making or marginal routes to concentrate on more profitable ones, causing a loss of coverage of the national system (Salgado & Oliveira, 2008).

c) This retraction of coverage has eroded the potential of air transport to leverage socioeconomic development and tourism, due to the loss of connections and potential capillarity to more remote regions (Salgado & Oliveira, 2008).

d) Further according to Salgado & Oliveira(2008), even with the increase in per capita income of all regions during the overall period in question, airlines have stopped serving small and medium-sized locations and have concentrated their flights in places with higher income and thus more potential demand.

e) The concentration of domestic flights at Congonhas and Guarulhos Airports (São Paulo) and Juscelino Kubitschek Airport (Brasília), and of international flights at Guarulhos and Galeão/Tom Jobim Airports (Rio de Janeiro), while understandable because of the economic importance of these places, is harmful to national integration and balanced socioeconomic development of the country, reduces the potential connectivity between domestic and international flights and impairs the country's ability to attract foreign tourists (IX CBRATUR, 2008).

 f) The concentration of the system tends to make the main airports, such as Congonhas, even more saturated (Bastos, Baum & Correia, 2008), while causing slack capacity at other airports operated by Infraero.

Support for regional airport operations requires studies on which to base specific public policies, considering their strategic importance to the country. This segment stands out as a multiplier of the economy, by providing access and facilitating business and services (including tourism) in geographically isolated or hard-to-access communities, thus improving

their quality of life (Salgado & Oliveira, 2008). Because of these factors, Salgado and Oliveira (2008) call attention to the need to identify and demarcate markets, even in a period of liberalized regulation. For these authors, the aim should not be to return to the strict regulatory regime of the past, with heavy government intervention. Instead, the goal should be to formulate public policies to leverage investments of the private sector to bring service to neglected areas, based on a better understanding of the functioning of the regional market.

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