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Industry Perspectives should be up to 1,000 words and provide a practitioner's point of view on contemporary developments in the air transport industry. Contributors should explicitly specify whether their views are espoused by their organization or not.

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attention is paid to the air cargo flows between major regions. By combining several levels of the air cargo market, this paper explains part of the economic rationality behind the air cargo market structure. The results of this paper will lead to a better knowledge of the air cargo sector, not only by academics but also by industry actors.

The establishment of 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.

Recent changes to the competitive environment in the highly contested Sydney to Los Angeles market have impacted the route profitability of almost 20 carriers. In particular the commencement of non-stop services by Delta Airlines and V Australia has impacted route profitability of almost 20 carriers. This paper investigates the product factors that enable airlines to command a price premium the Sydney to Los Angeles market. A sample of business and economy class net fare quotes, in addition to data collected on seven product factors is used in this study to estimate the relationship between price and product. The regression results show that service quality, space, connectivity and alliance membership all have a positive influence on price in this particular market. In a practical setting, the research outcomes are

Editorial

This issue of the *Journal of Air Transport Studies* includes five papers. Metrass-Mendes and de Neufville examine the US experience of air transportation policy for smaller communities. The results show overall gains in efficiency, mostly attributable to the US policy of encouraging competition between air carriers seeking to provide service to small communities. Nevertheless, a major flaw in the US arrangements seems to be that the policies have not kept up with changing conditions since deregulation in 1978. Subsequently, Kupfer, Meersman, Onghena and Van de Voorde provide useful insights into the relationship between air cargo and merchandise trade at the aggregate and disaggregated level with a particular focus on the air cargo flows between major regions. This paper explains the economic rationale behind the air cargo market structure. The results will lead to a better understanding of the air cargo sector by academics and practitioners alike.

In the following contribution, Ribeiro, Santos and Fraga examine both the internal and external factors that have led to the substantial decrease in the number of regional airports with regular scheduled air services following the deregulation of the Brazilian aviation market. They conclude that the country's potential for national integration and political unity has been weakened. Then, Hsueh, Douglas and Robertson investigate the product factors that could enable airlines to command a price premium in the Sydney to Los Angeles market. The regression results show that service quality, space, connectivity and alliance membership all have a positive influence on price on this route. Finally, Dimitriou, Sartzetaki, Voskaki and Athanasiadis present an input-output model and discuss how it can be used to quantify the benefits of tourist airports on regional economy. The methodology is applied to study a new airport on the island of Crete in Greece.

May we take this opportunity to thank all our authors and referees for their support in publishing this fourth issue of our Journal. Our continuing partnership with Air Transport News in conjunction with the open access character of the journal aim at ensuring that JATS can get a significant exposure to the academic and business audience and raise its profile accordingly. Enjoy reading!

Dr Andreas Papatheodorou, Editor-in-Chief

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AIR TRANSPORTATION POLICY FOR SMALL COMMUNITIES: LESSONS FROM THE U.S. EXPERIENCE

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Abstract

The last decades have witnessed a global trend toward airline deregulation, which has significant impacts on national policies regarding air accessibility to smaller communities. One important result of this liberalisation is that carriers are no longer constrained to serve routes, and may thus neglect service to less profitable destinations with lower traffic. Economic deregulation can therefore have detrimental effects on smaller communities. The United States has dealt with this issue through its Essential Air Service program. Its experience suggests lessons for other countries. U.S. policies have been reasonably successful in sustaining basic air service to smaller communities over the past thirty years of deregulation. Moreover, they have done so relatively effectively and efficiently. A large-scale analysis of the U.S. experience, and three case studies of the communities of Columbia and Jefferson City (Missouri), Rutland (Vermont), and Merced (California) demonstrate this phenomenon. The results show overall gains in efficiency, mostly attributable to the US policy of encouraging competition between air carriers seeking to provide service to small communities. The major flaw in the U.S. arrangements seems to be that the policies have not kept up with changing conditions since deregulation in 1978.

Key words: Aviation policy, Deregulation, Small communities, Essential Air Service.

1. INTRODUCTION

Ensuring equitable air service to remote population effectively and efficiently is a common concern to nations worldwide. In the present economy, the viability of a region is highly dependent on its accessibility, while economic development increasingly relies in air

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transportation, which sustains the movement of persons, goods, and tourism activity (Ishutkina and Hansman, 2008). This thus justifies Governmental attention to provide accessibility to all regions of their territory, to promote economic development, social equity and national cohesion.

Some of the benefits that air service brings to communities commonly mentioned in the literature include greater access to the global air transportation network, increased business investment and market development possibilities for businesses (Nolan et al., 2005), productivity gains, increased local employment, and tourism. Air transportation moves products quickly over long distances, enhancing timely delivery of goods and services, and enabling economic and social interaction among communities. Moreover, its distinctive characteristics – speed, cost, flexibility, reliability and safety, make it often the only means of access for geographically more remote regions.

In the U.S. until the late 1970s, airline regulation guaranteed that small communities were included in the national transportation network. The liberalization of the industry, through the Airline Deregulation Act of 1978 (ADA), released carriers from route obligations. Smaller communities might thus be overlooked by airlines seeking economically profitable denser markets. The concern for prospective detrimental impacts in these communities led to the creation of the Essential Air Service program (EAS) – a route subsidization system associated with a competitive bidding process, implemented in 1979.

This paper evaluates the performance of the EAS program according to the criteria of effectiveness and efficiency. Effectiveness is defined as the ability of the system to provide the quality service as indicated by frequency, schedule, and connectivity. Efficiency is commonly measured by the ratio of outputs to inputs. Efficiency here was assessed in terms of costs, given the relatively constant or slightly improved policy results. It was also assumed that costs can be estimated by levels of subsidy and airfares. Outcomes of the U.S. system are analysed in terms of overall results, as well as in the particular perspective of a multiple case-study design. The purpose of the paper is not to present an economic assessment, but to learn from experiences under deregulated conditions.

General observation of the thirty year-old experience indicates that EAS has succeeded in providing small communities with basic air service, fairly effectively and efficiently.

In the case-study featuring the communities of Columbia and Jefferson City (Missouri), we demonstrate the positive effects of competition in improving overall effectiveness – service, reliability and schedule, and efficiency – lower subsidies per passenger and lower airfares; as local participation and political interest play important roles in assuring the service sustainability. Considering Rutland, Vermont, we confirm the same effects derived from a low-cost carrier connection, and efficiency gains from a smaller aircraft-utilization. In the case of Merced (California), a community enjoying high levels of regional accessibility with good quality highway substitutes and alternative air transportation centres, we report inefficiencies – declining traffic, high levels of subsidy per passenger, that result from the failure to incorporate changing conditions in the EAS underlying statutes. This last case illustrates how the program is not targeted only to the most isolated communities and how the choice of the connection hub determines traffic sustainability.

The next section of the paper briefly describes the characteristics of the U.S. regulated and post-deregulation environments, focusing on the small communities. It then summarizes the instruments created for promoting service sustainability to these communities in the latter conditions. Next, it analyses the results of U.S. policy in general terms, and examines three case studies focusing on positive political lessons. A final section compares the U.S. provisions with the Canadian and European policy programs and offers some contributions.

2. U.S. AVIATION STRUCTURE

U.S. airline industry developed dramatically under regulation over fifty years. However, major changes were introduced by the revolutionary liberalization in the late 1970s ([Goetz and Vowles, 2009], [Borenstein and Rose, 2007], and [Reynolds-Feighan, 1995]). It is convenient to compare the two situations in how they sustain basic air service to small communities.

2.1 REGULATED STRUCTURE

2.1.1 Route obligations and network structures

General regulatory provisions consisted of control over entry into the industry and access to routes, requirements over conditions of service, regulation of airfares and airmail rates, and safety – the latter passed over to the Federal Aviation Administration (FAA) – an agency of the Department of Transportation (DOT) in 1958. Other situations, such as mergers and

acquisitions, and carriers agreements were also regulated. This control was performed by an independent regulatory agency, the Civil Aeronautics Board (CAB).

Unlike other countries, the U.S. never established a state-government owned airline. Instead, its regulatory agency certified carriers to operate in prescribed certificated routes. While medium- and long-haul routes were exclusively operated by "trunk" carriers, local carriers supplemented service to small communities. Most airline operations were performed on a point-to-point basis, implying system-wide inefficiencies: in general, routes had higher operating costs reflected in higher airfares, lower frequencies and significant lower average load factors. The regulatory route award process was largely responsible for preventing carriers from optimizing networks to reduce operation costs or improve service (Borenstein and Rose, 2007). The number of markets served by the network was limited.

2.1.2 Cross-subsidization based on reasonable profit

Carriers operating routes to small communities often received subsidies. In the earliest stages, the Congress "recognized the quasi-public character of certificated air service, and authorized the payment of direct, albeit concealed, Federal aid through air mail payments" (Lloyd, 1950). Later, the amendment of section 406 of the Federal Aviation Act of 1958, established a more formal subsidization system. Carriers were compensated both directly from the CAB, following a cost formula, and indirectly, with cross subsidies from their profitable routes. The principle behind cross-subsidization was to simultaneously keep long-haul rates above costs and thin short-haul rates below costs. The system was based purely on carriers' financial needs. It gave airlines what the CAB considered a reasonable profit, unrelated to the cost of serving a specific community (U.S. Government Accountability Office [GAO], 1983).

2.1.3 Infrastructure planning and management and Airport Funding

The CAB was also responsible for the development of the air transportation system. Unlike other countries, where national entities were created to manage their largest airports as well as smaller facilities (the case of Spain in Europe, Canada or Australia), the U.S. chose to implement a managerial system which, almost exclusively put airport ownership and management in the hands of City and Regional Authorities defending local interests. Concurrently, federal public interest and national air policy cohesion were supported by instruments of integrated planning, as the National Airport System Plan (NASP), a 10-year

plan providing a "summary of projected improvements for each airport eligible for Federal aid" (Office of Technology Assessment, 1984).

In regard to airport investment, the U.S. system secured funding for larger and smaller facilities with cross-subsidization and local participation. Infrastructure was initially funded by the collection of user charges, redistributed through the Federal-aid Airport Program (FAAP), which replaced the former Airport Development Aid Program (ADAP). Eligibility criteria for projects required airports to be part of the NASP. Shortly before deregulation, in 1970, the Airport and Airway Trust Fund (AATF) was created as a deposit of revenues from several aviation-user taxes on items as airfares, air freight, and aviation fuel. The fund supported both the Planning Grant Program (PGP) and the Airport Development Aid Program (ADAP). Grants were awarded by FAA and required some local matching of funds (Kirk, 2007).

2.2 THE PARADIGM SHIFT OF DEREGULATION

2.2.1 FAA and the end of CAB

The U.S. pioneered the passenger market liberalization. The Congress approved the Airline Deregulation Act (ADA) in 1978 and the national regulatory agency was phased out until it expired officially on 1984. FAA now oversees civil aviation, but on passengers' domestic market, only safety is maintained under strict regulation (GAO, 1983).[3]

2.2.2 Hub-and-spoke and segmentation: Regional commuters on smaller markets

As route obligations were dropped, "trunk" carriers chose to abandon less profitable lower density links. From the point of view of the structure of carrier networks, the consequences were revolutionary. Albeit the transfer hubs existed under regulation, it was the removal of market restrictions that led to consolidated nationwide hub-and-spoke networks, which concentrated operations at strategically located cities (Goetz and Vowles, 2009). Later, carriers like Southwest Airlines and others complemented these networks with more distributed structures that, not being purely point-to-point, employ more secondary hubs. These changes caused airlines to rationalize the efficiency of their services (Brown, 1992). With the reconfiguration changes they restructured their fleets - both by change in allocation and acquisition of aircraft, daily utilization and load factors increased and operational costs decreased (Heppenheimer, 1995).

[3] Regulations on mergers and acquisitions are still on effect, though rules were loosened. The proposals can be submitted for review by the Antitrust Division.

Deregulation allowed the entrance of new carriers; however, they still faced great opposition from the established major airlines on the main routes (Goetz and Vowles, 2009). On the marginal markets competition was lower. Regional commuters and air taxi services progressively increased their market shares, using regional jets or turboprops, since these markets did not require larger or faster aircraft (FAA, 2003).

2.2.3 Implications for Passengers

On average, passengers benefited from more destinations when connecting, and lower airfares. Although these consequences were also felt by small communities' shorter-haul passengers, their yields remain higher, and profitability of airlines serving them is uncertain. Carriers' subsidization was the instrument used by the U.S. policy, in order to sustain traffic levels on these markets.

2.2.4 Essential Air Service: The New Route Specific Subsidy

Immediately before deregulation, the Congress made provisions for assuring that small communities retained service under the new conditions. Anticipating the detrimental impacts that the abandonment of less profitable routes could have, it established the Essential Air Service (EAS) program, which it integrated into the Airline Deregulation Act (ADA) of 1978, (with special provisions for Alaska). Carriers started receiving subsidies allocated to specific routes where they competed for service.

In the 10 years following liberalization, the percentage of flights supported by EAS operated by small commuters increased from 10 to approximately 50 percent (NRC/TRB, 1991). In the beginning of the 1990s, this value was already over 80 percent, and in 2009, small commuters, like Great Lakes, Cape Air or Mesaba, were serving all the small and the majority of the communities were served by aircraft Beechcraft 1900, a 19-passenger turboprop (Office of Aviation Analysis [OAA], U.S. DOT, 2009). The EAS established basic air service requirements, defined which communities were eligible for receiving this service, and which of those would have subsidized carriers providing it. Its funding is assured by the AATF.

2.2.5 Infrastructure Planning, Management and Funding: the Airport Improvement Program (AIP)

Management of the air transportation infrastructure remained basically unaltered: national interest is defended by the FAA, while ownership and management is kept by City and Regional Authorities. However, at an operational management level, most U.S. airports are

associated with some form of privatization through service contracts (Carney and Mew, 2003). With regard to planning, the National Plan of Integrated Airport Systems (NPIAS) replaced the NASP in the early 1980s. Developed by the FAA, the plan is meant to identify all the significant components of the air transportation infrastructure, evaluate their current state and plan their future development, and provide the Congress with estimates of the funds needed to meet these goals (FAA, 2009).

Infrastructure investment did not significantly change under deregulated conditions, as the Airport Improvement Program (AIP), established by the Airport and Airway Improvement Act and funded by the AATF, replaced the former PGP and ADAP in 1982. Its purpose is to aid the planning and development of public-use airports included in the NPIAS, and its funding structure favours smaller airports, with grants covering a larger percentage of the cost of eligible projects in these cases than for larger facilities.

3. POST-DEREGULATION INSTRUMENTS

U.S. approach to addressing the issue of air accessibility to small communities differs significantly from those of other nations, specifically in respect to the attribution of subsidies and in regard to the participation of the communities, concerning both the administrative and the financing aspects (Reynolds-Feighan, 1995). The EAS program is the most important instrument U.S. air transportation policy for support of small communities. More recently, the Congress also implemented the Small Communities Air Service Development program (SCASD).

3.1 EAS PROGRAMME

3.1.1 The mechanism

EAS subsidizes carriers to provide service on specific routes, for which airlines compete through a bidding system. Airlines submit proposals that are packages including schedule, frequency and hub to which the community is connected, and fare schedules. The proposals must meet the minimum requirements defined by EAS, which refer to number of daily flights, weekend frequency, size of the hub, and aircraft equipment. EAS funding comes directly from FAA's appropriations from user fees.

3.1.2 Eligibility

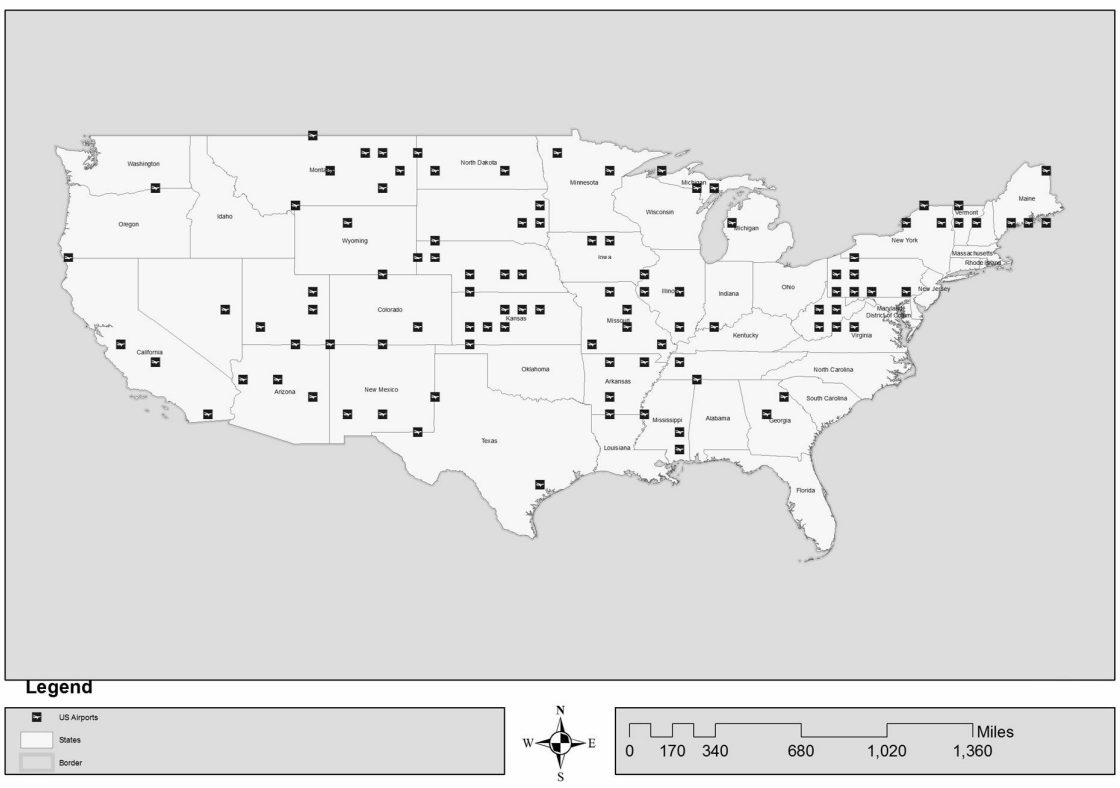
EAS criteria for eligibility and compensation changed little since its implementation. In order to qualify for EAS, a community is currently required to have been receiving scheduled service from the time of the ADA (1978) or the Airport and Airway Safety and Capacity Expansion Act (AASCEA) (1987), and to be located at least 70 miles from the nearest hub. Other communities may also be eligible if the local or state government or other party offers to pay 50 per cent of the compensation cost. Communities not served in 1991 are not eligible for EAS payments, unless they are located more than 200 miles from a hub, in which situation state or local governments need to match the DOT funds. In addition, a community needs to meet the subsidy cap of $200 per passenger, except it they are located 210 or more highway miles from the nearest alternative transportation centre (OAA, 2009).

3.1.3 Overview and Geographic Coverage

In 2009, thirty-five states, including Alaska, received funds from the EAS Program. Excluding Alaska, funding was of $152 million for one hundred and seven communities, served by one carrier. From the total of 107 EAS aviation airports, less than two percent were not receiving subsidy from the EAS Program as of its first year of implementation, 1979 (GAO, 1983).

Figure 1 locates the EAS subsidized communities for 2009 (excluding Alaska). Though the most of the communities are located in the interior of Continental U.S., the EAS serves several on both coasts, relatively close to major airport hubs. While there does not appear to be a concentration in a specific region, five agglomerations of communities are in the centre and Northeast of continental U.S. Important heterogeneities are registered across the communities, in terms of both isolation – measured by the distance to U.S. larger hubs, and size of the community). In 2009, approximately one fourth of EAS subsidized communities were in the category “a” - relatively non-isolated (approximately one hour or less driving to the alternative transportation centre). Disparities in accessibility to land transportation modes and access to low-cost served airports are also significant (GAO, 2009).

Figure 1: Communities subsidized by the EAS Program in 2009, within the Continental U.S.



3.1.4 Background

Table 1 summarizes the history of the EAS program. It was meant to be an element of transition after deregulation. However, it was renewed and made permanent. In its early years, it was supplemented by subsidies allocated under Section 406.

3.2 SMALL COMMUNITIES AIR SERVICE DEVELOPMENT (SCASD) PROGRAMME

3.2.1 The Mechanism

SCASD awards grants to communities, or sets of communities, through competitive selection. It gives priority to communities that "among other factors, provide a portion of the cost of the activity to be assisted, and establish a public-private partnership to facilitate the service" (OAA, 2009). SCASD is funded through annual FAA appropriations (AATF) and is very flexible in the use of its grants: funds may be used to pay for traffic studies, provide financial incentives for carriers (in the form of subsidy or revenue guarantees or with Air Travel Banks – ATB, taking the form of a trust account (Nolan et al., 2005 and GAO, 2005), cover the expenses of marketing costs of the airport or carrier, etc. Financial incentives cannot be extended over a period of 3-years.

Table 1: EAS Programme History

1978	EAS is established under Section 419 of the ADA.
1982-84	Section 406 subsidies end: The DOT reports inefficiencies in this section. CAB recognizes EAS Program is a significantly more efficient instrument, and ceases 406 funding in 1984.
1987	Expansion and extension of EAS: AASCEA extends the program through 1998. It specifies "basic EAS" and announces "enhanced EAS" (for communities willing to share cost or risk). DOT is allowed to incur obligations from the AATF for the payment of the EAS subsidies, effective fiscal year 1992.
1990-92	Insufficient funding for "basic EAS" and "enhanced EAS": Funding proved to be insufficient to establish the upgrades. Omnibus Budget Reconciliation Act of 1990 authorizes for annual funding exclusively for basic EAS eligible communities, and upgrades are finally implemented in 1992.
1994-96	Major cuts and exclusion of communities: Annual budget for EAS is reduced, causing discontinuity in subsidy support for several communities. Most significant budget reduction for FY 1996.
1997	Second extension: New extension approved by Congress. Rural Air Service Survival Act increases funding. Proposal for EAS to be funded from fees assessed on international flying over but not landing in the United States is successfully legally challenged by foreign carriers. Thereafter, EAS funding comes directly from FAA's appropriations from user fees.
2000	Changes in eligibility criteria: EAS excludes non-Alaskan communities closer than 70 highway miles to the nearest large or medium hub or requiring a subsidy per passenger in excess of $200 (unless that the community is more than 210 surface miles from the nearest large or medium hub).
2009	Budget enhanced provisions: Reform Act for the 21st Century authorizes an appropriation in addition to the already authorized funding. It limits adjustments to levels of essential air service to not less than the basic service level, and reviews for consistency all orders issued after September 30, 1999.

Sources: FAA and OAA, U.S. DOT.

The SCASD is small compared to EAS; it is limited to 40 grants per year. In 2008,[4] it awarded grants to only 15 communities, for a total funding of $6.5 Million. The list included communities like Merced (California) and Springfield (Illinois).

3.2.2 Background

The program was implemented in fiscal year 2002 by the Wendell H. Ford Aviation Investment and Reform Act for the 21st Century (AIR-21)[5] (Committee on Transportation and Infrastructure, 2009). Congress reauthorized SCASD 2008 and made it permanent by the Vision 100-Century of Aviation Reauthorization Act. SCASD has awarded over 220 grants since its establishment, and these have averaged about $500,000 each (OAA, 2009).

[4] Data for grant in FY 2009 was not available at the OAA, U.S. DOT as of February 2010.
[5] The same act also authorized the Regional Jet Service for Small Communities that provides federal credit instruments for purchase of regional jet aircraft by carriers serving small communities.

4. RESULTS

This section starts by examining the overall performance of the EAS in minimizing the latent detrimental impacts of deregulation on small communities. The evaluation criteria are effectiveness and efficiency, as defined in the introduction. We compare air accessibility conditions of small communities under regulation to the post-deregulation situation.

Following the general observations, three case-studies demonstrate the effects of EAS on four communities. SCASD results are part of the reflection, though not included on the general outcomes analysis. Both references ([Nolan et al., 2005] and [GAO, 2005]) sustain that the SCASD program has achieved mixed results. According to Nolan et al. (2005) in almost all cases the relevant service has been discontinued at the end of the short duration travel bank contract. Eugene (Oregon) represents the only exception: the community obtained additional service from two carriers after receiving guarantee of travel funds by numerous local businesses. The key factor for success in sustainability appears to have been local action, since other communities that did not receive this support had the service discontinued. Eugene airport and community officials corroborate this fact by stating that broad-based community support for the air service was more significant than the total funds collected for the travel bank (GAO, 2003).

4.1 GENERAL OUTCOMES

4.1.1 Effectiveness

Overall, U.S. policy and the EAS program appear to be relatively effective in their goal of providing basic air service to small communities: service exists and meets minimum standards. The program is found free of major flaws that would limit its effectiveness. Additionally, independent evaluations conducted by the GAO, both on a regular basis and as needed, concluded that, on balance, the program is meeting its goals and its statutory objective – to ensure continued air service to small communities (GAO, 2003a, 2003b, 2002 and 2000b).

The innovation introduced by competition, leading to the dominance of commuter carriers with smaller aircraft on the small communities routes (an effect of the EAS program), has proved to have significant impacts in quality of service ([Goetz and Vowles, 2009], [GAO, 1999 and 2000], and [Reynolds-Feighan, 1995]). It can be observed that flight frequencies in most small communities increased rapidly when commuter carriers started providing service, as the schedules improved to meet EAS requirements.

The existence of service is a general conclusion; since the EAS was not able to keep basic air service to every community that had it before deregulation. However, we observed that the abandonment of certain very thin routes may have been inevitable. This is demonstrated by the loss and reduction of service in some communities occurring prior to deregulation. Between 1960 and 1975, and despite the existence of Section 406, the intervention of CAB and its authority to prohibit service abandonments considered inconsistent with public interest, 173 communities had lost airline service (U.S. DOT, 1987).

During the deregulated period served by the EAS, some communities lost service, either temporarily or permanently. Examples of the first case are communities such as Athens (Georgia), Columbia and Jefferson City (Missouri), and Ely (Nevada) that lost service when Air Midwest shutdown in 2008. One case of permanent loss of scheduled commercial service is Paris (Texas), after it was excluded from the list of EAS subsidized communities in 1993.

The EAS includes a mechanism for preventing these situations and their negative impacts. Its statutes require that if a carrier single-serving an EAS-eligible community wishes to exit the market, it must file a 90-day service termination notice. During this time, DOT may require the carrier to continue flying in the market indefinitely. However, this mechanism does not appear to work effectively, as it did not prevent the sudden abandonment of scheduled service at airports such as the one serving Columbia and Jefferson City.

On the other hand, the EAS mechanism for ensuring a minimum quality of service is performing well for the eligible EAS airports. Comparing EAS requirements and current service conditions, it can be concluded that communities are being served according to the frequencies required, non-stop connections to hubs and schedule.[6] Situations of unreliability of service caused by delays and/or cancellations, such as the one experienced in COU before the termination of service by Air Midwest, appear to be reasonably under control of the DOT, and communities eventually benefit from better service with carriers' substitution, as shown in the first case-study. Regarding the investment in infrastructure, Federal mechanisms appear to be supporting airports effectively. In general, communities are reasonably well served in terms of facilities, as service limitations derive, from difficulties in sustaining carriers.

[6] Moreover, the hub-and-spoke network system on average gives passengers more destinations at connecting hubs, more scheduled frequency and average lower fares (Lee, 2003). Even though these benefits remain unproved on the particular case of the average smaller community passenger, the case study of Rutland (Vermont) provides an example of decreases in fares (round-trip is now at the same level as a previous one-way).

4.1.2 Efficiency

Efficiency of the EAS and the U.S. air transportation policy under deregulation is measured in terms of costs. We examine the accomplishments of the EAS program in maintaining the costs of providing small communities with basic air service at reasonable levels. We also analyse the results of the EAS on airfares and comment on the impacts of deregulation on the cost for the passenger.

The analysis of the global amount of subsidies in the airline industry for the period between the years 1978 and 2009 leads to the conclusion that the EAS is more efficient than earlier forms of subsidy, in the sense that its cost is lower. Despite the fact that EAS allocations have been increasing in the first decade of 2000, their value remains significantly smaller than total subsidy under regulation. It is clear there the EAS significantly reduced the Government's cost of providing small communities with basic air service.

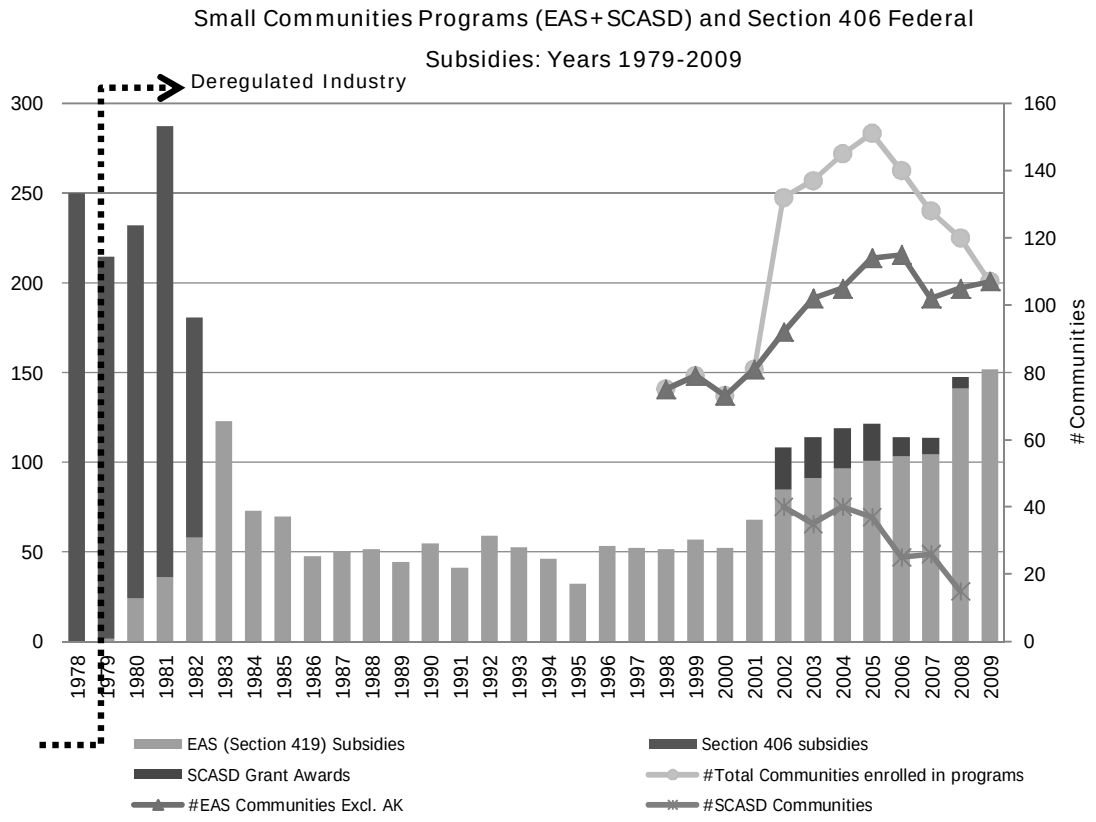
Figure 2 presents the information in 2009 million dollars. The first year shown, 1978, is the last year of passenger regulation. For this year, only Section 406[7] provided funding for carriers. Then, and for the earlier years of deregulated conditions until 1982, subsidies were allocated under both Section 406 and EAS (Section 419). From then until 2001, small communities were funded exclusively by EAS. Starting in 2002, the SCASD program complements EAS funding awarding grants to a much smaller number of communities than EAS. Although the graph shows the cumulative value of federal subsidies, we distinguish between the different allocation mechanisms that range from protected route packages to specifically direct subsidies, and include the guaranteed revenues form. Different subsidy approaches differ in social welfare implications, as well as in underlying agency costs (Nolan et al., 2005).

Comparing the values of federal subsidy prior to and after deregulation, the overall costs were significantly reduced. In 1978, the year immediately before the EAS implementation, Section 406 subsidies amounted to $76 million (GAO, 1983), which represents over $250 Million in 2009 dollars. The first year of exclusive EAS funding represented a 50 percent reduction in costs. Most recently, in 2009, the total costs still represent a 39 percent reduction from before deregulation. Moreover, subsidies raise remains significantly below the

[7] Section 406 funding is not specific for small communities, though it paid carriers compensation for operating in not profitable markets.

growth of operating costs for the airline industry in this period, caused by sharp increase in fuel prices.

Figure 2: U.S. Federal Subsidies and SCASD Grants in Million dollars[8]



Source: GAO and OAA, U.S. DOT reports

Gains in efficiency appear to result be primarily from the competition that the EAS developed for small communities markets and, over the national network, from the deregulated environment. Competition is commonly accepted as a positive force in most industries for its positive impact on efficiency and innovation. In respect to the provision of basic air service to small communities in the U.S., there is clear evidence of improvements resulting from competition between carriers that compete for the small communities routes in the two aspects.

[8] Information regarding the number of communities receiving EAS (Section 419) subsidies was not available until 1999 from the OAA, U.S. DOT. For consistency purposes it was decided not to include data from other sources for the remaining years. Number of small communities receiving Section 406 subsidies is not available, since this Section was not specifically targeted to them. As of February 2010 the, number of communities and SCASD grants were not available for FY 2009.

EAS introduced competition in the small communities market through an allocation process of subsidies that uses a carrier bidding system. This system simultaneously encourages carriers' efficiency and maintains the level of required subsidies at lower levels. Additionally, small community travellers are likely to benefit from lower fares (GAO, 1999) resulting from the same traffic efficiencies created by hub-and-spoke systems, with yields that have fallen sharply since deregulation. Regarding operational efficiency, the shift towards commuter carriage, with smaller aircraft and consequently lower capacity allows for more efficient flying on a frequent and timely basis, when comparing to the local-service jet carriers that used to serve many small communities.

Local participation may also act as another source of efficiency gains. In the EAS, where the communities do not match the subsidy funds as in the SCASD program, it still plays an important role in ensuring the sustainability of the service. This is shown in the case-study of the two Missourian communities. It is also the community that recommends the carrier that will be approved by the DOT for providing the service. This is important, since, in most situations, the community is more aware of the competing environment and the needs of its passengers, and knows better which hub and aircraft will be more efficient.

Despite these efficiency gains, the current needs of the EAS may raise some concerns. In 2008 and 2009, both the amount of subsidies paid to carriers, and the obligations incurred by the EAS program in funding these services increased significantly. The Administration has faced this fact by requesting much higher funding for 2010 (an increase of $50 Million over $125 Million) (GAO, 2009). One interesting trend illustrated in Figure 2 is that the EAS subsidies will be shared among fewer communities. Average subsidy per community has been sharply increasing since 2005, as subsidies raise and the number of communities benefiting from those decreases.

Another trend is that the average EAS community became smaller. Gains of efficiency can be demonstrated by the more rational way of serving small communities introduced by the EAS program, which moved subsidy payments from all small communities to those smaller communities that had real need for them. Evidence of this fact is the evolution on population size of the community served by basic air service, which decreased in average (Reynolds-Feighan, 1995).

We observe that the EAS mechanisms are not effectively targeted, as communities well served by other modes are receiving support from the program (GAO, 2003b, 2002, and 2000a). In the list of subsidized communities for the year 2009, there are several examples of communities with good highway access to alternative air transportation centres. One of these is Merced (California), within one driving hour to the reasonably well served airports of both Stockton and Fresno. Subsidy allocation to these communities is a consequence of the inability of EAS to update its underlying statutes to changing transportation environments Regional integrated multimodality planning appears to be inexistent. The EAS also appears to be lacking mechanisms that could improve its efficiency: It does not currently use annual and long term performance measures in its management – a conclusion supported by the program assessment conducted by the U.S. Office of Management and Budget and Federal agencies.

4.2 MULTIPLE CASE-STUDIES

Three case-studies illustrate some of the above results.

4.2.1 Columbia and Jefferson City (Missouri)

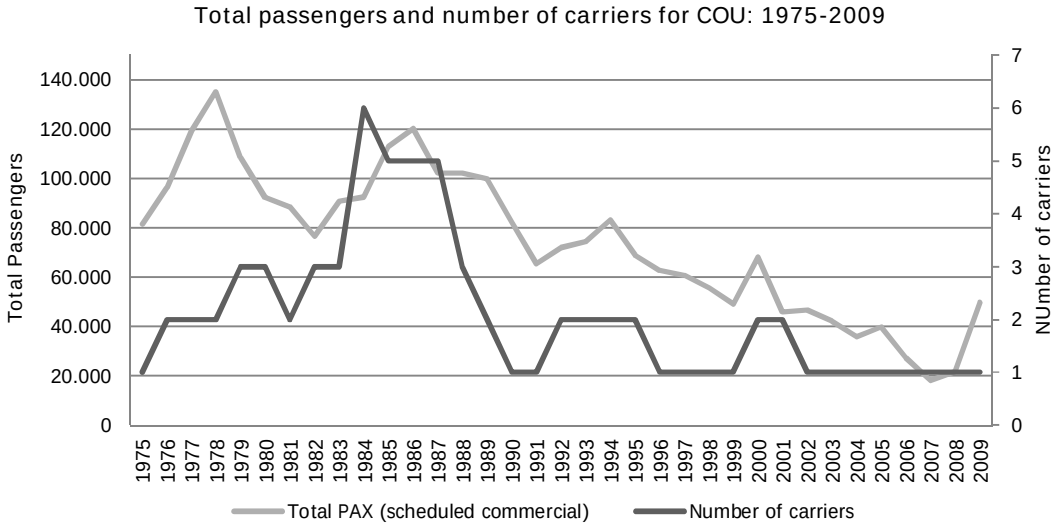
This case shows that competition has positive impacts on overall effectiveness and efficiency, and that political interest play important roles in assuring the service sustainability.

Columbia and Jefferson City are served by Columbia Regional airport (COU), a non-hub primary service airport. Another small airport in the area, Jefferson City Memorial, is about 35 miles from Columbia and does not offer commercial airline carrier flights.

COU faces competition from both St. Louis International (STL), and Kansas City International (MCI), which offer significantly higher schedule frequencies, lower fares, and more nonstop destinations. These airports are approximately 125 miles and 165 miles from COU, respectively. The difference between fares at Columbia and the two other competing airports decreased in the first decade of 2000, and the attractiveness of STL decreased when its hub carrier TWA merged out of existence. Columbia and Jefferson City were included in the list of EAS subsidized airports in 2006, after consistently losing traffic since the 1980s as Figure 3 shows. The same figure also shows that, since its first year of operation, Columbia has experienced instability in service caused by the entry and exit of several carriers.

The decision to support service with EAS subsidies is justified by political interest: Jefferson City is the capital of the state of Missouri and it was probably not considered acceptable that the State capital did not have air service of its own.

Figure 3: Total Scheduled commercial passengers for COU



Source: Columbia Regional Airport

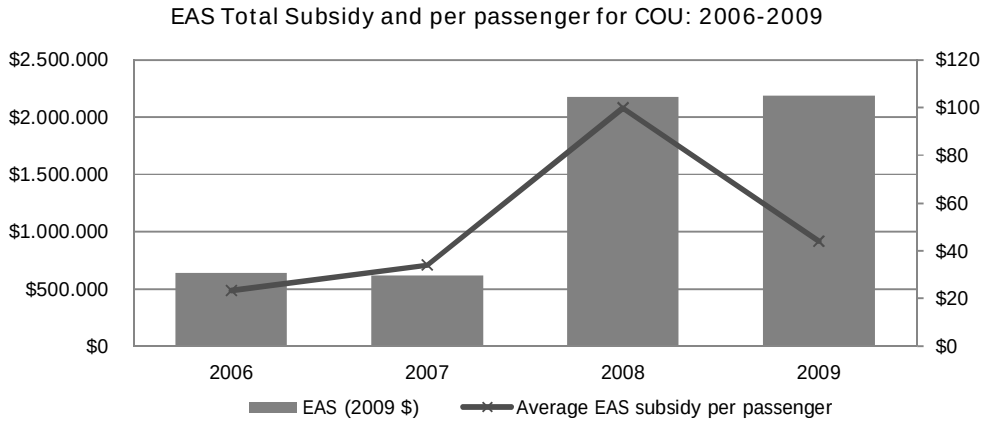
The first EAS subsidized service was not successful in reversing the declining trend. Air Midwest began operation between COU and Kansas City International (MCI) in 2006 and abandoned the market in less than two years.[9] Until the DOT approved another carrier in the summer of 2008, the airport suffered a 7-week gap in passenger service, which justifies the lower traffic level for 2008. Mesaba Airlines won the competition to serve COU, by providing a connection to Memphis International airport (MEM).[10] The grant, of nominal $2,186,590, contracted service through July 2010 (OAA, 2009). Several proposals, submitted by two other carriers (Great Lakes Aviation and Hawaii Island Air) testify to the competition. These carriers proposed less frequent flights and would have continued the connection to MCI.

[9] Air Midwest was a subsidiary of Mesa Air Group. It operated 24 round-trips a week, initially serving both STL and MCI, and in its last year only MCI. Alleging that the EAS subsidy of $598,751 (2009 dollars) (OAA,2009) was insufficient to make the route profitable as fuel costs rose abruptly, the carrier terminated the service. This situation was not specific to COU: in 2008, 17 EAS communities in 10 states lost service after Mesa Air Group shutdown Air Midwest.

[10] Mesaba is a regional carrier, wholly-owned subsidiary of Delta AirLines.

In the process of selecting the new EAS carrier, local council – including the airport Advisory Board, and local authorities (especially elected officials), recommended Mesaba to the DOT. Despite the fact that the carrier initiated service only in 2008, results in 2009 show that COU may be reversing the trend for declining traffic, with a significant growth of 128% in total passengers. For the years of 2008 and 2009, the EAS subsidy was significantly larger than that of the Air Midwest period. In 2008, the subsidy per passenger was considerably higher ($100) than in the previous year ($34) – both values in 2009 dollars (Figure 4). However, the peak value of $100 is likely due to the airport's complete loss service for 49 days during summer, with the consequent loss of many enplanements. Additionally, the economic recession of 2008 lowered demand. In 2009, the EAS subsidy per passenger had gone down to $44. If enplanements continue to increase in 2010, as a result of a recovering economy, the subsidy per passenger may drop further.

Figure 4: EAS Subsidy for COU, total and per passenger: 2006-2009



Source: OAA, U.S. DOT, 2009

The arrangement with Mesaba appears to have lessened the relative attractiveness of the STL and MCI airports. It also seems to be effective and efficient: Mesaba offers 20 round-trips per week (3 daily round-trips on weekdays and 2 on weekends) to a good connecting hub, MEM, on a 34-seat Saab 340 aircraft. Passengers benefit from a wider range of destinations (including international points), higher scheduled frequency, and reasonable airfares, since Mesaba's proposal included keeping an average one-way of $95. In respect with costs, federal subsidies are kept at a reasonable level.

Scheduled frequencies, and the choice of provider for the EAS, and its associated connecting hub, appear to play a significant role in the growth and sustainability of the route. In this particular case, the contracted provider of service was recommended to the DOT by the local authorities. These civic officials were able to count on the effects of competition between bidding carriers, and provided valuable insight knowledge of the market, when recommending a non-stop connection to an important hub like MEM. The comparison of results obtained by the first EAS carrier and the current one indicate that hub connectivity is a key factor for air service development.

4.2.2 Rutland (Vermont)

This case illustrates the efficiency gains -- reflected in higher passenger traffic, lower subsidies per passenger and airfares -- that result from the adoption of a low-cost carrier connection and the use of smaller aircraft, better suited to demand. It also demonstrates that effectiveness has been improved – better schedule frequency and connectivity.

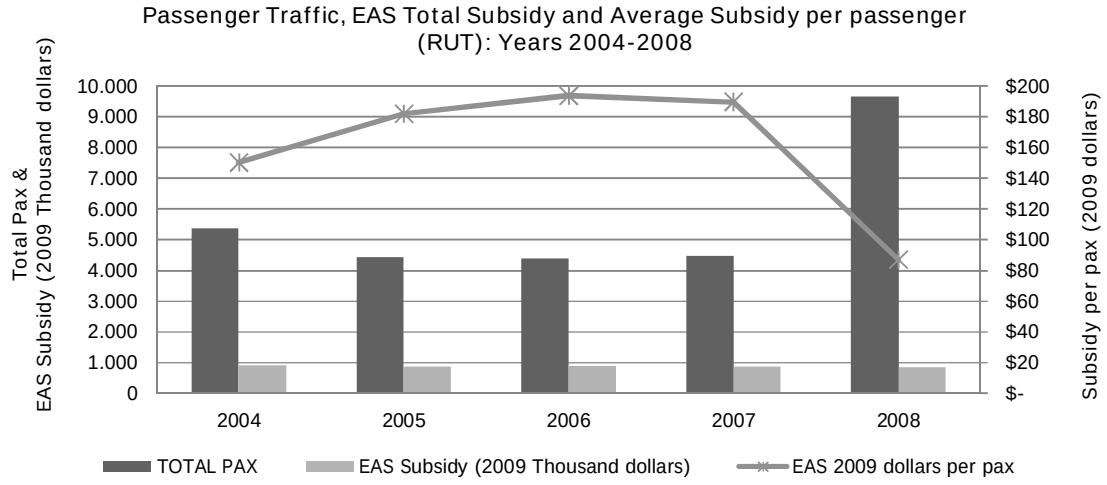
Rutland (Vermont) is served by the Rutland Southern Vermont Regional airport (RUT). It is state-owned, managed by the local agency Vermont Agency of Transportation, and is classified by FAA as a commercial service airport (over 2,500 enplanements per year). According to GAO, Rutland is relatively non-isolated - approximately one hour or less driving alternative transportation centres, the closest being Lebanon (within approximately 50 miles), Burlington International (70 miles), and Manchester International (120 miles).

Both Lebanon and Rutland have been receiving EAS support.[11] Cape Air started service in 2008 using 9-seat aircraft to connect the community to Boston Logan International with three daily flights. Previously, Commut Air provided service with 19-seat aircraft and a frequency of two daily flights (OAA, 2009). Commut Air operated as a Continental Airlines connection and, as Boston is not a hub for Continental, passengers did greatly benefit from this relationship.

Figure 5 presents the total number of scheduled commercial passengers at RUT (both enplanements and deplanements), for the 5-year period 2004-2008. It also shows EAS total subsidy, and the average subsidy per passenger, in 2009 dollars.

[11] In addition to the EAS funding, in 2004, Rutland received a SCASDP grant in the value of $240,000, completed by 2007 (GAO, 2009).

Figure 5: Total Scheduled commercial passengers, EAS total subsidy and per passenger for RUT: 2004-2008



Source: Bureau of Transportation Statistics and OAA, U.S. DOT reports

Competition on the bidding process induced efficiency. The value of total EAS subsidy did not decrease significantly over the 2007-2008 period; there was only a 5 per cent reduction, from $879 to $837 thousand (in 2009 dollars). However, the average per passenger cost declined 54 per cent, from $189 to $87, as a result of a 115 per cent increase in traffic. Regarding the cost for the passenger, airfares dropped 50 per cent, since Cape Air offers round-trips for the price the previous carrier charged for a one way ticket.

The 5 per cent reduction in total value of EAS subsidy, despite the 50 per cent increase in frequency, is likely result of Cape Air strategy of using a 9-seat aircraft, which also impacted fares: lower operating costs allowed the carrier to cut prices. In 2008, there were two carriers competing for the service: Cape Air and Big Sky Airlines. Big Sky proposed to use maintain the 19-seat aircraft on the route, while Cape Air estimated it would be financially more advantageous to have a smaller aircraft. This was supported by the local committee, headed by the Rutland Region Chamber of Commerce, who made the recommendation to the DOT.

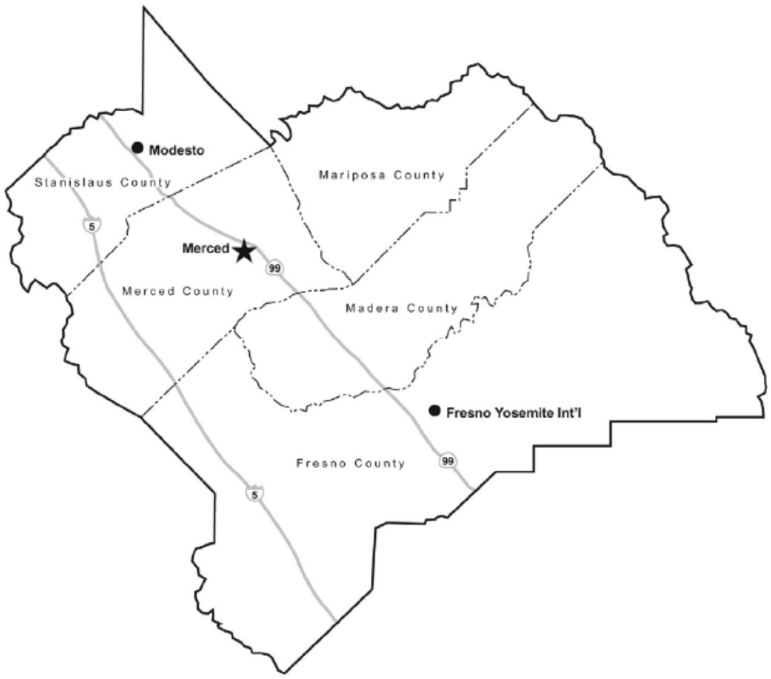
The 115 per cent increase in passenger traffic appears to be a result of effectiveness gains: higher frequency, better connections and airfares. Rutland is benefiting from better quality of service than the basic required by EAS. While essential determination established that Rutland would be connected to either New York City (NYC) or Boston, with one stop allowed,

and with a frequency of 2 on weekdays and 2 on weekends, Rutland is now being served by 3 daily non-stop flights to Boston. Moreover, Cape Air operates on code share with Jet Blue, a low-cost carrier who offers many low-airfare destinations from Boston.

4.2.3 Merced (California)

The case of Merced illustrates how EAS is inefficient in providing service to communities enjoying high levels of regional accessibility with good quality highway substitutes and alternative air transportation centres. It also demonstrates how the choice of the connecting hub is crucial for demand sustainability. Merced (California) has two airports: Merced Regional (MCE) and Merced Municipal (MEC). Scheduled commercial is only offered at MCE, currently connected to Ontario International Airport (ONT) by Great Lakes Airlines. However, other alternative air transportation centres may appeal to Merced's local passengers.

Figure 6: Merced Municipal Airport Passenger Enplanement Competitive Market Area



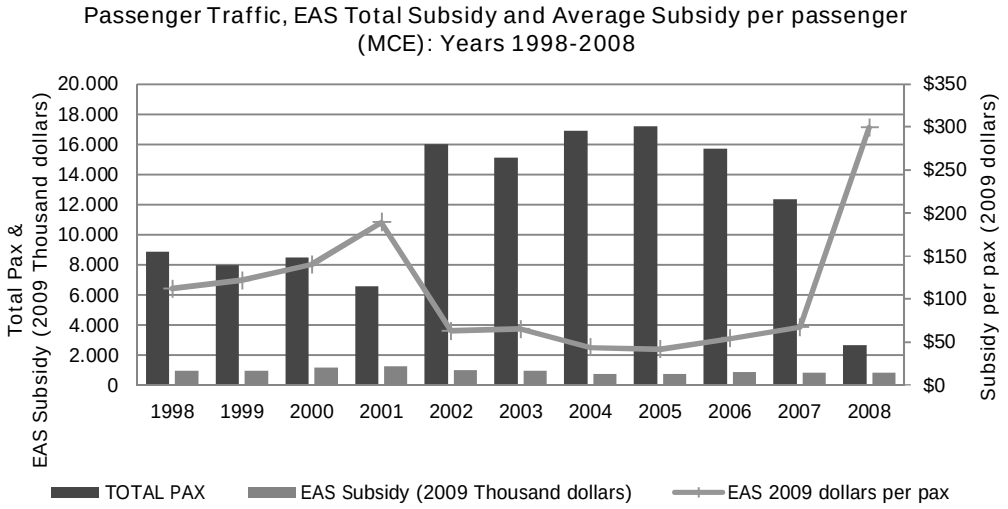
Source: Airport Master Plan, Chapter 4, 2007

Within approximately 1 hour driving, there are two more airports with commercial service: Fresno Yosemite International and Modesto City County. Merced Airport Master Plan of 2007 estimated that Fresno was capturing 94 per cent of the enplanements, Modesto 4 per cent,

and Merced was only serving the remaining 1 per cent. Figure 6 shows the location of the three airports, and the highway accessibility.

There are obvious reasons for passengers' preference for Fresno and Modesto. Their attractiveness results from their connectivity. Fresno is served by several airlines, offering a much higher scheduled frequency and number of destinations. Modesto is connected to San Francisco, which is more appealing than Ontario both as final destination and hub. Farther, yet easily reachable by highway in less than 2 and a half hours, the airports of Sacramento and San Jose provide attractive air service alternatives, with a large number of carriers, including low-costs such as Southwest and Jet Blue, schedule and frequency. Additionally, Los Angeles is another option for Merced's demand, within less than 5 hours. The consequences of this competition are that it is difficult to obtain low levels of subsidy for Merced. Figure 7 presents the total number of scheduled commercial passengers at MCE (including enplanements and deplanements), for the 11-year period 1998-2008. It is also includes the EAS total subsidy and the average subsidy per passenger, in 2009 dollars. Though there were no important changes in EAS level of subsidy, passenger instability has significantly increased the average subsidy per passenger in several years. In 2008, passenger traffic dropped by 78 per cent, which caused the subsidy per passenger to rise to $299, an increase of nearly 350 per cent over the previous year. The average subsidy per passenger for the entire period was of $109.

Figure 7: Total Scheduled commercial passengers, EAS total subsidy and per passenger for MCE: 1998-2008



Source: Airport Data, Bureau of Transportation Statistics, and OAA, U.S. DOT reports

Traffic levels for 2008 can be justified by the particular circumstances of the abandonment of service by Air Midwest, which shut down and, as in the case of COU, left the airport without service on short-notice, and the economic recession. However, data from the Bureau of Transportation Statistics for the first months of 2009, show even lower levels of traffic. The latter can be the result of the choice of Ontario as the connecting hub.

While 2008 represents significant deterioration of service, that is the result of a singularity in the traffic pattern, the difficulty of sustaining traffic at Merced is not new. The history of carriers serving Merced indicates that the service may not be sustainable, even when supported by EAS. This appears to result from Merced's particularly good regional highway accessibility. As soon as deregulation occurred, United Airlines – who had been serving Merced – abandoned the market. The period between 1979 and 1987 was a clear period of unstable conditions of service, with one airline entering and exiting the market per year. Following this, West Air, code-sharing as United Express was able to stay in the market for 12 years, until it was replaced in the same code-share by Skywest. During these years, and until 2001, the connection was made to either San Francisco or Los Angeles, which are attractive destinations and hubs and could justify the sustainability of demand. After this period, EAS supported the connection to Las Vegas, served by Scenic, and later by Air Midwest (Merced Regional Airport Mc Ready Field, 2007). The Las Vegas connection corresponds to the highest passenger levels, resulting in reduced subsidies per passenger, and provides evidence that the choice of the hub clearly affects the performance of the EAS subsidy.

5. CONTRIBUTIONS

U.S. Federal Policy for sustaining basic air service at small communities, and in particular the EAS program, appears to be relatively effective and efficient under deregulation. The thirty year-old experience demonstrates good overall results in providing the communities with air accessibility – service, schedule and frequency, within reasonable costs levels for the federal government. The design of EAS mechanisms have succeeded in establishing competition in the process of subsidization. We have shown the positive effects of competition in improving effectiveness, and efficiency.

Scheduled frequencies, the choice of the EAS carrier, and its associated connecting hub, appear to be key-factors in guaranteeing the growth and sustainability of the service to small

communities. Additionally, local participation and political interest play relevant roles in assuring the service sustainability. Some inefficiency – declining traffic, high levels of subsidy per passenger, was detected and is the result of the failure to incorporate changing conditions in the EAS underlying statutes. The program does not target only the most isolated communities. It also appears to lack mechanisms that could improve its efficiency: EAS does not currently use annual and long term performance measures in its management.

Despite the variations in the U.S., Canadian and European approaches to aviation deregulation and the variations among European countries, and its effects on air service provision to small communities, some aspects are common to the processes:

1. All policies recognize the need and support the provision of air service to small remote communities and this need is sustained in their Government policies and administrative and financial provisions;
2. U.S., Canadian and European Governments support both the transportation infrastructure and the air service.
3. Provisions for infrastructure investment are also similar: in most cases, smaller airports are cross-subsidized by the fee collection at larger facilities.
4. Inefficiencies are present in all systems and derive from the complexity of the "isolation" criteria and classification, failure to include changing conditions, and lack of coordination between transportation modes.
5. Moreover, Governments' provisions have been unsuccessful in incorporating evaluation measures into policies thus hindering their implementation.

The most relevant disparities between the policies of nations are observed in market structures and competition. In the U.S. and Canada, trunk or flag carriers and local carriers have withdrawn from service to small remote communities. Competition has been introduced to some extent on thinner markets with positive impacts on service. Small communities are currently being provided by small commuter carriers that by using smaller aircraft equipment fit for demand guarantee efficiency gains. In Europe, this is, to some extent, true; however, there is significant disparity between the levels of competition in the two continents. Some countries in Europe opted to maintain flag carriers serving small communities, such as Iberia in mainland Spain; moreover, established carriers maintain undisputed advantage over new entrants and local bureaucracy is a relevant impediment to competition in tendering

processes. Peripheral and small destinations are still mostly served by regional carriers and there is a significant number of restricted access routes (Williams, 2010).

Other differences between air transportation policies in Europe, Canada and the U.S. are observed in the support to air service. Unlike the U.S. that opted for full deregulation and establishes a minimum level of service and subsidizes carriers with a competitive bidding system on specific routes through the Essential Air Service Program, Canada chose to originally maintain light regulation in its more remote communities and later replace it with subsidies for travellers with concrete travel needs (medical care, shopping, etc.) (Metrass-Mendes, de Neufville and Costa, 2011). European nations, on the other hand, defined a system of Public Service Obligations (PSOs). While U.S. carriers are compensated with lump sums per annual service operations, Canadian carriers receive additional finance al support through contribution agreements with Inuit and First Nations organizations that are matched to specific shipment and medical requirements (Metrass-Mendes, de Neufville and Costa, 2011). In Europe, carriers are awarded financial compensation and there is in place a system of direct operational support to airlines for service on domestic peripheral regions (Reynolds-Feighan, 1995 and Williams, 2010). Additionally, and as in Canada, specific provisions were made for ensuring shipment and essential Health Care accessibility.

Although European and Canada's implementation show some efficiency flaws by failing to introduce or improve market competition, they appear to be more efficient than the U.S. policy when targeting both the more remote regions and the population's accessibility needs. Other policy differences are related to the decentralization level. European and Canadian air transportation policy are formally more decentralized regarding infrastructure ownership, management, and operation, than the U.S., though with little or no evidence of benefits for the communities[12] (Metrass-Mendes, de Neufville and Costa, 2011).

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[12] Since the 1970s, Canada's government policies have been advocating more direct control by First Nations and Inuit communities of their own matters. The divestiture process can be seen as an element of these policies that call for mechanisms to enable First Nations and Inuit communities to sustain the delivery of services to their members and it is thus effective in its goal.

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AIR FREIGHT AND MERCHANDISE TRADE: TOWARDS A DISAGGREGATED ANALYSIS

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Abstract

During the past 30 years, air cargo has evolved from a by-product to a potential profit centre for airlines. However, the success in the air cargo business depends on a number of factors. The evolution of world merchandise trade and particularly, the trade in high-value goods, is one of the determinants of the demand for air freight services. This paper provides an insight into the relationship between air cargo and merchandise trade on an aggregated as well as on a disaggregated level. Special attention is paid to the air cargo flows between major regions. By combining several levels of the air cargo market, this paper explains part of the economic rationality behind the air cargo market structure. The results of this paper will lead to a better knowledge of the air cargo sector, not only by academics but also by industry actors.

Keywords: air cargo, time series modelling, regional air freight flows, error correction model, international trade

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1. INTRODUCTION

With on-going globalization, air cargo transport has developed very rapidly during the past 30 years. Some time ago, air cargo was considered as a by-product of passenger transport. Currently, however, it is gaining importance and a number of airlines specialized themselves in the air cargo business. Furthermore, a number of (smaller) airports now consider air cargo as their core business. At the same time, a number of industrial-economic evolutions took place in the sector, such as co-operation agreements.

As a product, air cargo is heterogeneous. There is the traditional air cargo on the one hand, transported in full freighters or passenger airplanes' belly, and express cargo on the other hand. Strictly separating both, however, is artificial, since there are overlaps. The increasing importance of full-freighter transport results from a combination of various factors: insufficient freight capacity linked to more severe security regulation aboard passenger planes, a tendency towards consolidation and scale increase, and the important imbalance between some incoming and outgoing air cargo flows.

For the volume of air cargo, measured in tonne kilometres, one can differentiate between potential and realized air cargo. Potential air cargo volumes can be seen as the demand for air cargo which is determined by economic activity and particularly by trade. Thus, when analyzing the macro-economic characteristics of air cargo it is also necessary to get an insight into the relationship between air cargo, economic activity and trade, which is the objective of this paper. Next to the potential air cargo volumes, realized air cargo or the supply of air cargo, can be considered. Air cargo supply is determined by micro-economic aspects, influencing the strategies of cargo airlines. The supply of air cargo is influenced in particular by available capacity, competition from other modes, especially maritime container transport, and the costs and yields of the cargo airlines which are also determined by their competitive position in the sector. For airline companies, additional profit can be generated by filling unused belly capacity with cargo. Cargo yield, which traditionally has been below that of passenger transport, has improved over the last couple of years, approaching that of passenger transport. This paper focuses on the macro-economic aspects of air cargo.

More specifically, this paper aims at studying the relationship between air cargo and merchandise trade on a disaggregated level, focusing on one of the most important routes for air freight. The disaggregated analysis is combined with previous research done on an aggregated level to explain the economic rationality behind the air cargo sector.

Section 2 provides an insight into the most important trends in the air cargo market on an aggregated level. More particularly, the evolution of worldwide air freight traffic, the imbalances in air cargo and trade flows and the most important goods categories shipped by air freight are discussed. In section 3 the focus lies on the relationship between air cargo and merchandise trade on a worldwide level. A time series model using co-integration theory and an error correction model is used to discover the underlying factors that influence the development of air cargo. A disaggregated analysis of the relationship between air cargo and trade on route level is carried out in section 4. Section 5 summarizes the most important conclusions of this research and makes a suggestion for further research in this area.

2. TRENDS IN THE AIR CARGO BUSINESS

2.1. EVOLUTION OF WORLDWIDE AIR FREIGHT

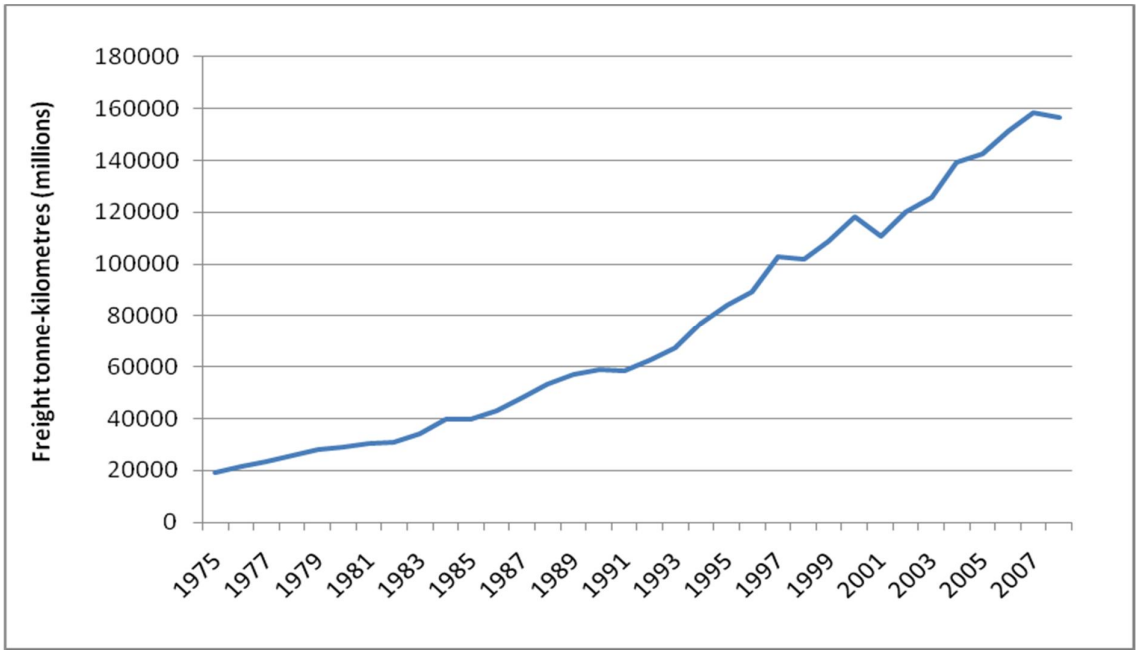
Figure 1 shows how worldwide air freight transport evolved from 1975 to 2008. It is clear from this figure that there was a strong increase in air freight during this period: from about 20 000 million FTKs in 1975 to 156 000 million FTKs[5] in 2008. The growth in FTKs is mainly due to the growth in freight tonnes carried, which increased stronger than the freight kilometres performed between 1975 and 2008. This strong growth of worldwide air freight results from a number of crucial developments at the demand and supply side of the (liberalised) international air freight market: a growing world trade, technological progress, increasing value/weight rate of goods, downward pressure on air freight yields, changing production processes (e.g. JIT, Make to Order), strategic importance of e-services, etc. The graph also illustrates the traffic decreases in 2001 and 2008 due to the September 11 effect and the worldwide economic crisis respectively. In section 3, it will be investigated which factors in the global economy are driving the demand for air freight.

2.2. AIR FREIGHT AND TRADE IMBALANCES

While passengers normally make a two-way journey, air cargo is carried in only one direction: from production to distribution or consumption centres. This results in imbalances between incoming and outgoing cargo flows. These imbalances are influenced by export/import imbalances between regions or countries and may result in large variations in air cargo rates according to the traffic direction. (Zhang and Zhang, 2002, p. 179)

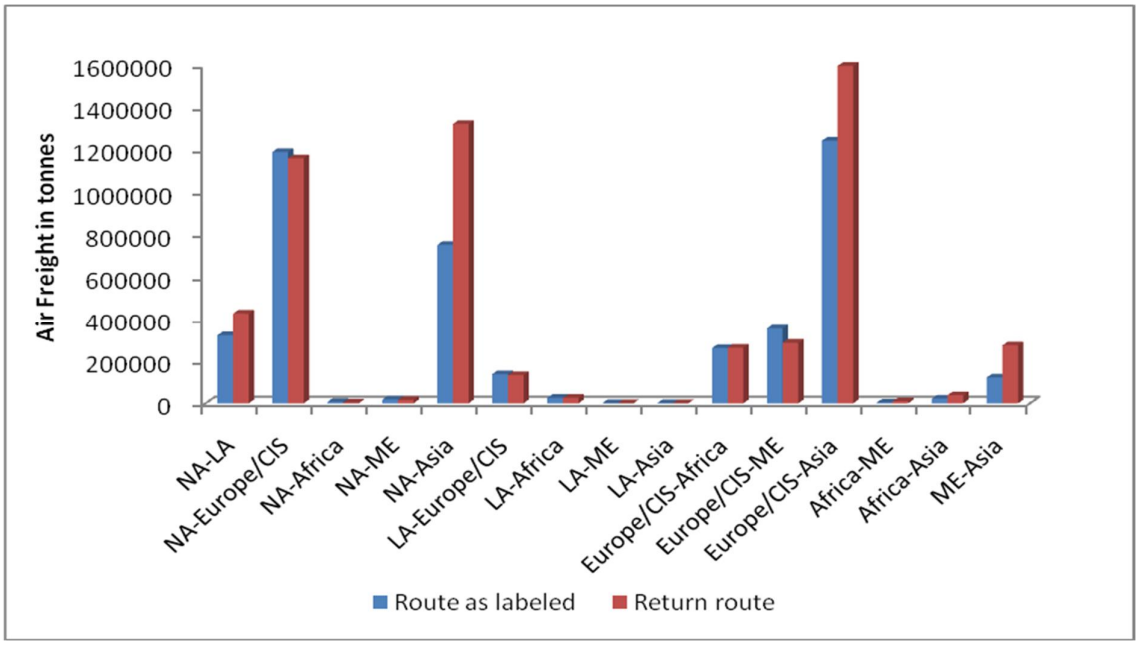
[5] A FTK is a Freight Tonne-Kilometre.

Figure 1: Evolution of Worldwide Air Freight Traffic in FTKs (millions), 1975-2008



Source: ICAO Journal, 1987-2006; ICAO Annual Report of the Council, 2008-2009

Figure 2: Air Freight Imbalances on Worldwide Routes (2008)



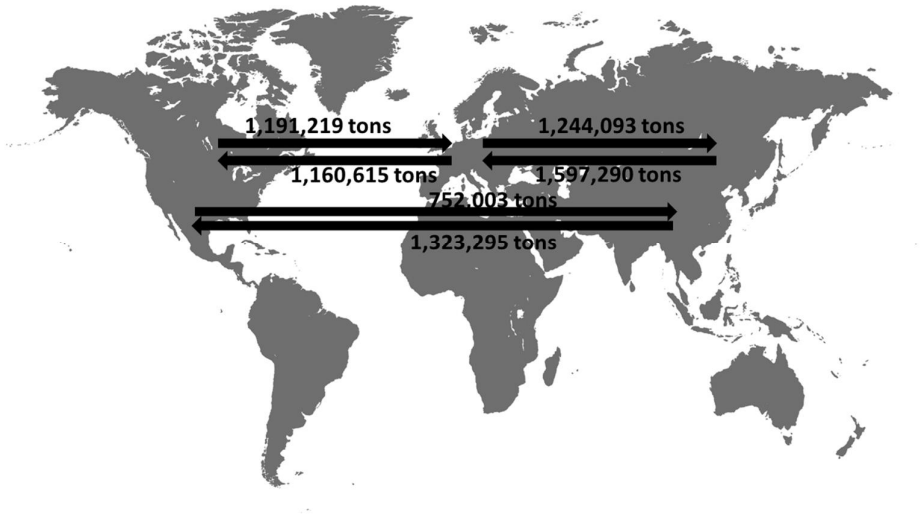
Source: own calculations based on ICAO TFS data

Figure 2 gives an overview of imbalances in air cargo flows between selected regional markets in 2008. The regional air freight volumes are calculated based on Traffic by Flight

Stage (TFS) data from ICAO. The figure shows that the most important routes[6] in terms of air cargo traffic are North America – Asia, Europe/CIS – Asia and North America – Europe/CIS. It is also clear from the figure that North America – Asia and Europe/CIS – Asia are the routes with the largest imbalance between incoming and outgoing air cargo flows. Between North America and Europe/CIS there is only a very small imbalance.

Figure 3 gives an overview of the air freight volumes in both directions on the three most important routes in terms of air freight. However, comparing[7] these inter-continental routes with the intra-continental air cargo traffic (see figure 4), it can be seen that even more goods are transported intra-continental than between the continents. Furthermore, it is also clear that there are large differences between continents regarding intra-continental traffic. Asia and North America for example generate enormous air cargo traffic flows while continents such as Africa and South America have rather small intra-continental traffic.

Figure 3: Air Freight Volumes on the Three Most Important Routes in Terms of Air Freight (2008)

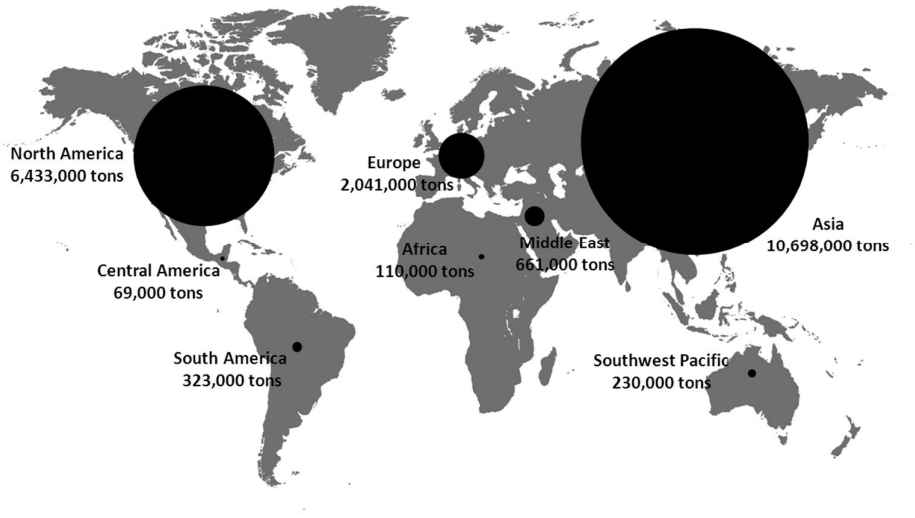


Source: own calculations based on ICAO TFS data

[6] For the definition of the regions see Annex. Due to methodological reasons, Europe and the Commonwealth of Independent States were seen as one region.

[7] The comparison between figures 3 and 4 gives a good idea about the relation between inter- and intra-continental air cargo traffic. However, the interpretation of these figures should be done carefully since two different data sources were used.

Figure 4: Intra-Continental Air Freight Traffic (Domestic and International, 2008)



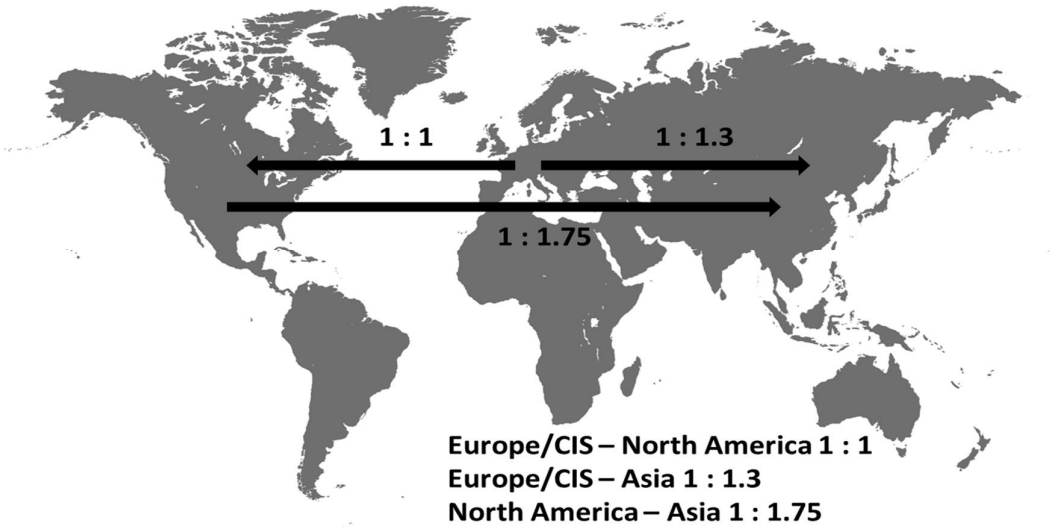
Source: IATA, World Air Transport Statistics, 2008

In figure 5 the air freight imbalances on the major routes in 2008 are expressed as export/import tonnages. Since the objective of this paper is to examine the relationship between air freight and trade on a disaggregated level, also regional trade flows are looked at. Figure 6 depicts the merchandise trade flows (in billion US$) between the three major routes in terms of air freight. These routes are also the most important ones in terms of trade value. There are trade imbalances on each of these routes. The route North America – Asia shows the largest imbalance. In section 4, the relationship between air cargo and merchandise trade is estimated for the route Europe/CIS – Asia.

2.3. COMMODITIES SHIPPED BY AIR FREIGHT

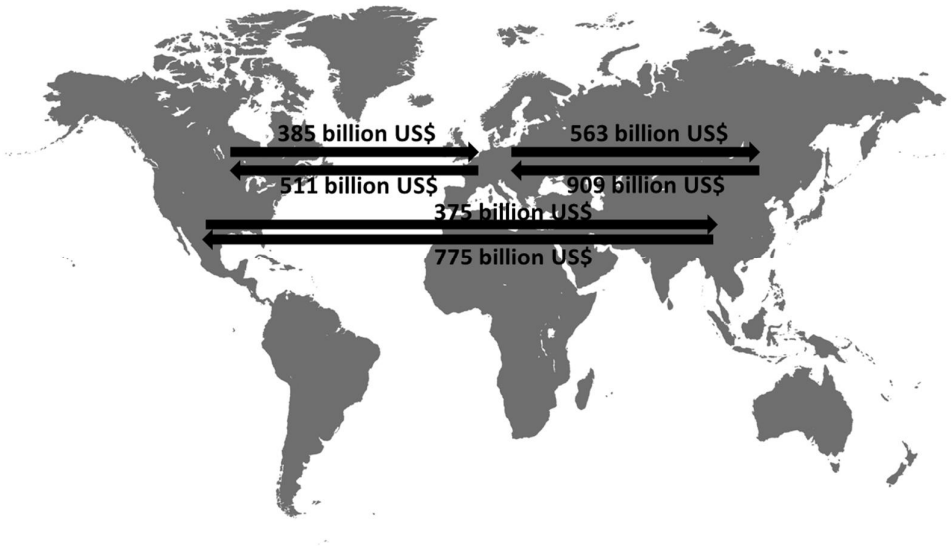
Table 1 represents the most important goods categories transported by air freight for different geographical markets in 2007. On a worldwide level, high-tech products represent the largest share. There are large differences between markets, e.g. the share of capital equipment in the air exports from Europe (EU-AS and EU-NA) is higher than its share in the air exports from North America (NA-EU and NA-AS). Capital equipment is the most important goods category in all the air exports from Europe. This difference is explained by the strength of European manufacturers of industrial machinery. (Clancy and Hoppin, 2006)

Figure 5: Export / Import Air Freight Tonnage Ratio[8] for the Three Most Important Routes in Terms of Air Freight (2008)



Source: own calculations based on ICAO TFS data

Figure 6: Merchandise Trade on Major Routes (2008)



Source: own calculations based on WTO data

[8] Explanation of export/import tonnage ratio: e.g. Europe/CIS to Asia, 1 : 1.3 – for every ton exported from Europe/CIS, 1.3 tons are imported back via airfreight.

The air exports from North America to Latin America are dominated by high-tech products. For its exports to Europe and Asia, high-tech products and capital equipment are the most important goods categories with only a small difference between them. Asia's air exports to Europe and North America, which are the largest air freight markets, mainly consist of high-tech products. These are also dominant in the intra-Asian air cargo traffic. The share of refrigerated foods in the freight traffic from Latin America to North America (LA-NA) is strikingly large.

Table 1: Commodity Share of Directional Air Freight Markets in 2007
(share of FEU[9]-kilometres, billions of FEU-kilometres)

	World	AS-EU	EU-AS	AS-NA	NA-AS	Intra-Asia	EU-NA	NA-EU	LA-NA	NA-LA
Billions of FEU-km	15.24	2.79	1.53	2.98	1.13	1.60	0.80	0.67	0.42	0.39
Refrigerated foods	5%	1%	3%	1%	4%	5%	3%	3%	41%	2%
Non-refrigerated foods	1%	0%	1%	0%	1%	1%	1%	1%	8%	0%
Consumer products	16%	22%	14%	15%	13%	16%	19%	15%	9%	16%
Apparel, textiles, footwear	17%	25%	9%	31%	3%	15%	12%	3%	19%	5%
High tech products	27%	32%	19%	36%	28%	35%	18%	24%	10%	36%
Capital equipment	19%	10%	37%	11%	26%	15%	32%	27%	6%	24%
Intermediate materials	12%	8%	15%	6%	21%	11%	14%	23%	4%	14%
Primary products	2%	2%	3%	0%	4%	2%	2%	3%	3%	3%

Source: Based on MergeGlobal world air freight supply and demand model, MergeGlobal Value Creation Initiative, 2008, p.36.

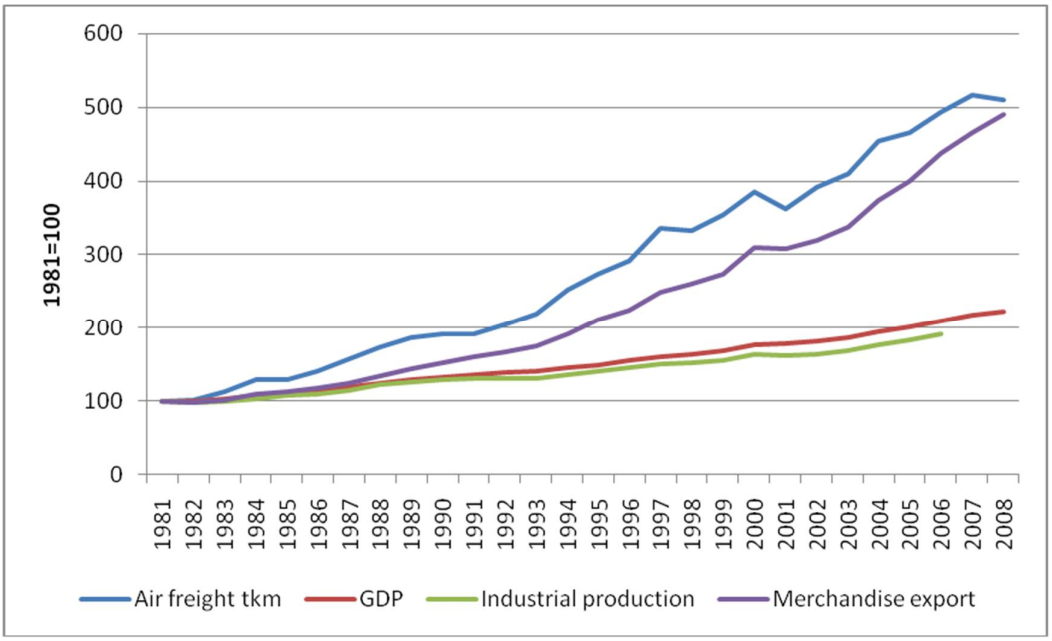
3. WORLD AIR FREIGHT AND MERCHANDISE TRADE[10]

As for general freight transport, also air freight is the result of economic activity. Traditionally the world demand for freight transport is related to world GDP. This relationship seems to work rather well for total freight flows, but is less straightforward for air cargo. One of the problems is that GDP is made up increasingly of services. According to the World

[9] A FEU is a forty-foot equivalent unit (2 TEUs).
[10] Based on Kupfer et al. (2010)

Development Indicators of the World Bank the share of services in total world value added was 53% in 1970 and reached nearly 70% in 2006. The evolution of GDP is therefore more and more driven by the services sector and less by activities which may generate air cargo. Sometimes the evolution of the world industrial production is suggested as an alternative for GDP to forecast trends in air freight cargo, but even this is a weak indicator. This is not only illustrated by figure 7, but can also be statistically formalized by using co-integration theory.

Figure 7: World Air Freight in TKM and World Economic Activity



Sources: Air freight in tkm: ICAO, GDP in constant USD of 2000: World Bank, Industrial Production: industry value added in constant USD of 2000: World Bank, Merchandise exports in USD of 2000: World Bank and IMF

One of the major problems in analysing time series which all show an upward trend, is to find out whether this trend is deterministic or stochastic[11]. This is traditionally done by unit root and/or stationarity tests. Time series with a deterministic trend are stationary and can be related to each other by simple ordinary least squares regressions taking into account the deterministic trend. Time series with stochastic trends and which are therefore not stationary can only be related to each other by a regression equation if they are co-integrated, which means that they should have a common trend. The seminal work of Nobel Prize winners Engle & Granger treats this in detail and Granger's Representation theorem states that co-

[11] Detailed information on testing unit roots, stationarity and co-integration can be found in a number of econometric handbooks such as Hamilton (1994), Hayashi (2000), Verbeek (2008), Franses (1998).

integrated series are related to each other by means of a very specific dynamic model, the error-correction model (ECM), which models the long run equilibrium relation between co-integrated series and the short run adjustments towards this equilibrium relationship. If non-stationary time series are not co-integrated, they cannot be represented by a simple regression and there is no long run equilibrium relation between them. Only their short term behaviour can be modelled in a statistically reliable way.

The first step in the analysis is to discover whether the trend in the time series under consideration is stochastic or deterministic. Traditionally this is tested by means of the following tests: Dickey-Fuller (DF), augmented Dickey-Fuller (ADF), Dickey-Fuller with de-trending (DFGLS), Phillips-Perron (PP), Kwiatkowski, Phillips, Schmidt, and Shin (KPSS), Elliot, Rothenberg, and Stock (ERS), and Ng-Perron (NP). If the time series have a stochastic trend, the next step is to test whether they are co-integrated or not. There are several tests for co-integration: Engle-Granger 2-step approach, Engle-Granger-Yoo 3-step approach, the dynamic ordinary least squares (DOLS) developed by Stock & Watson, the unrestricted ECM approach, and the Johansen co-integration test. Finally, if the series are co-integrated, their relation can be represented by an error correction model. If they are not co-integrated, there is no long run equilibrium relation which ties the series together.

Unit roots tests for world air freight in tkm (TKM), world GDP in constant prices (GDP), and world industrial production in constant prices (IP) revealed a stochastic trend in the series whether they were measured in levels or in logarithms. Several co-integration tests were applied indicating no co-integration between TKM and GDP, and between TKM and IP. This leads to the conclusion that there is no long run equilibrium relation between world air freight on the one hand and world GDP or world industrial production on the other hand.

As air cargo consists mainly of international traffic of high value goods, the evolution of world air freight can be better explained by an indicator for world international trade in high value goods. This is approximated by the volume of world merchandise exports (MERCH) as a global indicator of international trade in combination with the share of manufactures in the total value of merchandise exports (SHAREMANU)[12]. An increase of the latter can be the result of an increasing share of manufactures in the volume of merchandise trade, an

[12] As an alternative the share of office and telecom equipment in the value of total merchandise exports was considered but this was rejected as this resulted in multi-collinearity due to the high correlation with the evolution of the volume of merchandise exports.

increase of the value of the manufactures, or a combination of both. All co-integration tests indicated that TKM, MERCH and SHAREMANU are co-integrated. For the error correction specification, the best results were obtained with the logarithm of TKM and MERCH and by adding a dummy variable for the crisis in 1991 induced by the higher oil prices and the Gulf War (DUM91), a dummy variable for the structural impact of 9/11 (DUMBREAK), and a dummy for the impact of the financial crisis of 2007 the consequences of which became clear from 2008 onward (DUM2008).

This gives the following ECM model:

$$\Delta \ln TKM_t = \beta_1 \Delta \ln MERCH_t + \beta_2 \Delta SHAREMANU_t + \beta_3 \Delta DUM91_t + \beta_4 \Delta DUMBREAK_t + \\ + \beta_5 \Delta DUM2008_t + \delta(\ln TKM_{t-1} - \alpha_0 - \alpha_1 \ln MERCH_{t-1} - \alpha_2 SHAREMANU_{t-1} - \alpha_3 DUM91_{t-1} - \\ - \alpha_4 DUMBREAK_{t-1} - \alpha_5 DUM2008_{t-1}) + \varepsilon_t \quad (1)$$

Where:

TKM	world air freight in tkm (ICAO)
MERCH	world merchandise export in USD of 2000 (World Bank and IMF)
SHAREMANU	share of manufactures in the value of world merchandise exports
DUM91	=1 in 1991
	=0 in other years
DUMBREAK	=1 from 2001
	=0 before 2001
DUM2008	=1 from 2008
	=0 before 2008

Δ are first differences, ln indicates logarithms, and ε is the stochastic error term.

The long run equilibrium relation is given by

$$\ln TKM_t = \alpha_0 + \alpha_1 \ln MERCH_t + \alpha_2 SHAREMANU_t + \alpha_3 DUM91_t + \alpha_4 DUMBREAK_t + \alpha_5 DUM2008_t \quad (2)$$

Table 2: DOLS Estimation of the Long Run Relationship between World Air Freight and World Merchandise Exports

Sample (adjusted): 1983 2007
Included observations: 25 after adjustments
Newey-West HAC Standard Errors & Covariance (lag truncation=2)

		Coefficient	Std. Error	t-Statistic	Prob.
C	α_0	-0.352621	0.205264	-1.717892	0.1115
LNMERCH	α_1	0.977122	0.048301	20.22985	0.0000
SHAREMANU	α_2	1.010488	0.199940	5.053954	0.0003
DUM91	α_3	-0.066246	0.030391	-2.179768	0.0499
DUMBREAK	α_4	-0.070223	0.031744	-2.212168	0.0471
DLNXMERCH(1)		0.130266	0.330227	0.394475	0.7002
DSHAREMANU(1)		0.333607	0.610623	0.546339	0.5948
DDUM91(1)		-0.003808	0.016517	-0.230561	0.8215
DDUMBREAK(1)		-0.027513	0.046033	-0.597672	0.5612
DLNXMERCH(-1)		-0.074783	0.340557	-0.219589	0.8299
DSHAREMANU(-1)		-0.056812	0.394483	-0.144017	0.8879
DDUM91(-1)		-0.009554	0.019449	-0.491236	0.6321
DDUMBREAK(-1)		0.013636	0.033163	0.411179	0.6882

R-squared	0.997715	Mean dependent var	5.557736
Adjusted R-squared	0.995430	S.D. dependent var	0.466625
S.E. of regression	0.031543	Akaike info criterion	-3.768893
Sum squared resid	0.011940	Schwarz criterion	-3.135078
Log likelihood	60.11117	Hannan-Quinn criter.	-3.593100
F-statistic	436.6806	Durbin-Watson stat	1.810744
Prob(F-statistic)	0.000000		

As the sample is rather small, the long term co-integrating relation is estimated using the Stock-Watson DOLS-method (Stock & Watson, 1988, 1993). The results are reported in table 2. As a consequence of this estimation method the adjusted sample ends in 2007 which means that the impact of DUM2008 could not be estimated in the long run relationship.
The short run adjustments are estimated given the DOLS-estimates for α_0, ..., α_4 and are reported in table 3.

The error correction model reveals that the change in world air freight is due to the current change in world merchandise exports, the current change in the share of manufactures and an error correction term which is an adjustment to deviations from the long run equilibrium in the previous period. The adjustment speed, which is given by δ=-0.75 is rather high.

Table 3: Error Correction Model for World Air Freight and World Merchandise Exports

Dependent Variable: D(LNTKMICAO)
Method: Least Squares
Sample (adjusted): 1984 2008
Included observations: 25 after adjustments

		Coefficient	Std. Error	t-Statistic	Prob.
DLNMERCH	β_1	1.0817	0.0765	14.1462	0.000
DSHAREMANU	β_2	0.6820	0.2881	2.3673	0.028
DDUM91	β_3	-0.0832	0.0260	-3.1958	0.004
DDUMBREAK	β_4	-0.0437	0.0181	-2.4193	0.025
DDUM2008	β_5	-0.0603	0.0277	-2.1745	0.041
RESIDLONGRUN(-1)	δ	-0.7483	0.1627	-4.5983	0.000

R-squared	0.7885	Mean dependent var	0.0604
Adjusted R-squared	0.7381	S.D. dependent var	0.0499
S.E. of regression	0.0255	Akaike info criterion	-4.3036
Sum squared resid	0.0137	Schwarz criterion	-4.0156
Log likelihood	64.0985	Hannan-Quinn criter.	-4.2180
Durbin-Watson stat	1.7659		

with

RESIDLONGRUN = lnTKM + 0.353 - 0.977*lnMERCH - 1.0105*SHAREMANU + 0.066*DUM91 + 0.070*DUMBREAK

The elasticity of air freight with respect to merchandise exports is not significantly different from 1 neither in the long run equilibrium relation, nor in the short run adjustment. So a one per cent change in world merchandise exports will result in a one per cent change in air freight. An increase of the share of manufactures in the value of merchandise exports with one percentage point, will lead in the long run to a one per cent increase in air freight as α_2 is not significantly different from 1. In the short run the impact will be smaller than 1. There has clearly been a negative impact in 2001 as a consequence of 9/11 which has led to a structural downward shift in air freight. Figure 8 gives the actual value of air freight (in logarithms) and the fitted values calculated with the estimated error correction model within the sample for the years 1984-2008.

The driving force behind world air freight evolutions is clearly merchandise trade and especially the trade share of manufactures. This means that forecasts of world air freight will

rely heavily upon the future evolutions of factors affecting trade, which can be grouped as illustrated in Figure 9.

Figure 8 – Actual and Fitted Air Freight Values

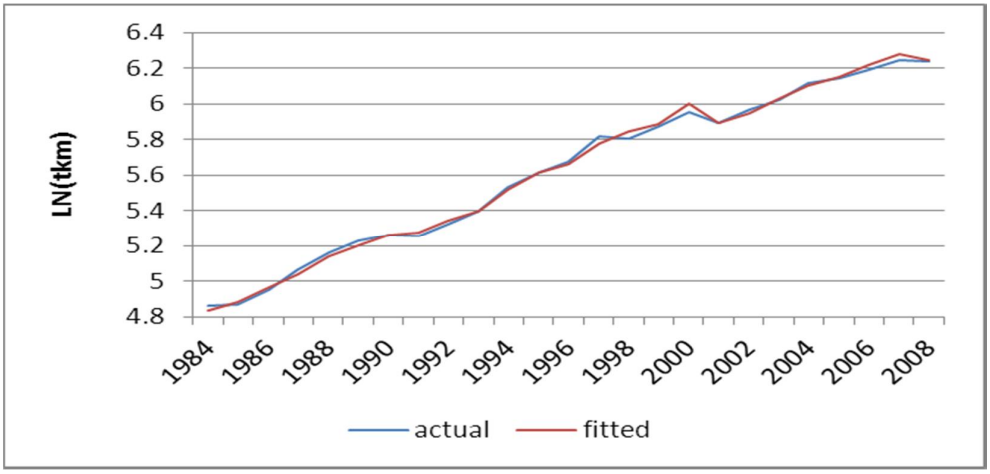
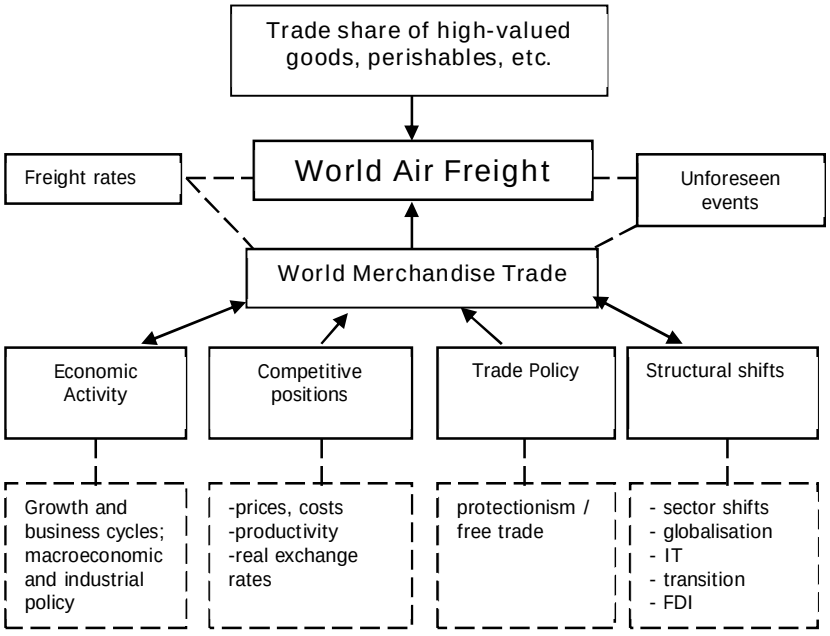


Figure 9: Factors affecting World Air Freight and World Merchandise Trade



Factors stimulating economic activity will, ceteris paribus, lead to more trade whereas slowdowns of economic growth will also hamper international trade. Shifts in the international competitive position of countries do not necessarily entail changes in the total volume of world trade but will have an impact on the trade pattern. The reduction or

abolition of protectionist policy measures and the stimulation of free trade will not only increase world trade, but will also have an impact on the trade directions. Finally, there are a number of structural shifts which have consequences for world merchandise trade.

Although some general trends can be recognised, there remains a lot of uncertainty on a number of factors which will impact the world economy:

- Will globalisation continue at the same pace or will trade be sculpted by a new regionalism?
- Will economic policy stimulate free trade or will there remain some protectionist attitude?
- Will the emerging economies be able to decouple fully from the North or will the world economy also in the future continue to be dominated by the United States?
- Will trade imbalances continue to exist at the same magnitude as they are today?
- What policy measures will be taken to come to a more sustainable economic growth?
- Will Europe be able to cope with its ageing population?
- What will be the role of the public sector not only specifically for airport infrastructure investment, but also generally to support a social economy?
- How will oil prices evolve over time?
- What are the perspectives for the poorest among the poor, especially sub-Saharan Africa?
- Etc.

These open questions will have an impact on world and regional economic growth and on the magnitude and direction of the trade flows of the different commodities. It might be worthwhile to include the transport price of air freight and of the best alternative, i.e. maritime shipping, in the analysis. At the supply side there is room for investigating the effect of oil price changes and capacity adjustments, and the way individual airlines adjust their strategy in order to determine their competitive position. Moreover, due to the imbalances on trade routes, resulting in imbalances between incoming and outgoing cargo flows, an analysis of the air cargo market on a disaggregated level is needed. This is the aim of the next section.

4. A DISAGGREGATED ANALYSIS

The ECM and the long run relationship showed that there is a link between air freight and trade on world level. However, due to the imbalances and differences between routes that were discovered in section 2.2 of this paper, the question arises whether the relationship between air freight and trade is also valid on a disaggregated level. A first step in answering this question was to analyse the relationship on a route basis. As the route between Asia and Europe/CIS[13] is one of the most important air freight routes and significant growth on this route is expected in the future, it was decided to concentrate on this route.

As merchandise exports and the share of manufactures in merchandise trade were found to be significant in the aggregated analysis, the analysis was first carried out with those two explanatory variables. However, as the share of manufactures in merchandise trade turned out not to be significant, the export in manufactures in USD of 2000 was used as explanatory variable. This can be motivated with the goods categories included in trade in manufactures, such as iron and steel, chemicals, other semi-manufactures, machinery and transport equipment, textiles, clothing, which better reflect the goods transported by air than merchandise export.

A pooled regression analysis was used as this, first of all, gives more efficient estimators. Moreover, because the number of observation is already limited, a pooled regression analysis has the advantage to leave more degrees of freedom to work with.

Finally, this leads to the most general form for a pooled regression analysis between air freight and trade in manufactures:

$$\ln(AIR_i) = \gamma_0 + \gamma_{1,i} + \gamma_{2,i}\ln(MANU_i) + \varepsilon_i \qquad (3)$$

where

i = 1 for Asia to Europe/CIS

i = 2 for Europe/CIS to Asia

$\varepsilon_i \sim IID(0, \sigma^2_\varepsilon)$, ln indicates logarithms and ε is the stochastic error term.

AIR: Air freight in tons[14] , MANU: Export in manufactures in USD of 2000[15]

[13] For the definition of the regions see Annex. Due to methodological reasons, Europe and the Commonwealth of Independent States were seen as one region.

[14] Own calculations based on ICAO TFS data

[15] Own calculations based on WTO, IMF and World Bank data

The results of the regression analysis are shown in table 4.

The results of the disaggregated regression analysis reveals that the elasticity of air freight with respect to trade in manufactures for both routes is higher than on world level. This difference, however, arises due to the disaggregated nature of the analysis on route level. On world level, routes with high as well as low elasticity's were included which compensated each other to result in a kind of average elasticity.

Table 4: Pooled Results on the Routes between Asia and Europe/CIS

Dependent Variable: LN(AIR)
Method: Pooled Least Squares
Sample: 1999 2008
Included observations: 10
Cross-sections included: 2
Total pool (balanced) observations: 20

Variable		Coefficient	Std. Error	t-Statistic	Prob.
C	γ_0	4.750341	0.599811	7.919731	0.0000
LN($MANU_1$)	$\gamma_{2,1}$	1.446654	0.119539	12.10189	0.0000
LN($MANU_2$)	$\gamma_{2,2}$	1.733240	0.180884	9.582035	0.0000
Fixed Effects (Cross)					
C_AE	$\gamma_{1,1}$	0.555841			
C_EA	$\gamma_{1,2}$	-0.555841			

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.939180	Mean dependent var	13.63152
Adjusted R-squared	0.927776	S.D. dependent var	0.394437
S.E. of regression	0.106003	Akaike info criterion	-1.473839
Sum squared resid	0.179787	Schwarz criterion	-1.274693
Log likelihood	18.73839	Hannan-Quinn criter.	-1.434964
F-statistic	82.35665	Durbin-Watson stat	1.656708
Prob(F-statistic)	0.000000		

Additionally, table 4 shows that the elasticity between air freight and trade in manufactures differs between the routes. As the difference is not very large, the Wald test was applied to see whether the difference between the coefficients $\gamma_{2,1}$ and $\gamma_{2,2}$ is significantly different from zero. However, the null hypothesis ($\gamma_{2,1} = \gamma_{2,2}$) can neither be rejected nor accepted, which is why it was decided that for the analysis it is assumed that coefficients for both routes are

not the same. Moreover, the difference in the elasticity can be explained by the fact that the percentage of high valued goods in the exports of manufactures from Europe to Asia is higher than in exports of manufactures from Asia to Europe. As especially high-valued goods are transported by air, it is thus likely that the elasticity between air freight and trade in manufactures is higher on the route between Europe and Asia than on the return route.

Figure 10 and 11 show the actual values of air freight and the fitted values calculated with the disaggregate model. Especially on the route from Asia to Europe/CIS there is still room for improvement in the model. In general, we see that the model fit on route level is not as good as on world level. The problem on route level is that not necessarily all goods categories belonging to the manufactures are transported by air. Goods as for example paper, iron and steel and fertilizers are transported rather by sea than by air. In contrast to the route level, on the aggregated world level, routes where a high percentage of trade in manufactures is transported by air were aggregated with routes where the percentage is relatively small. However, on route level we do not have this compensation. To get more accurate results the next step would be to not only look at the trade in manufactures on the routes but also to analyse the specific configuration of air freight on those routes, to eventually be able to find a better proxy for trade than that of trade in manufactures.

Figure 10: Actual and Fitted Air Freight Values for Europe/CIS – Asia

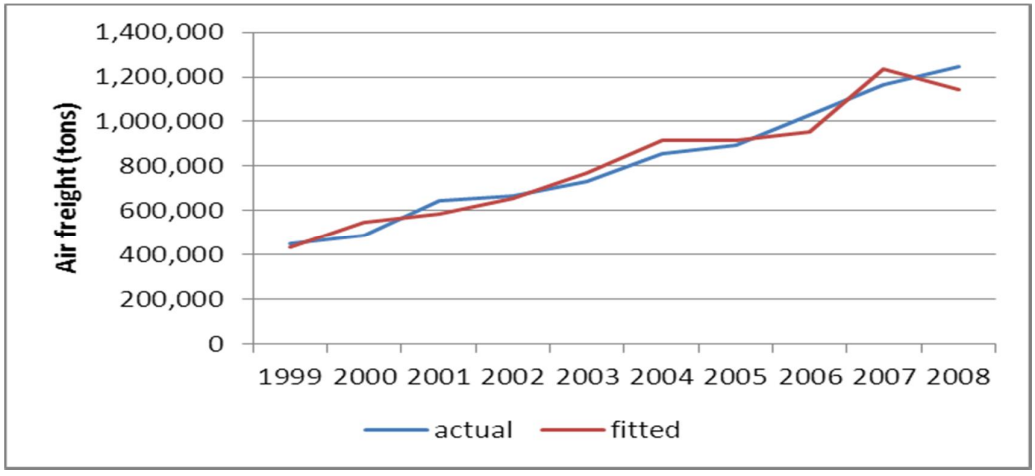
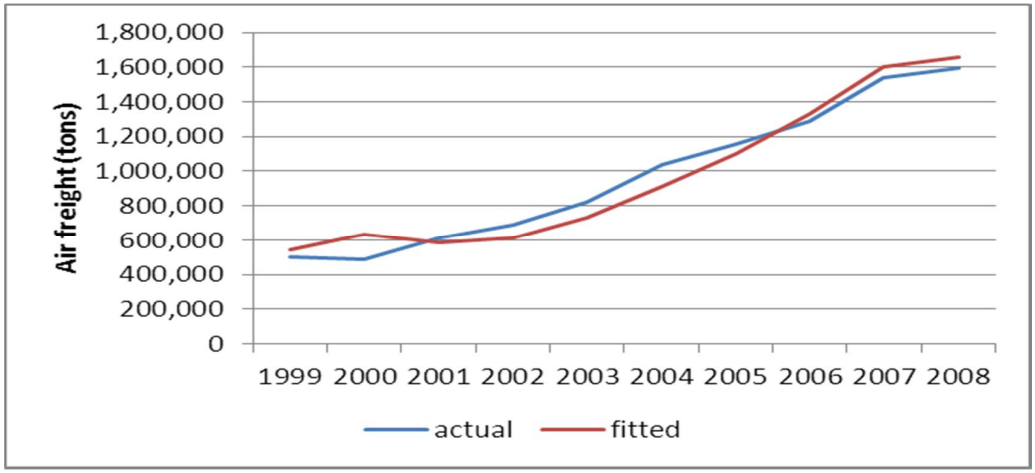


Figure 11 – Actual and Fitted Air Freight Values for Asia – Europe/CIS



5. SUMMARY AND CONCLUSIONS

Air freight transport has developed very rapidly over the last decade. While previously, air cargo was regarded as a by-product of passenger transport, a lot of traditional carriers consider it now as an instrument that adds positively to the ultimate goal of profit maximization. In addition, a number of carriers and airports became specialists in the air cargo market. Their success or failure depends on a number of factors. The future evolution of world merchandise trade is crucial and especially the trade in high value goods needs close monitoring. Special attention should be paid to the imbalances on trade routes, which results in imbalances between incoming and outgoing cargo flows.

The disaggregated analysis for the routes between Europe/CIS and Asia shows a strong positive relationship between air freight and trade in manufactures in both directions. The elasticity between air freight and trade, however, was found to be higher on the route from Europe to Asia than on the return route. However, the problem on route level that was encountered is that not necessarily all goods categories belonging to the manufactures are transported by air. Goods as for example paper, iron and steel and fertilizers are transported rather by sea than by air. In contrast to the route level, on the aggregated world level, routes where a high percentage of trade in manufactures is transported by air were aggregated with routes where the percentage is relatively small. On route level, on the other hand, we do not have this compensation. Therefore, in a next step, it would be interesting to look at the specific commodities shipped by air freight on route level, in order to study the relationship between the trade in those specific goods and the air freight

volumes on a certain route. In addition, the disaggregated analysis should be carried out for other routes that are important for air freight, e.g. the routes between North America and Asia and those between North America and Europe/CIS. Moreover, further research should include the fact that air cargo carriers often fly in triangles in order to improve their average load factor.

Furthermore, it should be mentioned that the analysis in this paper has been focused on the demand side of air freight. A change in demand can, however, also have repercussions on the supply side of air transport. To have a better understanding of the commercial side of the air transport business an in-depth analysis of individual carriers at business economic level should be carried out, e.g. on the way cargo yield and profitability are influenced by changes in demand and supply for air cargo.

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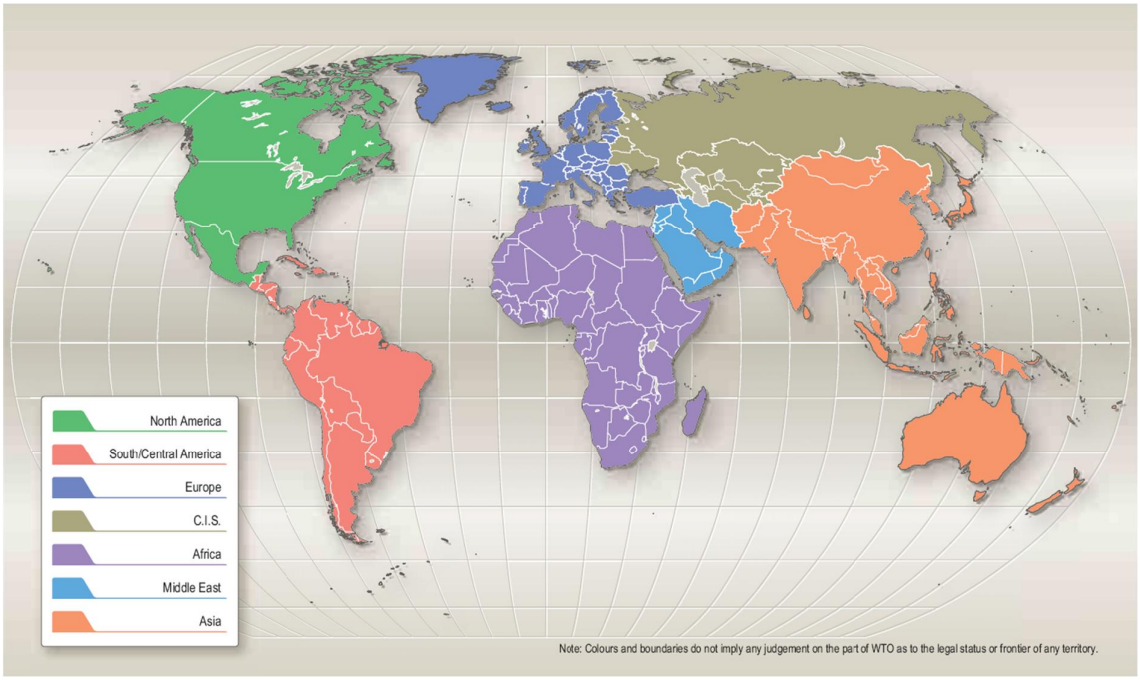
Annex - Definition of Regions according to the WTO

An example for 2008:



See also for the definitions of the regions: http://www.wto.org/english/res_e/statis_e/its2009_e/its09_metadata_e.pdf

Source: World Trade Organization, 2009, p.239.

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

[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

[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.

[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

[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:

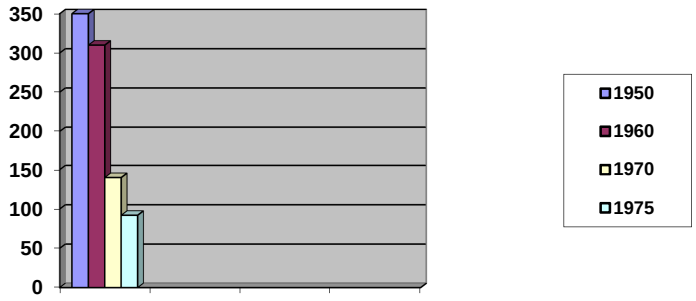
a) there would be a policy to encourage mergers and acquisitions, to reduce the number of carriers;

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.

[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

[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

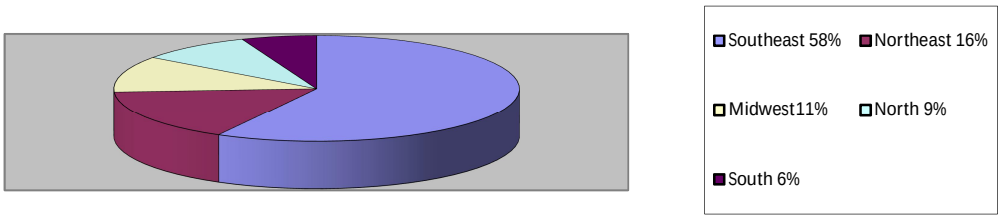
Airport	City	Passenger Flow (through November 2009)	Percent of National Total
André Franco Montoro/Guarulhos International	São Paulo	7,642,894	64.37%
Galeão/Tom Jobim International	Rio de Janeiro	2,353,368	19.82%
Juscelino Kubitschek International	Brasília	145,339	1.22%
Santos Dumont	Rio de Janeiro	166	0.001%
Congonhas Internation	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)

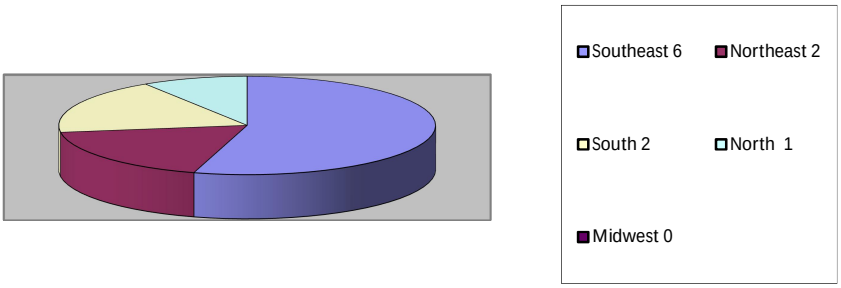
Another important aspect is the cost of jet fuel at regional airports. According to the International Air Transport Association (IATA), this input accounts for between 20% and 40% of total airline operating expenses, the second largest expense item after payroll. In Brazil, the Southeast region contains 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



Source: Petrobras, cited in Fregnani et al (2008)

Figure 3: Regional Distribution of Refineries in Brazil



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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WHAT PRODUCT FACTORS ALLOW AIRLINES TO COMMAND A PRICE PREMIUM IN THE SYDNEY-LOS ANGELES MARKET?

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Abstract

Recent changes to the competitive environment in the highly contested Sydney to Los Angeles market have impacted the route profitability of almost 20 carriers. In particular the commencement of non-stop services by Delta Airlines and V Australia has impacted route profitability of almost 20 carriers. This paper investigates the product factors that enable airlines to command a price premium the Sydney to Los Angeles market. A sample of business and economy class net fare quotes, in addition to data collected on seven product factors is used in this study to estimate the relationship between price and product. The regression results show that service quality, space, connectivity and alliance membership all have a positive influence on price in this particular market. In a practical setting, the research outcomes are particularly relevant to the areas of Airline Pricing & Yield Management, Airline Strategy, Airline Marketing and Product Planning.

Keywords: Price, product, airline competition, Sydney to Los Angeles

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1. INTRODUCTION

Recent changes in the global economic environment have led to weakened air travel demand and consequently, airlines are faced with excess capacity during the downturn in the business cycle (Levenstein and Suslow, 2002). Consumers are becoming increasingly sensitive to airline ticket price and therefore, a study of passenger willingness-to-pay for product attributes is beneficial but also necessary. Pricing is an important part of airline management as airline economics is driven by yield, unit cost and load factor. Price is a key factor that affects a passenger's propensity to use air transportation as a means of travel and plays an important role in the choice of airline itinerary (Garrow et al., 2007). Product planning is also an important part of airline management. The homogeneous nature of the perceived product on offer forces the innovative carriers to product differentiate in order to sustain competitive advantage (Doganis, 2002).

This paper uses the Sydney to Los Angeles (SYD-LAX) market to study the relationship between *price* and *product*. The duopoly between Qantas and United Airlines which existed for several decades has now ended. V Australia and Delta Airlines both entered the market with non-stop services in 2009, bringing the total number of carriers offering net fares in the SYD-LAX market to almost 20. Such a study adds value to airline planning particularly in commercial areas such as network planning, schedules planning, revenue management and strategic alliances.

2. THEORETICAL CONTEXT

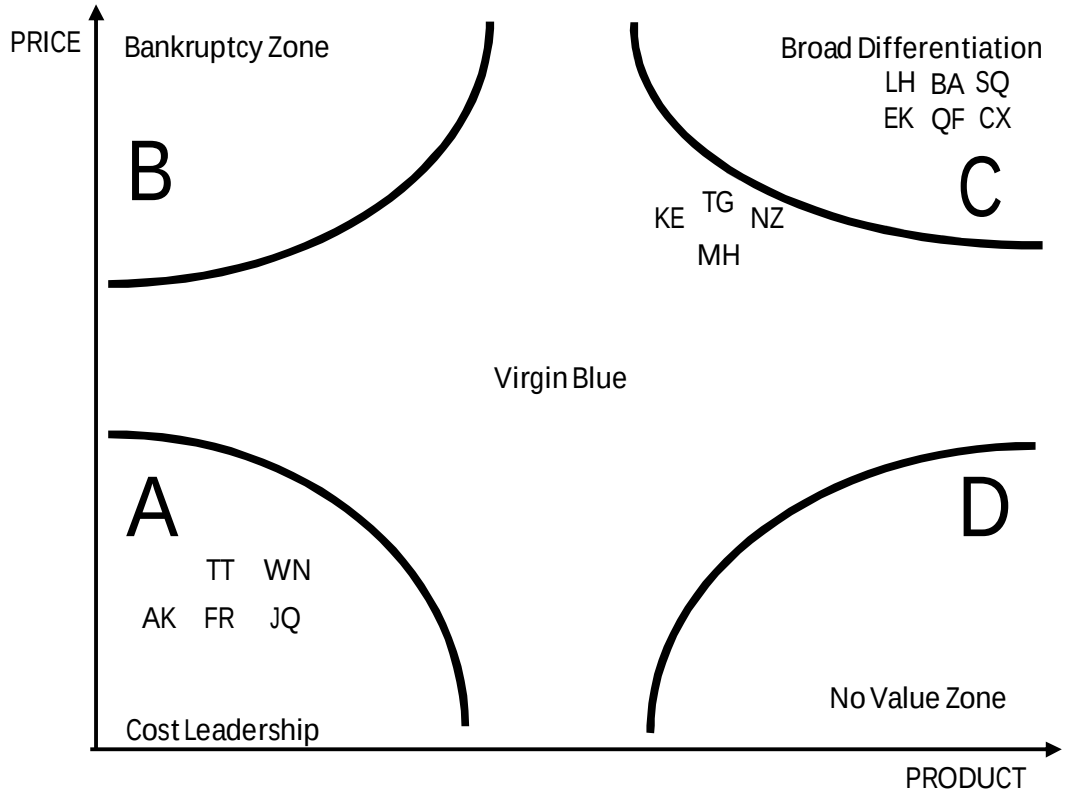
Few studies have explored the area of passenger willingness to pay for airline product attributes (Garrow et al., 2007). Indeed, the factors affecting consumer willingness to pay have become more complex and dynamic over time (Allsopp, 2005). According to Martin et al. (2008) many airlines are asking themselves the question: Which attributes really do matter to specific classes of passengers? Also, what price premium are passengers willing to pay for different products? Table 1 provides a summary of previous studies that have analysed airline product attributes. Attributes have been grouped under four categories for easier reference. Passengers exhibit different degrees of willingness to pay, reflecting different price sensitivities. Passengers also have different expectations and preferences for product. Exploiting the heterogeneous nature of price elasticity and service level sensitivity, there is value in understanding the positioning of

carriers on the *Price vs. Product* map (Fig. 1). The revenue management product differentiation theorem states that each airline's product can be mapped on a graph which has price on one axis and service on the other (Pinchuk, 2002).

Table 1: Previous Studies incorporating Aspects of Airline Product Attributes

Literature	Service Quality	Comfort	Convenience	Image
Balcombe et al. (2009)	Meal Provision Entertainment	Seat Pitch		Punctuality Airport Lounges
Garrow et al. (2007)		Legroom Aircraft Type	Flight Time Stop Penalty	
Lee and Luengo-Prado (2004)			Frequency Non-Stop Dummy	OTP
Borenstein (1989; 1991)		Equipment	Frequency No. of Stops	
Harris and Emrich (2007)		Flight Capacity	Schedule Frequency	
Suzuki et al. (2001)	Service Quality		Trip Length Frequency of Service	Airline Network Size Safety Record
Morash and Ozment (1996)			Frequency of Service	OTP
Coldren et al. (2003)	Food Quality Crew Friendliness		Non-stop/Single Connect Time-of-Day Dummy	Code-share Dummy OTP
Proussaloglou and Koppelman (1995; 1999)	On-Board Amenities		Service Frequency Flight Schedule	FFP On-Time Reliability
Gimeno and Woo (1996)			Frequency	
Evans and Kessides (1994)			Direct Flight Dummy	No. of Routes Served
Abramowitz and Brown (1993)				Code-share Dummy On-Time Rating Safety Record
Toh and Hu (1990)	Service by Attendants Food & Beverage		Convenient Schedule	OTP FFP
Park (2007)	Meal Service IFE	Seat Space Legroom	Convenient Schedule Non-Stop Flight	OTP Safety Record
Mason (2008)	IFE Food	No. & Size of Cabins Seat Configuration		FFP Airport Lounges
Jou et al. (2008)	Entertainment Quality of Food/Drink	Seat Comfort	Number of Flights Convenient Schedule	Flight Safety FFP
Park et al. (2005)	Meal Service IFE	Seating Comfort Seat Space Legroom	Non-Stop Flight Convenient Schedule	Safety Record OTP FFP
Douglas (2005)		Seat Pitch Seat-Bed	Number of Stops Elapsed Journey Time	Alliance Membership Nationality
Doganis (2002)	On-Board Service IFE	Aircraft Type Individual Space Seat Pitch	Frequency Timings Connections	Punctuality Airline Lounges Safety Reputation
Shaw (2004)	In-Flight Service	Seat Pitch Seat Width	Frequency Timings	Punctuality FFP

Figure 1: Framework for Mapping Airline Price and Product Positioning



Note: The placement of airlines on the continuum in Fig. 1 is estimated and may not be accurate.

The aim of this paper is twofold:

1. To determine the product factors that enable airlines to command a price premium in business and economy class in the Sydney to Los Angeles market.
2. To gain an understanding of price and product positioning by mapping carriers on the graph outlined in Fig. 1.

3. DATA

3.1 PRICING DATA

Fare information was obtained from a leading Australian on-line travel distribution agency, travel.com.au. 12 pricing snapshots of business and economy class fares were collected between May and September 2009. Within each pricing snapshot, fare quotes for each individual carrier were noted; providing sufficient variability in the '*y*' dataset. As such, average

or representative fares are not used in this study as much valuable information pertaining to sample variation is lost under this approach. Fares were searched 2-3 weeks prior to departure for a travel period of 2-3 weeks. The following was observed during the data collection process:

- All-inclusive (fees, taxes and surcharges) return net fares.
- Lowest-restricted fares available.

3.2 PRODUCT DATA

This paper analyses the effect of seven product attributes on price. Table 2 outlines the product factors used in this study in addition to some relevant key features of the data.

Table 2: Key Features of the Data

Variable	Units	Key Features	Expected Sign
Price (Net Fare)	$AUD	Log or level form	Dep. variable
Service Quality	Skytrax rating	Score between 1-5	Positive
Individual Space	Square inches	Seat Pitch × Seat Width	Positive
Elapsed Journey Time	Minutes	SYD-LAX + LAX-SYD	Negative
Frequency	Flights/week	Weekly frequency	Positive
Connectivity	No. of Connections	No. of connections within 4 hours (MCT = 2 hour)	Positive
Alliance Membership	Yes/No	Dummy (discrete) variable	Positive
Code-sharing	Yes/No	Dummy (discrete) variable	Positive

4. METHODOLOGY

A hedonic regression technique was employed to determine the important product attributes in business and economy class, and their estimated impact on price. Although hedonic methods have been used in a range of industries including automobile, housing, information technology, medicine and university education, the application of hedonic approaches to the study of airfares is new to the airline industry (Good et al., 2008). Very few studies have employed the hedonic approach to estimate passenger valuations of different air travel characteristics (BTCE Report 80, 1992). However, some research employing hedonic models has been undertaken in the hotel industry to better understand the relationship between room rates and hotel amenities (Kuminoff et al., 2010), and such a study would yield similarly beneficial outcomes for airlines

searching for information on the determinants of price with respect to product-related attributes. The hedonic pricing framework is valuable to the aims of this study because:

(a) It assists in addressing changing dynamics in quality when new products enter the market (Good et al., 2008).
(b) The model identifies attributes that have a significant effect on price (Good et al., 2008).
(c) Passengers' marginal willingness-to-pay for a change in product attribute can be derived (Bajari et al., 2010).
(d) This method is particularly powerful as it helps an analyst understand the relationship between price and product under a highly competitive, product differentiated environment (Bajari et al., 2010).

4.1 DEPENDENT AND INDEPENDENT VARIABLE

The dependent variable is *Net Fare*. This has been chosen because the aim of this paper is to answer the key question: What product factors (independent variables) allow airlines to command a price premium (dependent variable) in the Sydney to Los Angeles market? The explanatory variables included in this study are: service quality rating, overall individual space, elapsed journey time, frequency, connectivity, alliance membership and code-share.

4.2 FUNCTIONAL FORM SPECIFICATION

Table 3 outlines different functional form specifications that were considered in this study. The *Log-Level* specification was chosen for this study. Specifying the dependent variable in *Log Form* results in interpreting percentage changes in *y* (it is more meaningful to interpret a percentage change in price as opposed to a fixed change). Specifying the independent variables in *Level Form* facilitates the interpretation of parameter estimates. This specification for *x* (unit changes) is easier to interpret than a log specification (interpreting percentage changes in *x*).

Table 3: Functional Form Specification

Options	Dependent	Independent	Interpretation
Level-level	y	x	$\Delta y = \beta_k \Delta x$
Level-log	y	$\log(x)$	$\Delta y = (\beta_k / 100)\%\Delta x$
Log-level	$\log(y)$	x	$\%\Delta y = (100\beta_k)\Delta x$
Log-log	$\log(y)$	$\log(x)$	$\%\Delta y = \beta_k \%\Delta x$

4.3 MODEL FORMULATION

Table 4 outlines the variables in the regression model, their notations and corresponding coefficient estimates. The formulated model is shown below.

$$\log(NF) = \alpha_0 + \alpha_1 SQR + \beta_1 OIS + \gamma_1 EJT + \gamma_2 ASF + \gamma_3 CON + \delta_1 AAM + \delta_2 ACS + \varepsilon \qquad (1)$$

Table 4: Variables in regression model

Variable Name	Notation	Coefficient
Net Fare	NF	-
Constant Term	-	α_0
Service Quality Rating	SQR	α_1
Overall Individual Space	OIS	β_1
Elapsed Journey Time	EJT	γ_1
Airline Schedule Frequency	ASF	γ_2
Connectivity	CON	γ_3
Airline Alliance Membership	AAM	δ_1
Airline Code-Sharing	ACS	δ_2
Error Term	-	ε

4.4 KEY ASSUMPTIONS

1. The error term captures all other stochastic and unobserved factors (apart from the independent variables) affecting the determination of net fare.
2. Interpretations are assumed 'ceteris paribus'.

5. RESULTS & DISCUSSION

5.1 BUSINESS CLASS

An econometric RESET test on the model indicated presence of functional form misspecification. Scatter-plots were constructed (Figures 2-4) to better visualise patterns of non-linearity in the underlying data. Non-linear relationships are evident between *Price* and three independent variables (frequency, space and journey time). Quadratic functions were fitted to these independent variables to improve model fit.

Figure 2: Scatterplot of Price vs. Frequency

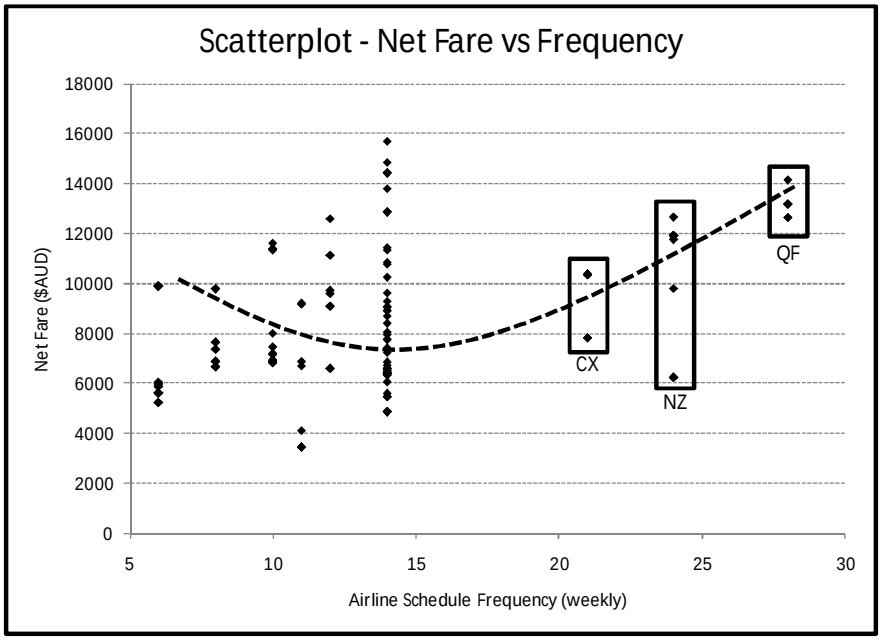


Figure 3: Scatterplot of Price vs. Space

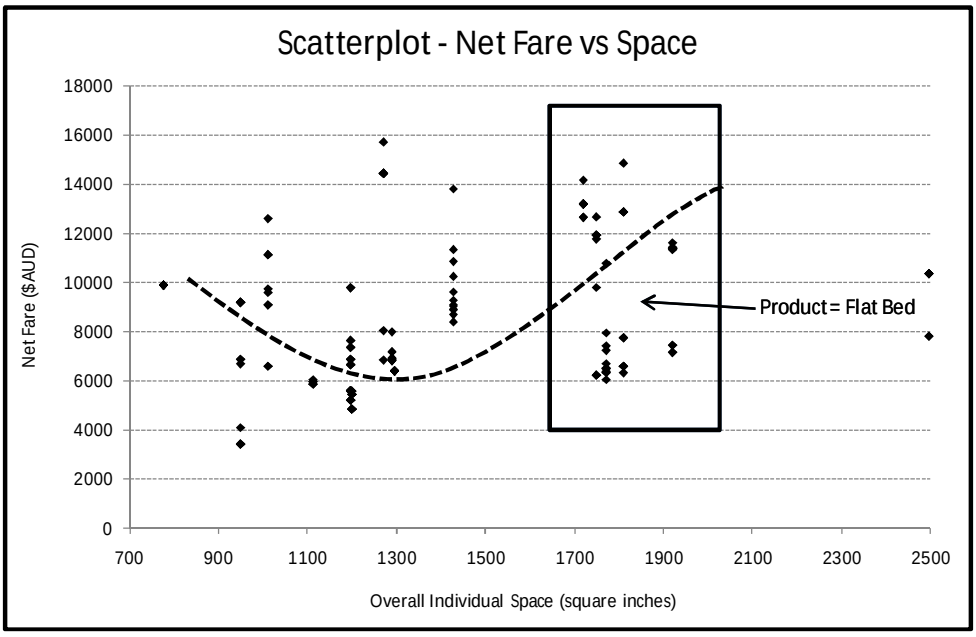
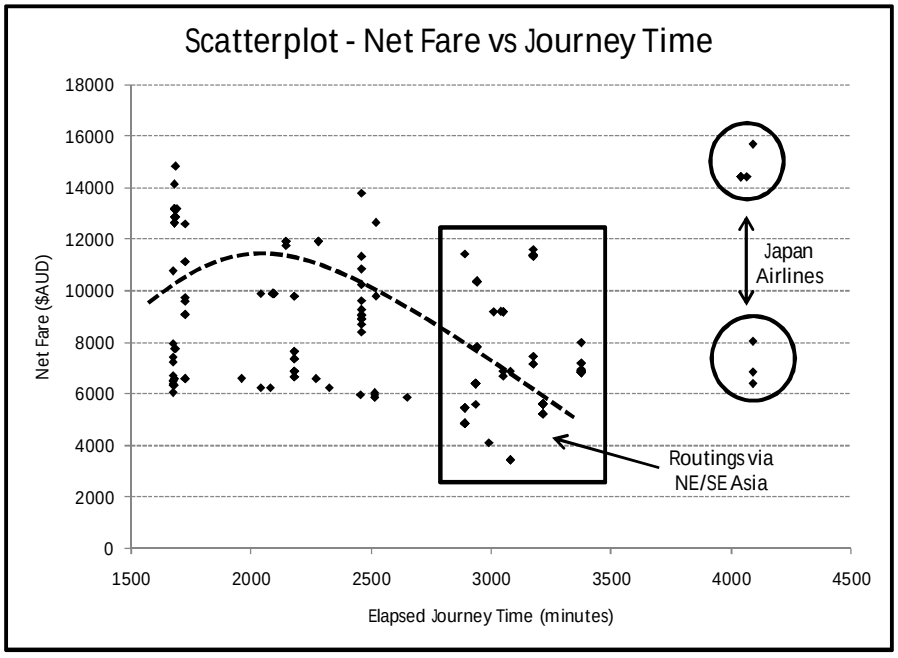


Figure 4: Scatterplot of Price vs. Journey time[4]



A revised model shown below contains the three adjustments in functional form for frequency, space and journey time. Results of the regression estimation for business class are presented in Table 5.

$$\log(NF)_{Business} = \alpha_0 + \alpha_1 SQR + \beta_1 OIS + \beta_2 OIS^2 + \gamma_1 EJT + \gamma_2 EJT^2 + \gamma_3 ASF + \gamma_4 ASF^2 + \gamma_5 CON + \delta_1 AAM + \delta_2 ACS + \varepsilon \quad (2)$$

Table 5: Business Class Regression Results

Variable	Coefficient	P-Value
SQR	0.6086***	0.000
OIS	-0.0005**	0.018
OIS^2	0.196E-06***	0.003
EJT	0.0015***	0.000
EJT^2	-0.369E-06***	0.000
ASF	-0.1069***	0.000
ASF^2	0.0025***	0.000
CON	0.0427***	0.000
AAM	0.1213**	0.011
ACS	-0.1372***	0.001
Constant	6.1933***	0.000

*** significant at 1%, ** significant at 5%.
Adjusted R^2 = 0.63, F-statistic = 29.7. Log (NF) is the dependent variable; sample size = 171.

[4] JL journey time excessive as overnight in Tokyo is required on outbound journey. After conducting a sensitivity analysis these outliers were removed.

The results show that service quality has a positive association with price. The managerial impacts that flow from this outcome are relevant to both commercial and operational divisions of an airline. Carriers who are recipients of global airline service quality awards should develop marketing initiatives in order to promote awareness. This can increase the proportion of higher yielding traffic (prepared to pay higher premiums for better service) carried by an airline. The results are relevant to operational areas such as cabin crew service delivery training.

The return on investment is positive when the product transitions from a reclining seat into a flat-bed, highlighting the importance of space in business class in a long-haul market. However, cost-benefit analysis is also necessary when evaluating seating plan reconfigurations, weighing up the predicted revenue gain against the costs of carrying out such projects. The results point to a negative association between price and journey time. This shows that carrier pricing ability suffers significantly as elapsed travel time increases in a long-haul market. A positively increasing function is observed between price and frequency. More specifically, pricing ability improves significantly with a double-daily frequency, indicating that convenience is an important factor in long-haul business class air travel. Especially in dense long-haul markets such as Sydney to Los Angeles and Hong Kong to London, the competition is such that daily frequencies are required to appeal to business class traffic.

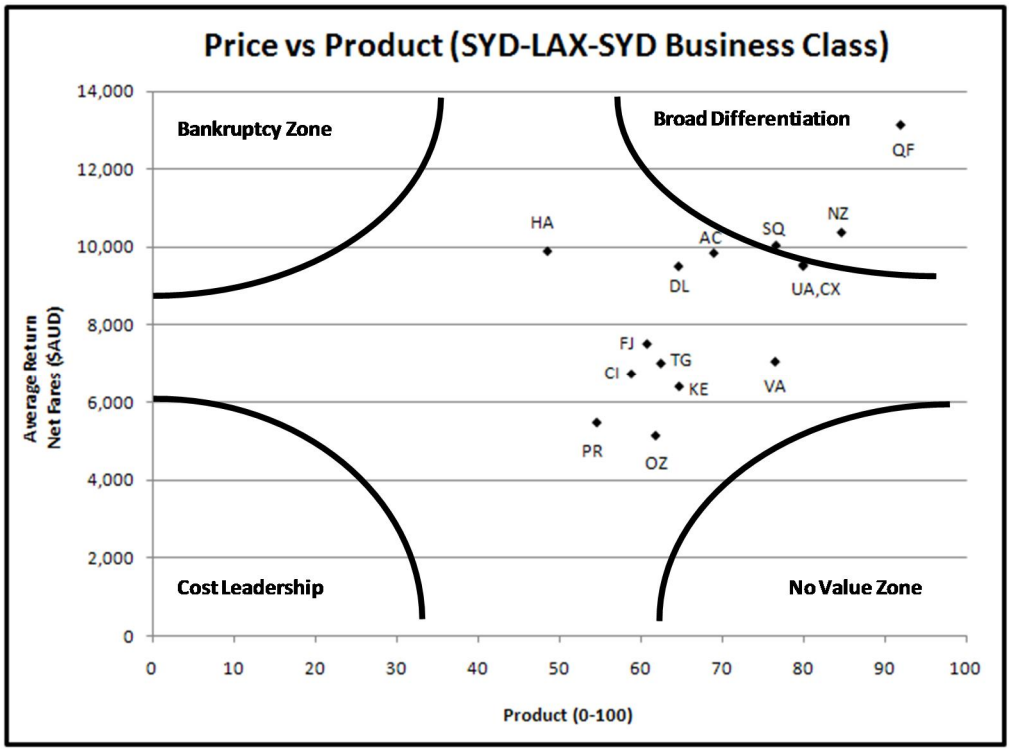
Connectivity has a positive influence on price. These results are particularly relevant to airline network planning, as morning arrivals into Los Angeles are the most attractive because connections to all parts of the US are maximised. Afternoon arrivals into Los Angeles are less attractive due to inconvenient connections (approx. five hours transit) to east coast destinations. Alliance membership has a positive effect on price. This makes sense, as interline connections (e.g. Qantas and American Airlines) between alliance carriers increase network coverage, thereby increasing passenger willingness-to-pay for a more extensive network offering. This finding is relevant to alliance carriers serving markets in which connectivity is important at both hub airports. Examples include the Hong Kong-London market (Cathay Pacific and British Airways of Oneworld) and the Bangkok-Frankfurt market (Thai Airways and Lufthansa of Star).

To gain understanding into the positioning of carriers on the *Price vs. Product* graph (Fig. 1), the following was carried out:

- Weightings: service quality (25%), comfort (35%), and convenience (40%).
- Product incorporates: service quality, space, journey time, frequency, connectivity.
- Each carrier's product specifications were converted into an index (base carrier = 100).
- The final score for *Product* was calculated by adding the service quality score, comfort score, and convenience score together.
- An average net fare was calculated for each carrier based on all pricing snapshot periods. *Price* is based on the result of this calculation.

Figure 5 provides an illustration of the relative positioning of carriers in terms of price and product offering in the Sydney to Los Angeles business class market.

Figure 5: Price and Product Positioning in the Sydney-Los Angeles Business Class Market



An understanding of Figure 5 is important from a strategic, competitive and operational perspective. The innovative carriers will shift towards the top right-hand-side, capturing price

premiums in return for a superior product; whilst those who fail to deliver on product enhancement will drift down and left as their product enters the 'decline' phase of the product life cycle and their fares reduce in order to re-capture market share lost to competitors. This framework can be used as a benchmarking tool, enabling carriers to visualise where competitors are. It can also assist carriers in leveraging core strengths and competencies. Operationally, shifting towards the 'broad differentiation' zone requires not only commercial input, but is also dependent on airline operations (e.g. crew training, airport lounges, catering).

5.2 ECONOMY CLASS

Multi-collinearity between the *x* variables can lead to higher standard errors and insignificant *t*-ratios. A relatively high correlation coefficient of 0.640 between frequency and alliance membership was found. As a result new variable was added to allow for an interaction effect between *ASF* and *AAM*. In addition, a quadratic function was applied to service quality as a simple scatterplot yielded a positively increasing non-linear relationship between *SQR* and price. A revised model shown below[5] contains the two adjustments outlined above. Results of the regression estimation for economy class are presented in Table 6.

$$\log(NF)_{Economy} = \alpha_0 + \alpha_1 SQR + \alpha_2 SQR^2 + \beta_1 OIS + \gamma_1 EJT + \gamma_2 ASF + \gamma_3 CON + \delta_1 AAM + \theta_1 ASF.AAM + \varepsilon \quad (3)$$

Table 6: Economy class regression results

Variable	Coefficient	P-Value
SQR	6.5182***	0.000
SQR^2	-0.9962***	0.000
OIS	0.00065	0.667
EJT	0.00038***	0.000
CON	-0.0232***	0.008
ASF	-0.0709***	0.000
AAM	-0.2325	0.197
ASFAAM	0.0614***	0.000
Constant	-3.5248	0.202

*** significant at 1%, ** significant at 5%.
Adjusted R^2 = 0.50, F-statistic = 22.5.
Log (NF) is the dependent variable; sample size = 175.

Consistent with the business class findings and with *a priori* expectations, service quality exerts a positive effect on price, suggesting that particularly in long-haul air travel passengers are

[5] *ACS* is not included in the final economy class model. Its inclusion causes several independent variables to be statistically insignificant, and also introduces functional form misspecification issues.

willing to pay a price premium for the expected return in better service. The results show that an increase in individual space is predicted to increase price. From an airline product planning perspective, understanding the effect of 'space' on passenger willingness-to-pay is important before the design or re-design of cabin seating configurations. As passenger preferences continue to change, it would be beneficial to analyse the relationship between price and legroom specifically for premium-economy class in future research.

Longer, more indirect routings are associated with higher price in economy class. This is partly due to the increase in costs (e.g. landing fees, ground-handling, catering) incurred on carriers for multi-stop itineraries. Furthermore, as most carriers have minimum yields, this has been factored into the calculation of fares on longer indirect travel itineraries (e.g. SYD-LAX via Seoul). Although a negative coefficient on connectivity is observed, when the sample size is reduced to the four non-stop carriers (Qantas, United, Delta, V Australia), the effect of connectivity on price becomes positive. Holding all other factors constant, carriers with good connectivity at Los Angeles are also predicted to be able to achieve higher load factors, thus improving the airline economics (both yields and loads) of the operation. The short-run effect of increasing frequency in the SYD-LAX economy class market is a drop in price. Due to the price-elastic nature of the leisure market, carriers who increase frequency also need to develop marketing and other forms of promotional initiatives to stimulate demand. Although its predicted effect on price may not be positive, the result is expected to be different if the model was run on a dense high frequency short-haul market such as Sydney to Melbourne. In line with the business class finding, alliance membership also exerts a positive effect on price in economy class.

Applying the same methodology as previously outlined in the business class section, Figure 6 plots the estimated positions of carriers on the *Price vs. Product* graph in economy class.

5.3 LIMITATIONS & POTENTIAL SHORTCOMINGS

The Sydney to Los Angeles market, with four non-stop carriers and several one-stop operators, can be described as an oligopoly. In such a setting, carriers need to take into account not only the products they and competitors are offering, but also their own and their competitors' ability to influence price. With price being endogenously determined in an oligopolistic framework,

competitor pricing should be included as a relevant explanatory variable (i.e. the pricing of one carrier is influenced by the pricing of others). However, there is justification for *not* including competitor pricing as an independent variable in this study. Table 7 illustrates this point further.

Figure 6: Price and product positioning in the Sydney-Los Angeles Economy Class Market

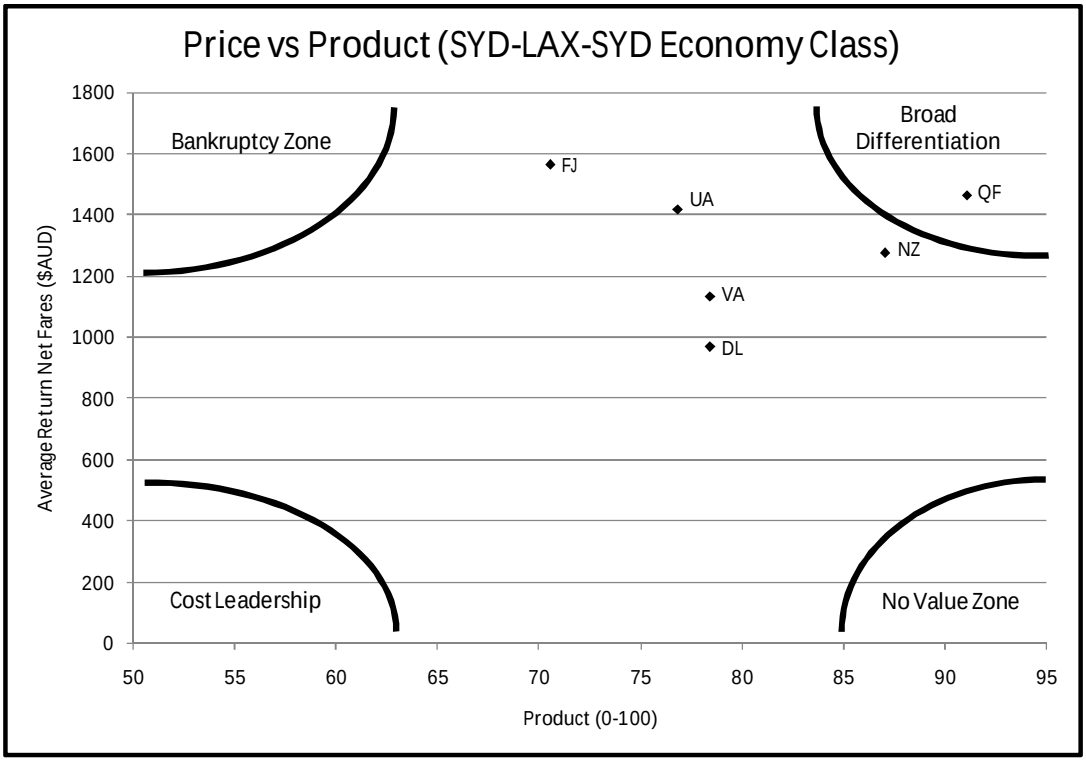


Table 7: The Sensitivity of a Carrier's Pricing to Competitor Pricing

		2. *Reaction* [effect on price]		
1. *Action* [price change]	Carrier Group	Non-Stop	One-Stop	One-Stop
	Non-Stop	Moderate	Moderate/Weak	Minimal
	One-Stop (via Pacific)	Moderate	Moderate	Minimal
	One-Stop (via Asia)	Minimal	Minimal	Minimal

Due to minimum yields (factored into the calculation of net fares for more indirect routings), a change in price by Airline X *does not* necessarily affect the price-setting of Airline Y in the SYD-LAX market. In other words, 'competitor pricing' as an explanatory variable (in some cases), has

minimal or nil impact on the dependent variable, justifying its exclusion in this study. Some limitations that arise as a result of this include:

(1) The model cannot be used to predict changes in an individual carrier's price resulting from a change in competitor pricing structure.
(2) The error term, *u*, which captures stochastic and unobserved effects affecting price, now contains minor deterministic element (as the direction of carrier reactions to competitor pricing activity are sometimes predictable).
(3) The hedonic regression models need adjusting (to include competitor pricing as an explanatory variable) if the study is repeated in an oligopolistic airline market such as SYD-AKL [all carriers operate non-stop] or SYD-LHR [all carriers operate min. 1-stop].

Some would argue that the omission of 'competitor pricing' as an explanatory variable would have a significant impact on the empirical results. However a practical example illustrates that in fact, in this study the impact does not change conclusions drawn. Following the entrance of Delta Airlines in the market in July 2009 which forced most non-stop rivals to reduce price (note that 3 and 9 pricing snapshots were obtained before and after DL entry respectively), two separate regressions were run to test the effect of an external shock on the model. Although the magnitude of some coefficients changed (journey time), the economic and statistical significance of the explanatory variables (individual and joint) remained relatively stable, reinforcing the model's ability to produce valid and reliable estimations of the relationship between product and price.

6. CONCLUSION

This study was conducted during a period of volatility and change in the airline industry. In 2009, the Sydney to Los Angeles market saw the arrival of two new non-stop carriers, challenging the two incumbents on the route. Most competing carriers were forced to evaluate pricing tactics and product strategies in the face of decreased demand and excess capacity.

This paper employed hedonic regression analysis to highlight the most important product factors in the Sydney to Los Angeles market and their estimated effect on price. In *business*

class, service quality, space, shorter journey time, frequency, connectivity and alliance membership, allow carriers to command higher pricing ability. In *economy* class, four product factors, service quality, space, connectivity and alliance membership, have a positive influence on price. The methodology developed is beneficial to the airline industry in two respects. Firstly, the modelling framework can be applied in future research, which is valuable following product innovation and change in competitive structure. Secondly, the regression models are valuable to airline management as they can be used to conduct 'what-if' analysis, formulating predictions of fares by adjusting aspects of the product offer. The examination of the *Price vs. Product* plot can be used as a benchmarking tool to understand the positioning of competitors and partners. It can also be used to assist airline strategic planning in the development business objectives, whilst encouraging revenue management to work more collaboratively with product planning.

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Appendix 1: IATA airline codes

Airline	Code
Qantas	QF
United Airlines	UA
Delta Airlines	DL
V Australia	VA
Air New Zealand	NZ
Air Pacific	FJ
Air Tahiti Nui	TN
Hawaiian Airlines	HA
Air Canada	AC
Cathay Pacific	CX
China Airlines	CI
Japan Airlines	JL
Korean Air	KE
Asiana Airlines	OZ
Singapore Airlines	SQ
Thai Airways	TG
Philippine Airlines	PR

AN INPUT OUTPUT MODEL TO QUANTIFY THE BENEFITS OF TOURIST AIRPORTS ON REGIONAL ECONOMY

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Abstract

Airports are widely recognized as having a considerable economic and social impact on their surrounding regions. These impacts go far beyond the direct impact of an airport's operation, extending also to the wider benefits that air service accessibility brings to regional business interests. Airports provide essential infrastructure to support regional social and economic growth. According to ACI, airports are major economic assets offering significant economic returns and benefits. A growing literature on this subject highlights the difficulties to calculate the effects of airports. This paper deals with the estimation of benefits of tourist airports on regional economy. The methodology approach is based on an input-output model that - estimates the key categories of effects from tourist airport operations. Conventional wisdom is to present a well-organized modeling framework, appropriate for planners, managers and decision makers in order to quantify the effects of tourism airports on regional economies. The application is a new airport on the island of Crete in Greece, one of the most attractive tourist destinations in southeast Mediterranean.

Keywords: tourist airport, economic effects, regional development

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1 INTRODUCTION

Airports are recognized as engines of economic and social development, by creating job opportunities and financial growth. According to ACI (1998) airports are major economic assets offering significant economic returns and benefits. Decisions made in respect of airports affect local regional and economic performance. Moreover, the impact of regional tourist airports is very vital due to the fact that there is a high interrelation between airports and tourism. Based on data from World Tourism Organization (UNWTO) and Euro statistics, it is concluded that many islands in the Mediterranean draw a considerable part of their income from the tourism industry, which in turn, is heavily dependent on the aviation industry. The relationship and the complexity between tourism and air transport have been an investigation area in many researches; in the research presented by Cooper *et* al. (2000) it is concluded that tourism is depended upon aviation industry and any changes in its efficiency is a significant counterpart of the region development.

This research measures the contribution of a new international tourist airport to the region, in terms of jobs and added economic value. The application is a new airport in the island of Crete in Greece (at Kastelli valley), which is one of the most popular tourist destinations in southeast Mediterranean.

The methodology is based on an econometric Input-Output model that measures three separate impacts: the Direct, the Indirect and the Induced. The Direct impact represents the employment and activity in the aviation sector. The Indirect impact includes the employment and activity supported down the supply chain to the aviation sector. Finally, the Induced impact, as mentioned by Britton *et* al. (2005), considers the employment and activity supported by the spending of those directly or indirectly employed in the aviation sector,. The airport's total economic impact is the sum of the direct, indirect, and induced effects. In addition, the study quantifies the net economic effects (e.g. on employment, incomes, etc.) resulting from the contribution of air transport to tourism (demand-side effects).

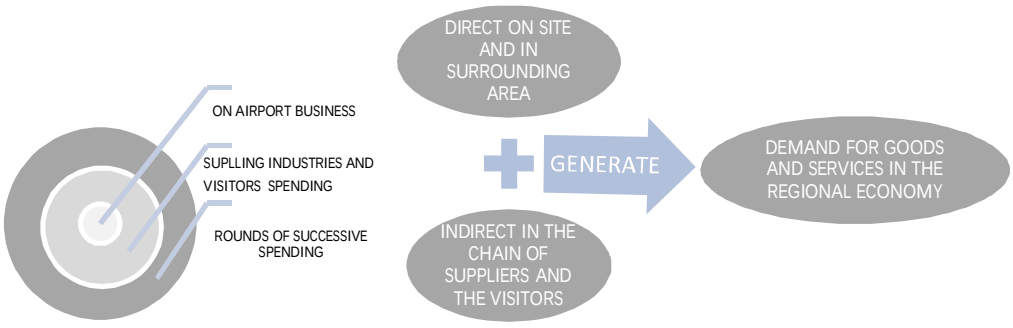
1.1 METHODOLOGICAL FRAMEWORK

The methodology is based on input output analysis. As Lynch (2000) highlights the most commonly used tool for studying the impact of transportation projects is the input-output model, because this model not only captures the direct effects of the project, but also captures all the secondary indirect and induced effects. According to Transportation

Research Board (TRB, 2008) report the method provides economic impacts in three categories: direct, indirect, and induced impacts. The sum of the three categories comprises the total economic impact of the airport studied. The induced economic impact category looked at the jobs lost should the airport(s) cease to exist. A more detailed description of each type of impact is as follows:

- Direct effects include employment and output generated directly by the airport and refer to the employment and revenues attributable to the commercial activities, which take place directly at the airport.
- Indirect effects represent employment and output generated by firms primarily off-airport, but whose activities are attributable to the airport. These impacts measure the purchase of goods and services by airport businesses from other firms, in terms of the employment and revenues related to the business activities resulting from their operations in support of airport operations.
- Induced effects are the multiplier effects caused by successive rounds of spending throughout the economy as a result of an airport's direct and indirect effects. These impacts estimate the increase in employment resulting from direct and indirect airport activities. The jobs sustained by the direct and indirect airport activities generate an increase in household income.
- The Total economic impact is the sum of the direct, indirect, and induced effects.

Figure 1: Distribution of Economic Impacts of an Airport



1.2 DESCRIPTION OF THE MODEL

1.2.1 The Equations

The Input Output model describes an economic system in which n industries (each producing a single commodity) interact with each other using, as inputs, the outputs of the n

industries. In its basic formulation the equilibrium equation of this model can be written in matrix form as:

$$(I-A)\ X=Y \qquad (1)$$

Where

I = n × n unit matrix

X = nonnegative vector of gross output of each production sector

Y = nonnegative vector of final demand

A= n × n nonnegative matrix of technological coefficients or the input- output matrix and

n= number of production sectors in which (I−A)−1 is referred to as the multiplier, or Leontief inverse matrix (Chiang e*t* al., 2005).

1.2.2 The Input Output Transaction Table

The monetary input output table shows the magnitude of transactions that occur between the different sectors of the economy and provides a useful overview of the economy structure. Augusztinovics (1995) recognizes that in this table the sum of every sectoral final output value equals with the sum of every sectoral value-added, which is called the gross national product. In general, some sectoral final output value may be unequal to this sectoral value-added. However, theoretically it is possible that all sectoral final output values equal their respective sectoral values-added. Lisheng (2010) notes that this is a kind of balance in the economic system between final output values and values added.

The model used a matrix of technical coefficients that was derived from the input-output table for the year 2005, drawn up by EUROSTAT (2008) for the economies of the European Union. The data used for updating the model consist of the input-output table for the reference year, including the import matrix, growth rate forecasts of value added per sector (agriculture, industry, services) and the forecasts of components of final demand (consumption, investments, exports and imports). The updated input-output table was estimated by a process of iteration that provides estimations on the intermediate consumption of imported goods and services, the structural composition of final demand by product, domestic production by product, and imports by product. The Transaction table for the region is presented in the Appendix.

1.2.3 The Technological Coefficient Matrix

The matrix (I-A)-1 which is the inverse of (I-A) in the case of n sectors is the Leontief matrix and is the key ingredient of the model. It is a representation of a country's (or a region's) economy and helps predict the effect of changes in one industry on others; in addition, it shows all the connections between the different branches of the economy. The rows of this matrix consist of the outputs that concern resources supplied by a given sector to each of the sectors of activity and to the final demand. The columns consist of the inputs from the different sectors.

The matrix of technical coefficients is created from the national INPUT–OUTPUT TABLE which shows the input and output structure of the Greek industries. The technical coefficients have been calculated from the values taken from the matrix of transactions divided by total production. The technical coefficients serve to provide indications on the technical structure of the economy. This shows which sectors have a high level of value added, productivity and exports. These coefficients summarize the induced effects. The matrix of technical coefficients for the region of Crete is calculated and presented in the Appendix.

The changes in the final demand because of the existence of the new airport are measured in terms of increased employment and increased output. Based on the multipliers per industry category, the total impact of the proposed airport on the region economy is estimated by multiplying the matrix by the changes in the final demand caused by the new airport.

2 MODELING APPLICATION IN THE NEW AIRTPORT OF CRETE (KASTELLI)

2.1 REGIONAL ECONOMY OF CRETE

The economy of Crete, which was mainly based on farming, began to change visibly during the 1970s. While an emphasis remains on farming and stock breeding, due to the climate and landscape of the island, there has been a drop in manufacturing and an observable expansion in its service industries (mainly tourism-related). All three sectors of the Cretan economy (agriculture, processing-packaging, tourist services) are directly connected and interdependent. The island has a per capita income close to Greek national average, while unemployment is fall behind of that of the country overall. The gross added value by

industry and the total employment of the area in comparison with the whole nation are presented below.

Table 1: Gross Value Added by Industry in million euros (current prices)

Industries	Agriculture, forestry, fishing	Industry including energy	Construction	Trade, household hotels and restaurants, transport	real estate, rents and business activities	Other services
GREECE	7,670	27,110	12,077	66,943	37,484	48,517
CRETA	755	827	616	3,261	1,655	2,636

Source: EL.STAT (2007)

Table 2: Total Employment by Industry in million Euros

Industries	Agriculture, forestry, fishing	Industry including energy	Construction	Trade, household hotels restaurants, transport	real estate, rents and business activities	Other services
GREECE	544,983	550,711	385,282	1,539,228	409,856	1,271,732
CRETA	49,072	19,982	24,653	98,255	18,076	60,901

Source: EL.STAT (2007)

2.2 TOURISM IN CRETE

Traditionally, Crete attracts a high number of tourists because of the climate, the coast along the Mediterranean, the spatial allocation of islands as well as the high number of archeological places. Crete is a faraway European destination (over 3.000 miles) from the countries that represent the main sources of tourist market. Thus, the transport participation in the total holiday package is high and depends on the time window the origin, and the final destination. Analyzing the volumes of Crete tourist market, the higher share is from European regions, representing more than 90% of total International Tourist Arrivals, diachronically.

The tourism in Crete is the most dynamically developing business sector. The tourist season lasts from April to October; the peak tourist months are July and August. Despite the economic downturn the long-term forecasts by the Greek National Tourism Organization (GNTO) and the Hellenic Institute of Tourism Research refer an average annual growth

around 3% due to 2020. The tourist business is based on partnerships of resorts with global tourist operators, promoting tourist services for summer holidays vacations. Last decades, widely applied business practice is developed based on policy named “all inclusive” where tour operators and resorts promote tourist packages including the whole chain of transport and accommodation services for the duration of holidays.

2.3 KEY FIGURES OF THE NEW AIRPORT AT KASTELLI VALLEY

Given the importance of Crete to the regional economy and the potential constraints on future growth associated with its facility limitations, there are focused planning efforts to ensure that the future aviation needs will be met. Crete is an important tourist destination not just in Greece but in the whole of Europe. The new airport will re-allocate aviation activities from the existing airport to new airport. Key objectives of this project are focused on three strategic issues: a) meet the Crete growing needs for air transport services; b) provide accessibility to new tourist market; and c) improve Heraklion airport’s role in European network providing opportunities to be a hub in an eastern Mediterranean region.

The existing airport is situated near an urban area, where many tourist facilities are located. According to national statistics, Heraklion city is the 4th most populated city in Greece (about 200.000 residents). Also, the Crete tourism facilities promote around 64,000 beds to serve tourism during the tourist season. Therefore, the Heraklion airport serves both business and leisure traffic, providing accessibility most big cities in Greece and airports accommodate charter airlines in Europe. Currently, 15 airlines currently operate from Heraklion City Airport, flying to 31 different destinations. The international passengers of Crete are travelling mainly during the summer period with charter flights that impose high peaks in various subsystems of the airport terminal. However, the major part of aviation market is reached by charter industry providing seasonal connections to Germany, United Kingdom, Italy, France, Russia, Scandinavia and Central Europe, which are the main areas of origin for the 90% of international tourist arrivals.

The 80% of total passenger traffic concerns the tourism season (May – October) and around 47% concerns the peak season extend from July to September each year. The nature of tourism and aviation business along with the seasonal nature of demand leads to growth of charter and seasonal flights to/from Heraklion airport, where more than 2 million passengers have been used charter flights in 2007 (Greek National Statistics, 2009). The existing

international airport of Heraklion (named Nikos Kazantzakis) is the second busiest airport in Greece after Athens International Airport. The international air transports represents the second international airport in Greece (3,927,292 in 2007) and has become overused during the peak holiday season, given that it receives more international charter flights during peak season than any other Greek hub.

The demand for air travel in the Greece is predicted to grow from the current levels by the year 2025. Failure to increase the airport capacity will have a negative impact on regional and national economic growth and international competitiveness. Taking into consideration that the existing airport has reached its capacity and that the tourist market and regional business are growing, the new airport is expected to meet the future needs. In addition, it will contribute significant to the tourist and aviation business in local, regional, national and European level.

The new airport will be almost twice as large as the existing one. It will be located in northwest part of Heraklion prefecture, close to the town of Kastelli. The new airport will be the primary commercial, serving the air transportation needs of the people and businesses in and around the island of Crete. The airport's auxiliary facilities and infrastructure will cover an area of 600 hectares with a runway length 3,800m, capable of handling aircrafts up to the size of A380 and two full parallel taxiways (4F Category). An additional area of 22 hectares (54 acres) will be reserved for commercial activity, in the south-west part of the new airport. In addition, a passenger (approximately 70,000 m^2) and a freight terminal (approximately 15,000m^2) will be included. The apron area will accommodate up to 44 airplanes.

Table 4: Traffic Key Figures for the Existing and the New Airport

	PAX in 30^{th} design hour	Aircraft Movements	Scenario
Existing Airport	3,000	200	Real Value
New Airport in 2015	3.500	302	Pessimistic
	3.750	322	Medium
	4.000	338	Optimistic
New Airport in 2025	4.250	354	Pessimistic
	5.000	388	Medium
	5.500	426	Optimistic

2.4 ASSESSMENT OF DIRECT ECONOMIC IMPACT

The direct impact is the employment and income generated by the direct operation of the airport. This is the most obvious economic impact, the most easily measured, and the most frequently quantified (Graham, 2008). The direct employment is depended on the volume of passenger traffic. This is equivalent to the number of employees per million passengers per year. The direct impacts are calculated based on observable and historical relationships between airport activity and changes in employment, considering the three areas that generate employment at the airport: the airlines related industry, the airport industries and the commercial related companies. The direct impacts are equal to the number of total staff on site and number of total jobs (both part time and seasonal jobs). According to ACI 2004 from the European airports, an average of 950 jobs is supported per million passengers, depending on the measures taken by airports to reduce costs and increase productivity (ACI, 2004). The new airport is estimated to support 4000 jobs and the output that will generate is estimated around 850 million Euros.

2.5 ASSESSMENT OF INDIRECT ECONOMIC IMPACT

The indirect impact is composed of the supplying industries and of the spending of air passenger visitors in the area serviced by the airport. The industries including transportation are estimated to create 1500 jobs, due to the existence of the airport, and an output of 45 million euros. Thousands of visitors arrive daily at the tourist destination of Crete. These visitors stay and spend money on hotels, shopping, entertainment, ground transportation and food. The total amount spent by air visitors is derived from the number of visitors that are attracted annually and the average expenditure they spend per night multiplied by days (EL.STAT, 2007). In particular:

Non residents tourist arrivals =2,135,198

Average spent per day =109 euro

Average days spent in Crete =15 days

Air passenger visitor spending = air passengers x average spent per day x days =>

Air passenger visitor spending = 2,135,198 x 15 x 109=3,491,048,730 euros

2.6 ASSESSMENT OF INDUCED ECONOMIC IMPACT

The circulation of direct and indirect impacts through the regional economy generates additional multiplier impacts associated with suppliers' additional earnings and wages.

Induced impact is the employment and income generated by the spending of incomes by the direct and indirect employees on local goods and services such as housing, transport, food, retail. Spending resulting from direct and indirect activities is spent again by the recipient employees and local businesses. Employees use their salaries and wages to purchase goods and services from other businesses. Businesses make their own purchases and hire employees, who also spend their salaries and wages throughout the local, regional, and state economies. Induced impact is an estimate of the recycling of euros through the economy, and is estimated using the impact multipliers.

3 RESULTS -TOTAL ECONOMIC IMPACT ON THE REGION

The following tables summarize the total economic impact that the airport will have on the region:

Table 4: Measures of Direct and Indirect Impact

Impact Measure	Direct Impact	Indirect Impact
Employment (FTE Jobs)	4000 jobs	1500 jobs
Output (million Euro)	850 million Euro	45 million
Value added (million Euro)	700 million Euro	23 million

Table 5: Total Direct Impact on the Region

Impact Measure	Direct Impacts	Multiplied Impacts	Total Impacts	% Creta	%Greece
Employment (Jobs)	4000 jobs	4096 jobs	8096 jobs	3.00%	0.18%
Output (million Euro)	850 million Euros	375 million Euros	1225mil. Euros	10.00%	0.50%
Value added (million Euro)	700 million Euros	210million Euros	910 mill. Euros	7.8%	0.38%

Table 6: Total Indirect and Induced Impact on the Region

Impact Measures	Indirect Impacts	Induced Impacts	Total Impacts	%Greta	%Greece
Employment (Jobs)	1500 jobs	605 jobs	2105 jobs	0.78%	0.04%
Output (million Euro)	45 million Euro	57 million Euro	102 mill. Euro	0.8%	0.04%
Value added (million Euro)	23 million Euro	37 million Euro	60 million Euro	0,51%	0.03%

*GDP of Greece (2008) =239.141 million EURO, *GDP of Crete (2008) =11.641million EURO,
*Total Employment Greece: 4.701.792 jobs, *Total Employment Crete: 270.939 jobs
Source:EL.STAT. (2007)

4 CONLUSIONS

The above results provide an instructive defensible picture of the economic and employment impacts that can arise from the development of the new airport. The new airport will be itself an industry that will generate jobs, earnings and great economic activity. The tourist airport will have a great profound impact on the economic prosperity of the state. It will facilitate tourism and encourage foreign investment and international trade.

As was calculated in the input output analysis approximately 4000 direct and 1500 indirect jobs are estimated to be supported inside the airport. The circulation of direct and indirect impacts through the regional economy will generate additional multiplier impacts associated with suppliers and additional earnings and wages. The application of the method suggested that these impacts will result in an additional 10.200 regional jobs and output of 970 million Euros in the region. The total value added of the airport on the Region of Crete will be 970 million Euros. Moreover, the air passenger visitor spending that was not included in the model approach is considered as an external variable. The total additional spending of the tourists in the region of the island of Crete is estimated to be 3.491.048.730 euro. This is equal with 1.5% of the GDP of Greece and 30% of the GDP of Crete; this result indicates the importance of tourism in Crete and the value that will be added if the capacity will be met in the future.

In addition to supporting the region's economy, Crete's New International airport will be itself an economic generator. Beyond the economic impact that is quantified in this report, the airport system will also provide essential qualitative benefits to the residents, businesses and visitors, who will also rely on the airport system for health, welfare, and safety needs. These impact assessments will be used for a number of purposes in order to promote understanding of the Great economic and social role of a regional tourist airport and its development from the decision makers and stakeholders and use them as a tool in order to examine investments, approaches to airport development and planning policies.

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APPENDIX A: The Input Output Transaction Table with the 16 Sectors for the Region

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	OUTPUT
A	1748	2	0	90	0	0	89	392	25	0	32	0	174	1	2	0	13645
B	0	54	0	0	0	0	0	74	4	0	1	0	0	0	0	0	1 134
C	4	0	17	0	0	611	7	13	1	0	5	0	0	0	0	0	796
D	8	23	0	637	1	1	458	218	15	1	18	29	2	10	2	0	7897
E	111	0	30	121	495	55	808	578	84	42	48	124	11	89	21	0	6 111
F	11	0	12	32	19	3	153	105	47	45	1588	351	28	80	1	0	26 526
G	893	64	27	415	144	2 294	1032	1746	562	40	85	664	160	791	31	0	38264
H	0	0	0	6	1	1	13	0	263	4	4	49	0	9	265	0	20 474
I	32	9	25	22	14	95	1647	6	521	41	49	443	7	12	40	0	20587
J	299	19	14	68	133	272	1756	253	134	334	382	545	43	85	55	0	9 935
K	0	0	17	103	23	345	1664	235	93	88	96	232	10	124	71	0	22 881
L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21 239
M	0	0	0	0	0	0	0	0	2	6	0	26	5	33	0	0	11 283
N	5	0	0	0	0	0	0	0	6	39	2	140	0	58	0	0	11 989
O	0	0	0	0	0	0	0	31	14	0	0	0	0	7	5	0	3 306
P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 317
Total	4 566	283	286	2132	2 140	13 678	13848	8 447	10 275	2 035	2 723	6 310	1 033	3 917	622		361 134
Taxes	24	36	31	133	158	1 342	921	449	1087	220	83	501	70	326	36		20 195
Total intermediate consumption	4591	320	317	2265	2 299	15 021	14769	8 897	11362	2 254	2 806	6 811	1 102	4 243	659	0	381 330
Value added	7627	727	377	1828	3 665	11 136	29807	11 577	8739	7 052	20 074	14 338	10 148	7 690	2 647	1 317	
Output	12218	1 047	695	4093	5 965	26 157	44576	20 474	20101	9 306	22 881	21 149	11 250	11 933	3 306	1 317	
Imports	1427	87	102	3804	147	369	0		486	629		90	33	55			
Total Input	13645	1 134	796	7897	6 111	26 526	44576	20 474	20587	9 935	22 881	21 239	11 283	11 989	3 306	1 317	

Source:Eurostat 2005

A:Agriculture, B:Fishing, C:Mining, D:Manufacture, E:Electricity, F: Construction, G: Trade, H: Hotels and Restaurants, I: Transportation, G: Financial intermediation services, K: Real Estate, L:Public administration and defense, M:Education, N:Health, O:Other services, P: Private Households with employed

APPENDIX B: The Inverse Matrix of the Technical Coefficients in the Region

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
A	1.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B	0.00	1.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C	0.00	0.00	1.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D	0.08	0.01	0.09	0.00	0.05	0.24	0.04	0.1	0.07	0.01	0.03	0.04	0.02	0.1	0.03	0.00
E	0.02	0.00	0.10	1.13	1.09	0.01	0.01	0.04	0.01	0.01	0.01	0.02	0.00	0.01	0.01	0.00
F	0.00	0.00	0.05	0.03	0.01	1.00	0.01	0.01	0.00	0.01	0.03	0.01	0.00	0.01	0.01	0.00
G	0.10	0.04	0.07	0.01	0.03	0.12	1.04	0.10	0.04	0.00	0.02	0.05	0.02	0.08	0.02	0.00
H	0.00	0.00	0.00	0.11	0.00	0.00	0.00	1.00	0.00	0.03	0.00	0.00	0.00	0.00	0.02	0.00
I	0.01	0.07	0.04	0.00	0.01	0.03	0.09	0.02	1.12	1.06	0.03	0.05	0.00	0.01	0.02	0.00
J	0.03	0.02	0.03	0.02	0.02	0.05	0.06	0.04	0.02	0.14	0.03	0.04	0.01	0.01	0.03	0.00
K	0.02	0.01	0.07	0.03	0.03	0.07	0.10	0.06	0.07	0.00	1.11	0.06	0.02	0.03	0.13	0.00
L	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00
N	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	1.01	0.00	0.00
O	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.02	0.00	0.02	0.01	1.04	0.00
P	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00