A STUDY ON THE ECONOMIC IMPACT OF THE 2001 MADEIRA AIRPORT ENLARGEMENT

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RESUMO:

O alargamento do Aeroporto da Madeira em 2001 supunha-se catalisador da procura turística e capaz de reconverter o turismo madeirense e, assim, reforçar a dinâmica de desenvolvimento regional. Sete anos volvidos, importa avaliar os seus impactos, mormente no que respeita à criação de novas rotas turísticas e desenvolvimento da procura. Baseados em dados sobre fluxos de passageiros e procura turística, e recorrendo a um modelo econométrico simplificado, estimámos o impacto do alargamento em termos de procura e PIB. Os resultados mostram um crescimento moderado a partir de 2001, mas é de admitir que, sem ele, ter-se-ia assistido a um desempenho menos favorável. A metodologia proposta constitui, contudo, um ponto de partida na abordagem à problemática dos transportes em geral e da oferta de transporte aéreo no contexto do desenvolvimento regional em particular.

Códigos JEL: R1 e R4

ABSTRACT:

The expansion works at the Madeira Airport in 2001 were expected to foster tourist demand and to structurally change the tourism industry in Madeira, thereby reinforcing the dynamics of regional development. Seven years on, it is now important to assess the various areas where it impacted, namely with regards to the creation of new tourist destinations and the expansion of demand. Using data on passengers' travels and tourism demand, and making use of a simplified econometric model, we have estimated the impact of the expansion both in terms of demand and GDP. The results show a decreasing rate of growth from 2001 on, although a concession must be made to allow for the fact that, without the expansion, a not so favourable result might have emerged. The proposed methodology is, however, a starting point for the approach to the transport sector in general and the supply of air transport within the context of regional development in particular.

JEL codes: R1 e R4

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1 INTRODUCTION: TRANSPORT COSTS, ACCESSIBILITY AND MOBILITY IN AN ISLAND CONTEXT

One of the most controversial transport policy issues in Portugal concerns the development of a new airport infrastructure in the Lisbon metropolitan area. The debate around the new airport infrastructure is centered on whether the Airport of Portela (the present Airport of Lisbon) is reaching saturation level or not. The supporters of further airport extensions and investments in new airports also point to significant employment increases as a key argument in favor of airport extensions given that air traffic is an important employment generator. Furthermore, the supporters of investments in new airports also remind the public and policy makers that such investments create thousands of news jobs in the construction industry, despite this being on a temporary basis. On islands, the expected increase in direct airport employment line of reasoning is secondary as the key argument in the political and academic debate on the potential economic benefits of major airport developments concerns the likely impact on the tourism industry.

Contrary to what is happening at Lisbon, one of the most consensual policy issues in Madeira concerns the economic significance of the Airport of Madeira. Airports are understood by almost all residents as a critical transport infrastructure on islands due to their remote and peripheral location and dependence on the tourism industry. More than everywhere else, the economic and social importance of an airport on an island lies in its role as an engine of increasing levels of mobility and induced economic growth as a result of higher levels of accessibility. However, despite the consensus in terms of the economic relevance of the Airport of Madeira, there is a lack of empirical studies relating to the subject under analysis.

In order to make a contribution to the scientific knowledge about the issue of the impact of airports located in a peripheral area, this paper analysis the recent evolution of the Airport of Madeira. This is a very appropriate topic to be analysed as a low cost carrier (easyJet) is to start a low cost flight between Funchal and Lisbon. The current airport performance in terms of take-offs and landings and passenger traffic is described and subjected to econometric estimation. The data available suggests that Airport of Madeira Administration must deal with moderate growth in terms of passenger traffic airport operations. Efforts to increase productivity and the expansion of existing routes should be taken into account as the main development goals in a foreseen future.

This paper is structured as follows. The second section discusses the necessary conditions that underlie the relationship between investments in transport infrastructure and economic development on islands. We argue that extra investment in airport infrastructure does not lead automatically to extra employment as islands economies are clearly dependent on a single economic engine, the tourism industry, and the social and economic dynamics at work on islands differs from the EU core regions model. The subsequent section provides a brief descriptive analysis of Madeira Island's economy with particular attention to the tourism industry. The penultimate section provides a detailed analysis of the recent evolution of the Airport of Madeira, in terms of traffic and operations at the airport in order to establish the likely impact of the 2001 airport extension. The closing section summarizes the paper's results and argues for further research on the subject.

2 AIR TRANSPORT AND ISLANDS' REGIONAL DEVELOPMENT: LIMITS TO THE TRADITIONAL STUDIES ON THE SUBJECT

There is little doubt that airports have a positive impact on regional economic welfare. Airports also play substantial roles in shaping the economic prospects of their surrounding regions. In fact, most studies suggest a positive relationship between high quality infrastructure and economic development, especially in affluent and economically advantaged regions. The recent studies on the subject still highlight the fact that top quality infrastructure are a necessary condition to foster the emergence of high tech sectors in large metropolitan areas (Sassen, 2001; Castels, 2001). Grimes (2000: pg. 14) states that "among the many factors which make urban locations attractive for new investment, and which make it difficult for rural areas to compete for such [high-tech] investment, are economies of scale associated with their size, access to a large pool of labor skills, to vital transport services, particularly frequent airline connections, and to information and telecommunications infrastructure". Gelhausen *et al.* (2008) also claims that European regions with airports and sufficient air services have better indicators in terms of social and economic development with lower unemployment, higher labor productivity and higher per-capita income.

A regional development agenda focused on high-tech-sectors is clearly unviable if not accompanied by an adequate supply of air travel services. Bruekner (2003) asserts that an inadequate offer of airline services is an obstacle to the development of larger urban areas as a whole and especially in terms of employment growth, the city attractiveness as a location of new business and the viability of existing firms in terms of R&D activities and access to external markets. Button *et al.* (1999) also relate the number of high-technology employment firms operating in metropolitan areas to the local airport size (based on the inclusion of a dummy variable indicating whether the area airport is one of the USA 56 largest on the econometric estimations). Both studies suggest that an international airport can be seen as a major economic engine and a critical factor to foster urban economic development, especially in the high tech sector. Brueckner (2003) computes a 0.9 per cent rise in employment for a 10 per cent increase in the passenger traffic variable, which means that traffic increase translates into higher employment at a 10:1 ratio. This is a very interesting ratio in terms of size. Klophaus (2008) also point to a very substantial multiplier effect as he claims that one million additional passengers per annum create between 500 and 1000 new jobs at German airports. Brueckner (2003), Button *et al.* (1999) and Grimes (2005) assert that higher frequency in terms of direct flights impacts the viability of high-tech clusters and research parks, a key goal of any urban regional development program. Concerning the causal mechanism shaping the impact of air traffic on economic growth it is argued that an increasing number of face-to-face contacts and social and economic interactions, which depends obviously on the number of direct flights available at low cost, condition the innovation potential and the viability of R&D projects.

Based on their extensive analysis of the link airports and economic growth Banister and Berechman (2001, pg. 211) and on islands economies features it is possible to conclude that:

- "buoyant local economic condition are more important than transport infrastructure improvements in terms of growth generation";

- the adjustment process within the regional economy following a transport investment is quite often a very slow, complex and long term one; the time span "over which the impacts are expected is a long one"; highly

desirable and expected changes such as new firms creation and labor market adjustments often take place years after the initial investment; from an island point of view;

- a good transport infrastructure is very important in terms o image and perception, which is particularly relevant issue on islands;

- it is almost impossible to assess the alternative course of the economic dynamics of a region if the investment was not made; however, it can be argued that, concerning island, an international airport is a sine qua non condition in terms of the economic viability of such regions even if such infrastructures are not used to its full potential;

- actors' expectations can significantly affect the consequences of a particular transport investment with respect to economic growth; for example, emerging entrepreneurs in the tourism sector might to pursue an investment strategy based on expectations about increasing levels of visitors.

Concerning islands, this paper claims that the nexus transport infrastructure & economic growth also involves a R&D dimension, as claimed by Brueckner (2003) and Button *et al.* (1999) but in a different way compared with other regions (Rallet and Torre, 1998). This paper is based on the hypothesis that the absence of critical mass in terms of information intensive firms limits the scope for travel demand induced by international collaborative projects and edge cutting research on the local firm's part. Thus we cannot expect a measurable share of the travel demand resulting from individuals traveling for business purposes (and R&D collaborative projects). Less favoured Regions (LFR) stereotype concerning R&D/innovation and economic development (an innovation adverse backward and isolated society and underdeveloped economy) for once matches the reality, even if Madeira is an example of a successful leap-frog in terms of GDP indicators (Rodriguez-Pose, 2001; Regional Government, 2000).

For the above reasons there are no reasons to apply a one size fits all approach to the analysis of likely impact. Firstly, the benefits of a new infrastructure in terms of travel time reduction and increased mobility are not questioned even in remote and peripheral regions, but the marginal impact in developed regions already favoured by high densities of infrastructure and under-developed regions is not obvious (Vickerman, 1996; Banister and Berechman, 2001). As stated by Banister and Berechman (2001: pg. 210); "in developed countries, where there is already a well-connected transport infrastructure network of a high quality, further investment in that infrastructure will not result on its own in economic growth".

Secondly, the causal mechanism between transport and economic growth is not evident. One may consider that it is transport infrastructure that leads to economic growth or, inversely, that it is additional economic growth that requires additional transport infrastructure. The historical correlation between GDP transport demand increases and between accessibility and social development indicators is unquestionable and the traditional economic line of reasoning is quite attractive. Concerning the impact of additional public investment in transport infrastructure in terms of economic growth, the economic rationale is the following one: further investment on transport infrastructure will induce additional private investment due to prospects of higher productivity and profitability based on credible expectations in terms of transport costs savings. As a consequence, extra economic growth should be expected. However, as shown by Banister and Berechman (2001) the likely impact of additional investments depend on 3 fundamental

conditions (economic externalities and economic dynamism, investment conditions and political factors), far from being satisfied in the islands economies context.

A further comment on the islands political economy issue is provided. Islands economies face challenges in terms of economic development as several development blocks work simultaneously to lessen the development potential of such regions. Firms operating on micro-islands cannot benefit from economies of agglomeration and there is no economic space for a larger number of firms. Another key development block in islands concerns the low level of market demand and lack of locally produced raw materials, which imposes a severe burden in terms of imports. As a consequence the production function is a trunked one by extra transportation costs and finite demand levels. As stated above, there is no economic space for a large number of industry sectors and firms, except on a few industries able to explore real comparative advantages. Given the multitude of development blocks at work on islands this paper is based on the premise that extra levels of accessibility would impact economic development via mitigation of the most adverse consequences of remoteness and insularity, as shown by Almeida (2008). More precisely, we hypothesize that extra flights at low costs can only overcome to a limited extent the lack of size (critical mass) factor and the economies of agglomeration problem "by facilitating easy face to-face contacts with [external firms] in other cities" and the economic valorization of tourism's raw materials (Brueckner, 2003: pg.1456). In the end, there are reasons to expect that all these development blocks affect in a unique way the likely impact of transport infrastructure on the economic development and development of entrepreneurial qualities on islands. However, due to reasons of lack of space, such issues are not going to be dealt with here in detail.

Islands development prospects are also impacted by core regions investments on infrastructures. Thus, we discuss briefly the likely impact of a new transport infrastructure in core regions to the extent to which lagged regions may be affected. Even if investments in transport infrastructure are quite easily justified by increasing levels of demand in core regions, such new investments add new competitive advantages to core regions at the expense of the remote ones. For that reason, Vickerman (1996) concluded in the 90s that the Trans European Network (TEN) would probably cause regional disparities within EU to rise, taking into account the core regions extra potential to attract new investments. Therefore, investments in transport infrastructure might not be instruments of social and economic cohesion, as it was alleged at the time. Concerning Less Favoured Regions (LFRs), there are reasons to suggest that additional transport investment intended to improve global accessibility between core regions and LFRs might, in fact, increase regional disparities (Vickerman *et al.*, 1999). Improved connections between core regions and LFR will reduce the 'natural' degree of protection allowed by distance and remoteness. Local monopolies operating in such regions might be challenged by the increased exposure to outside competition and in the end bankruptcies may follow (Almeida, 2008). However, it is a well established fact that an inadequate infrastructure both in quality and quantity might exclude (certainly excludes) any region from the economic competitive game (Vickerman *et al.*, 1999). Thus, from an island point of view, investment in transport infrastructure should be understood as a second order condition (a necessary condition but not a sufficient one) in terms of development and a starting point for a new development strategy based both on the up-grading of traditional competitive factors and on the development from scratch of new sectors. An airport is also a critical gateway to the incoming tourism for the region.

In conclusion, from an island point of view, it should be admitted that extra investments in airport facilities do not lead automatically to extra employment in the high-tech sector or flamboyant research parks and industrial districts. The positive impacts of an international airport are conditioned by multiple size effects (population, tourism demand, and firm density) and the simultaneous impact of multiple (economic, social, cultural) factors. The historical development dynamics of most islands should also be accounted for. As a consequence, for most micro islands, extra air travel services are a necessary condition for additional economic growth only for relatively higher levels of economic development and firms' density. However, airports are a critical infrastructure in most islands due to mobility reasons and individuals' well being. And for that reason, they deserve further attention as a dearth of scientific research on this subject is quite evident in this unique geographical setting.

3 BRIEF DESCRIPTIVE ANALYSIS OF MADEIRA ISLAND ECONOMY

Madeira's economy depends less and less upon the primary sector (2.2% in terms of added value) and gradually upon civil construction sector (3.4%), tourism industry (7.7%) and public administration (23.83%) (See Table 1 for further details). And it is well known that EU funds and to a lesser extent, national funds transfers are critical to foster the growth dynamics in most islands economies. As usually in the island context, services are overweighed, if compared with the EU average. Despite the evident challenges faced nowadays by the outermost regions, the present development strategy based on direct and indirect impacts of public investment and on the development of the tourism industry permitted a remarkable growth record in the Portuguese context (See Table 2). Much like the majority of the island economies, public investment is very important as an explanatory factor of economic growth, and such investment is quite often translated into high quality transport infrastructure (1). However, as suggested above, the classic development strategy pursued by most islands economies is under threat. The 'insular penalty factor' thesis (based on highlighting the alleged development blocks at work on islands) is not 'untouchable' anymore (Ferreira, 2000). Extra funding is now 'linked' to 'empirical evidence', which suggests the end of the exception regime as traditional assertions concerning specific development constraints are no longer accepted without proof. The EU Commission vision matches alternative theoretical accounts that suggest peripherality will increasingly become an "aspatial issue, necessitating fundamental changes to our concepts, models, indicators, and policy approaches" (Copus, 2001: pg. 539; see also Copus and Skuras, 2006). According to Copus and Skuras (2006: pg. 29) "aspatial peripherality is defined as a range of processes which are increasingly emerging to compound or distort the handicaps conventionally associated with remote locations". Most authors acknowledged that physical distance or travel/freight costs are decreasingly constraints to economic activity and quality of life in peripheral regions (Armstrong, 2004). As a consequence, the growth performance of LFRs should also be conceived as influenced "by the effects of poor utilization of new information and communications technology, or by inadequate networks linking local businesses, institutions and global sources of information or markets" (Copus and Skuras, 2006: pg. 79)

The tourism industry is a critical industry in an island context given the lack of natural resources, market potential and economic viability (of most investment projects). The tourism sector is the most important in terms of GDP, employment, added value and growth prospects, if we take into account all direct, indirect, induced and catalytic effects, and it is frequently the only really competitive economic sector in an island context. As a consequence the majority of islands economies pursue the tourism growth agenda.

TABLE 1

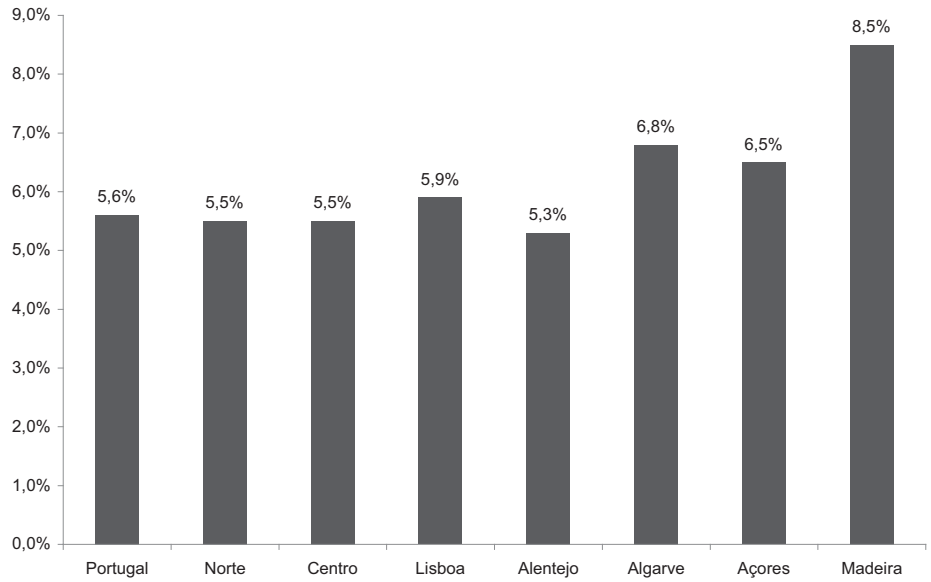
Added value by sector (2005, millions of euros)

Sector ownership structure	Total	Perc.
All sectors	3743	100.0%
A- Agriculture, hunting and forestry;	62	1.7%
B- Fishing	22	0.6%
C- Mining and quarrying;	14	0.4%
D- Manufacturing;	147	3.9%
E- Electricity, gas and water supply;	128	3.4%
F- Construction;	357	9.5%
G- Wholesale and sale trade; repair of motor vehicles, motorcycles and personal and household goods;	568	15.2%
H- Hotels and restaurants;	289	7.7%
I- Transport, storage and communications;	292	7.8%
J- Financial intermediation;	155	4.1%
K- Real estate, renting and business activities;	706	18.9%
LMNOP- Public administration; Education; Health and social work; Other community, social and personal services activities	815	21.8%

Source: DRE

FIGURE 1

Portuguese regions annual growth rate (1995-2006)



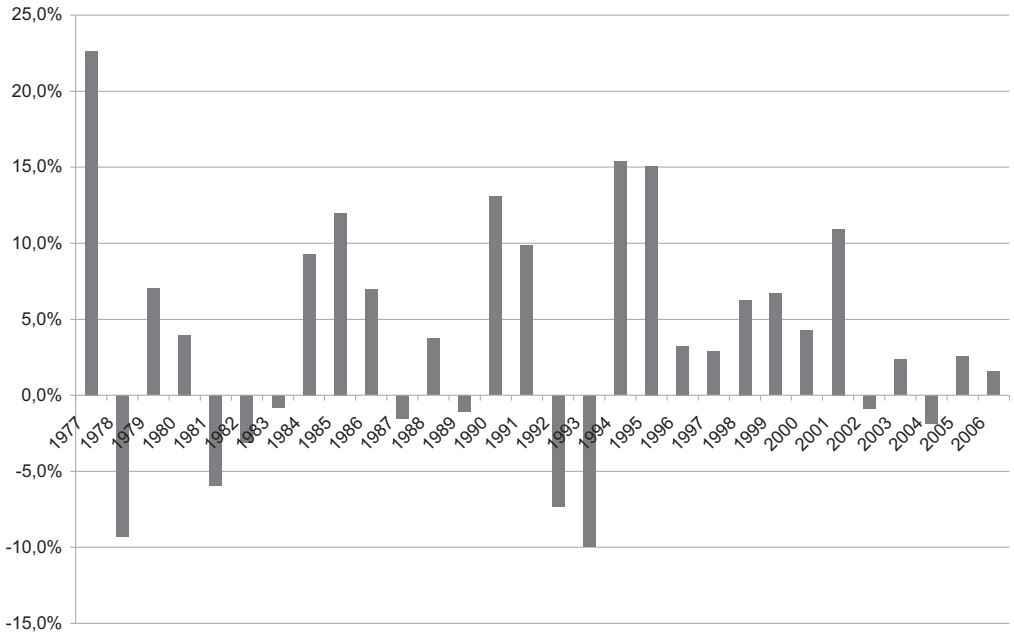
Source: INE

Figures concerning the tourism industry in Madeira (still) prompt those who are optimistic among readers and industry actors. The data in terms of arrival and overnights stays shows a continuous increase between 1976 an 2006 (compound annual grow rate of 6.1%), which points to the overall quality of Madeira as a tourism destination. However, figure 2 suggests besides a generally increasing trend in terms of arrivals and overnights stays, periods of crisis and increasingly negligible growth rates.

Figure 3 shows the low level of seasonality with a slight concentration in terms of arrivals between April and August. Figures related to the number of international visitor's shows the national market accounts for 24.8% of the total number of visitor and the international market accounts for 75.2%. In terms of accommodations, the international market accounts for 86.5% of the market and had experienced an increase (annual average rate) of 5%, slightly higher

FIGURE 2

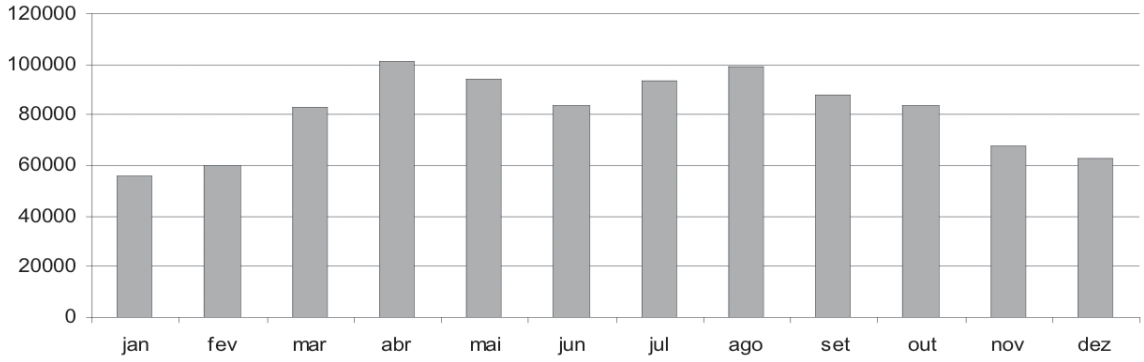
Annual growth rate: overnights (1976-2006)



Source: DRE

FIGURE 3

Arrivals 2007: seasonality levels



than the national market (3.9%). The Portuguese national average stay was 3.1 nights (data for 2007), while the international visitor stays on average 6.0 nights (data for 2007).

Given the critical importance of the tourism industry to the development prospects of island and the tourism industry dependence of the tourism sector on high quality air travel services, the overall strategic importance of Airport of Madeira is a well established fact.

4 THE AIRPORT OF MADEIRA: WHAT HAPPENS SINCE 2001?

For someone travelling to Madeira after an interregnum of 20 years, it is evident that Madeira Island is equipped nowadays with a modern and very suitable transport network. The Airport of Madeira symbolizes the public investment and financial effort aimed at improving the island transport network infrastructure. In terms of Madeira Island external accessibility, an exclusive use of the air mode of travel is the rule. As far as goods traffic is concerned, the maritime mode prevails, but air freight is becoming increasingly important. Where inter-island accessibility is concerned, the air and maritime transportation modes are equally important. However, inhabitants of Porto Santo prefer the air travel mode due to the time factor (a 20 minutes flight compared to a 2 hours maritime journey) and price factor (subsidised travel fares). Tourists prefer travelling by boat, obviously for leisure reasons.

Madeira Archipelago contains 2 international airports, the Airport of Funchal and Porto Santo. As the Airport of Funchal accounts for 94.5% of the Archipelago's passenger traffic, the Airport of Porto Santo is excluded from our analysis. Table 2 provides some key data concerning Funchal Airport. Table 3 summarises some indicators regarding the infrastructure. As can be seen, tourists (1,128,586) accounts for 46.8% of the total number of arrivals in 2007 (1,202,976).

The Airport of Funchal was enlarged and some basic facilities improved in 2001. That was the largest public enterprise of the last half century here in Madeira. Such an up-grade was aimed at allowing inter-continental flights and large body aircrafts to be received, without the need for a technical stop elsewhere. New connections and a new approach in terms of external tourism promotion (based on the alleged competitive reinforcement of the region) were envisaged at the time. Direct connections to non traditional destinations were now technically feasible and as a consequence increasing numbers of visitors were expected. And at the time, the Regional Government studied the eventual progressive liberalisation of the air travel market, but with a public service guarantee requirement. Due to the amount of improvements in terms of the airport infrastructure, the Regional Government understood that additional investments were not needed in the foreseeable future. In order to establish the ranking of the Airport of Madeira at national level, we analyze data provided by ANA, which places the Airport of Madeira in fourth place in terms of number of flights and also in fourth place in terms of passenger traffic.

Passenger traffic analysis will be now considered in order to assess the real impact of Madeira Airport in terms of individuals' mobility and the development of the tourism industry. Figures 4-7 and tables 4 and 5 present some information related to the extension and magnitude of passenger air traffic. Data concerning passenger traffic is analysed in terms of arrivals, departures, regular flights, charter flights, and passengers' nationality; an analysis of monthly number of take offs and landings for the period between 1980 and 2006 and a examination of annual data in terms of passenger arrivals, good traffic and mail is also provided. It can be said that these figures show a general increasing trend but also an increasing number of crisis events.

TABLE 2

Madeira's Airport: key figures

Funchal Airport characteristics	
Denomination	Aeroporto da Madeira
Airport Autority	ANAM Aeroportos e Navegação da Madeira, S.A.
ICA/IATACode	LPMA/FNC
Latitude / longitude	LAT 32 41 39 N LONG 96 46 41 W
Altitude	58.5 m / 192 FT
Temperature	22.4º C (Aug.)
Localisation	16 km from Funchal
Timetable	24 H
AFTN	LPMAYDYA
Freight terminal capacity	16,000 ton / year (2002)
Number of check in gates	40 (2002)
Luggage collection's systems	4 (2002)
Aircraft parking capacity	15 places for medium large body aircraft 11 places for medium large body aircrafts 2 places for large body aircrafts
Airports enlargement cost	530 millions euros
Number of runways	2
Lengths of runways	2781 m
Number of gates	16
Terminal area (m^2)	44590 m^2
Runways capacity (ATM/hour)	…
Terminal capacity (pax/hour)	3200 pax/hour
Number of airlines operating	More than 30

Source: ANAM

TABLE 3

Infrastructure indicators

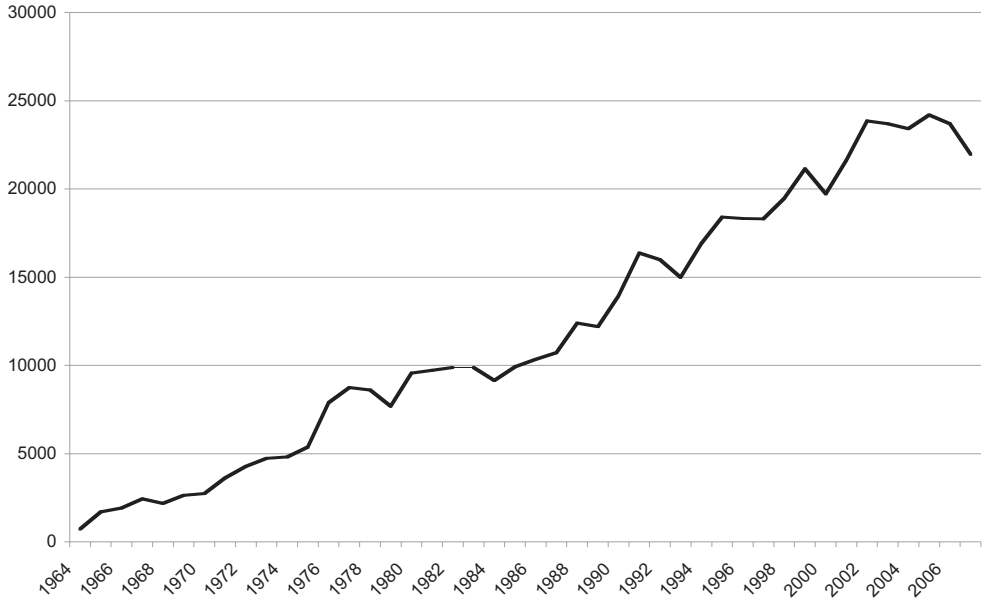
Goods and passenger traffic figures	**Figure**	**Year**
Airport passenger traffic	2,419,697	2007
Airport goods traffic (tons)	6,796.7 tons	2007
Demographic and geographic figures		
Area (km^2)	779 km^2	2007
Inhabitants	245	2007
Infrastructure figures		
Aircraft parking capacity	16	2007
Indicators		
Airport passenger traffic /Aircraft parking capacity	121,231	2007
Airport passenger traffic/ tourists arrivals	79.9%	2007

Source: ANAM

Figures 4 and 5 provide some data relative to the number of landings and take-offs. The compound annual growth rate relative to the total take-offs and landings is 8.3% per year for the period 1976-2007. However, a progressive decrease in terms of annual growth rate is evident for the entire period. For the 2000-2007 period a negligible growth rate of 0.6% per year is computed, compared to a figure of 4.1% for the 1990-2000 period. Thus, there are no reasons to suggest a high magnitude impact in terms of airport operations as a result of the airport extension in 2000.

FIGURE 4

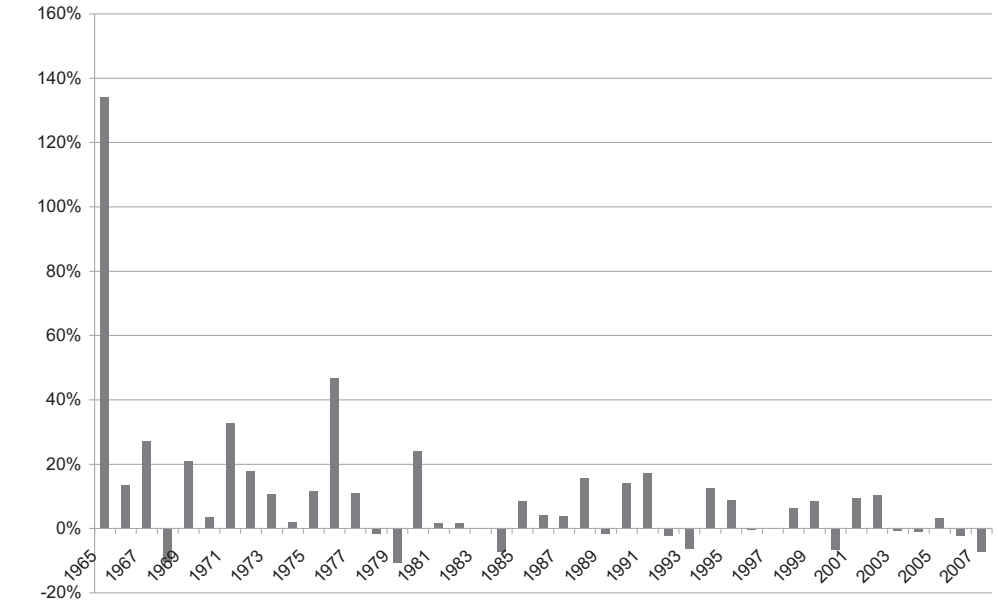
Evolution of take-offs/landings (1964-2007)



Source: ANAM

FIGURE 5

Take-offs/landings annual growth rate (1965-2007)



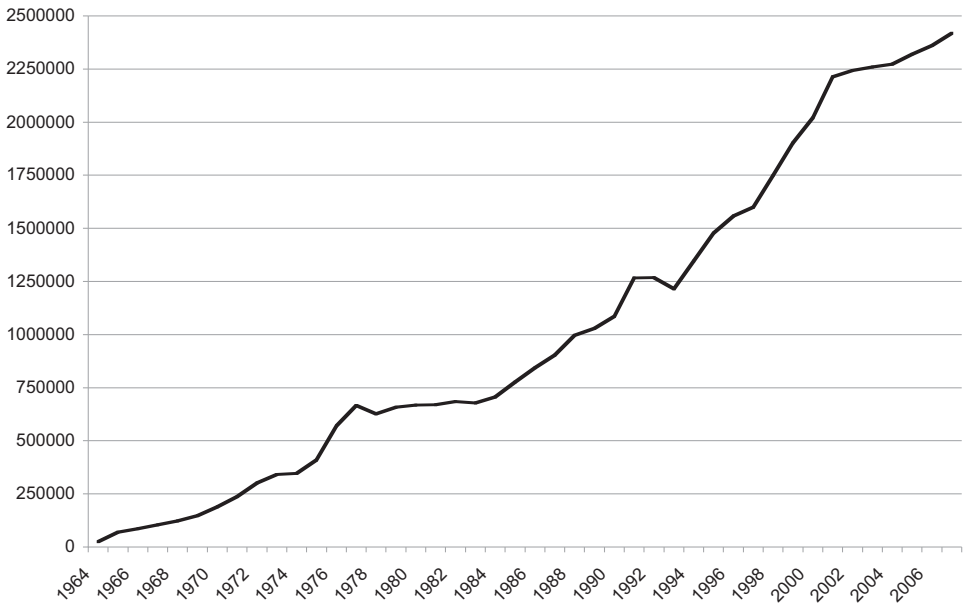
Source: ANAM

Figure 6 presents data relating to the number of passengers arriving at and departing from the Airport of Madeira. A compound annual growth rate of 11.2% per year for the period 1976-2007 is computed. Contrary to the figures computed for the operations at the Airport variable, the passenger traffic is still growing. However, a progressive decreasing annual growth rate is evident for the entire period. For the 2000-2007 period, a growth rate of 2.6% per year is also computed. The same figure for the 1990-2000 period is 6.4%. The figures computed in terms of tourist arrivals also suggest a slow-down for growth in arrivals: an annual growth rate of 5.4% for the 1990-2000 period and 3.2% for the 2000-2006 period. Both, the analysis of the passenger traffic and tourist arrivals variables suggest that the tourism industry is entering a phase of stagnation. However, as a result of the start of operations by a low cost carrier, a sustained increase in terms of airport operations and passenger traffic should be expected.

As can be seen in table 4, the commercial landings segment account for 86% of the total number of operations at the airport. The domestic market corresponds to 39% and international market accounts for 61% of the market. Regarding the domestic market, the Funchal-Porto Santo route accounts for 31% of the market in terms of landings/take-offs, however only 9% in terms of passenger arrivals and departures. The territorial flights (Funchal-Lisbon

FIGURE 6

Evolution of passenger traffic (1964-2007)



Source: ANAM

and Fuchal-Oporto routes) accounts for 69% of the domestic market in terms of operations at the Airport and 91% in terms of passengers in the domestic segment. International traffic accounts for 56% of passenger traffic, territorial flights accounts for 40.4% and regional traffic for less than 4%.

Figure 7 describes the evolution of the market segmentation in terms of regular and charter. Data related to market segmentation in terms of international market and charter market is depicted in Table 5 for the year 2007. It is also evident that the growing importance of regular market, which suggests that most connections between Madeira and European cities are quite regular. Regular flights accounts for 73.4% of passenger traffic and charter flights accounts for 26.2% of passenger traffic in 2007. It is quite evident that the regular segment has been gaining market share since the 90s, but further gains should not be expected. The increasing levels of

TABLE 4

Take-offs/landings and passenger traffic shares by origin (2007)

	Take-offs/ landings			Passengers	
Commercial	21.954	86%		2.418.489	100%
Domestic	8.585	39%		1.052.659	44%
Interior1	2.650	31%		94.839	9%
Territorial2	5.935	69%		957.820	91%
International	13.369	61%		1.355.591	56%
Schengen	9.280	69%		770.419	57%
EU non Schegen	3.553	27%		533.521	39%
Other International	536	4%		51.651	4%
Regular	17.421	79%		1.774.304	73%
N/Regular	4.533	21%		633.946	26%
Transit	…			10.239	0%
Non Commercial	3.662	14%		1.208	0%
Total	25.616			2.419.697	

Source: ANAM

FIGURE 7

Evolution of the shares of regular and non regular flights

Source: ANAM

TABLE 5

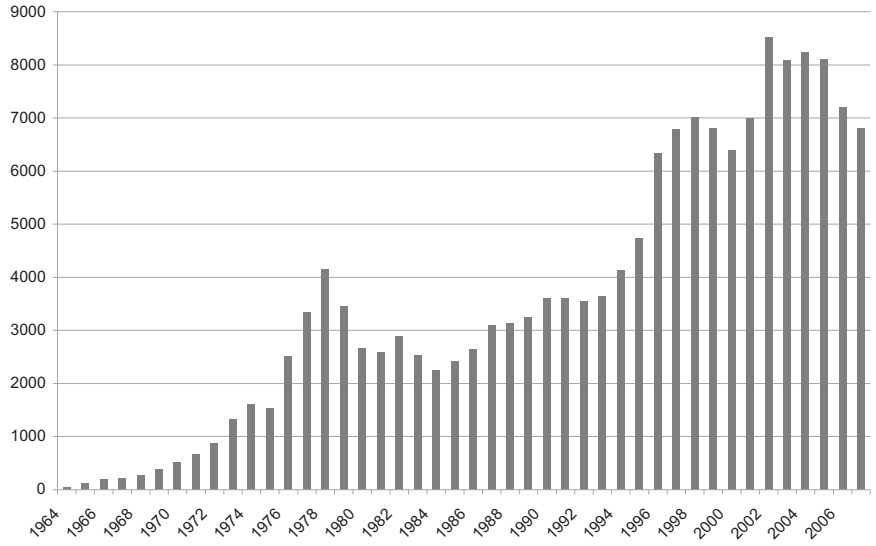
Shares of regular and non regular flights

Landings/Arrivals	Total 2007	Share 2007
Total Landings	10976	
Regular Flights	8705	79.31%
Non regular Flights	2271	20.69%
Total Passengers	1202976	
Regular Passengers	886713	73.71%
Non regular Passengers	316263	26.29%

Source: ANAM

FIGURE 8

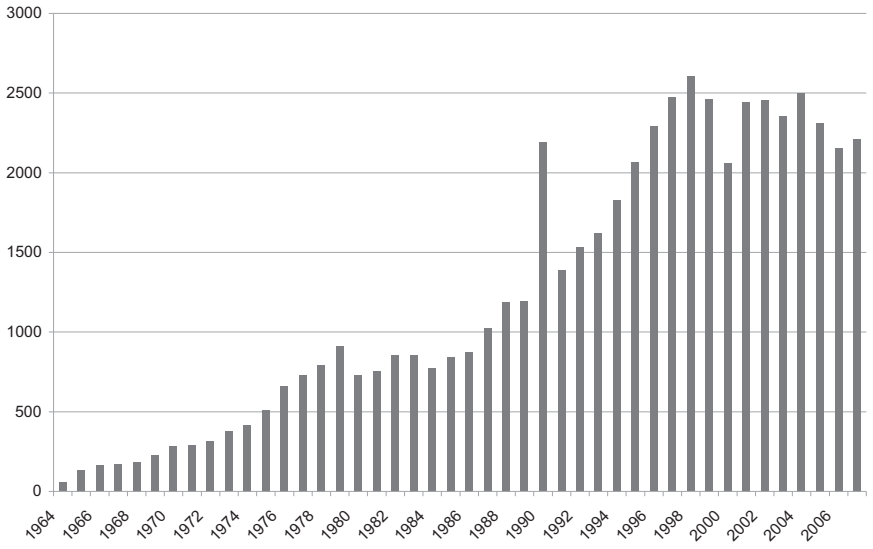
Merchandise flows (tons)



Source: ANAM

FIGURE 9

Mail flows (tons)



Source: ANAM

merchandise and mail transported by air until the late 90s are also evident in figures 8 and 9. However, once again there is evidence to suggest that the Airport of Madeira has reached a state of seeming stagnation.

We now turn to the market structure. There is one regional route, the Funchal-Porto Santo route, which connects the two islands of the archipelago. Porto Santo Island has a population of only approximately 5000 inhabitants and is located 75 km away from Funchal. The regional market is supplied by SATA. The direct connections between Funchal and Porto Santo are very important to the local residents of Porto Santo in terms of accessibility. SATA provides an average of eleven flights per day between Porto Santo and Funchal, which seems to point to the very fact that the mobility needs of local inhabitants and the local tourism industry concerns have been taken into account. There are two routes available between Funchal and Mainland Portugal: the Funchal-Lisbon route and the Funchal-Oporto route. The Funchal-Lisbon is the most important route in terms of traffic and daily flights offer with an average of 11 daily flights and it is operated by two companies: TAP and Easyjet. There are only 2 flights available for the Funchal-Oporto route operated by TAP. From Lisbon, connections to several cities around the world are available. In order to travel to another city in Europe, one stop at Lisbon is usually necessary as only the European cities which are the origin of most of the Islands visitors are directly available from the Airport of Funchal.

Concerning the Madeira –mainland Portugal market TAP Air controlled the entire market until a few days ago. Nowadays, TAP Air Portugal and Easyjet offer an average of 11 daily flights, i.e., one flight every 2 hours between 6:00 am and 11 pm. The Lisbon-Funchal route is the most important one in terms of local residents, business men and official public administration needs.

About 30 different air travel companies share the global market in terms of passengers arriving at Madeira Island, but the majority of them are assigned to the charter segment (See Table 6). The Portuguese companies account for about 65% of the global market especially in the regular segment. TAP Air Portugal and SATA dominate the regular market (about 100% market share). TAP accounts for 37.5% for the market share, obtained in the Lisbon Funchal route. TAP offers flights between Funchal, and Porto Santo, Lisbon, Porto, London and Caracas as well as offers flights between Lisbon and the main capitals of Europe. Easyjet has become a challenge to TAP since a few days ago offering flights between Funchal and Lisbon and a growing share in the market should be expected.

Table 6 provides some information related to the market shares of the air travels companies in operation at Funchal Airport in terms of passenger traffic and landings/take-off. The Charter market segment is operated by 20 different companies without any degree of concentration in terms of market share. Table 7 shows that the Funchal-Lisbon route is the most important one in terms of take-offs and passengers. London ranks second.

Lisbon and to a small scale Porto acts like as a hub. If someone intends to travel abroad, they will probably take a flight to Lisbon or London and then to the final destination in any part of the world (Caracas, New York, Ottawa). Funchal is connected to more than 30 different destinations, most of them in England, Germany and Scandinavia. More than 30 European cities are connected with Funchal's Airport.
From Funchal to the mainland an average of 10-12 daily flights are available (10 to Lisbon and 2 to Porto) and local inhabitants pay a reduced fare due to social cohesion issues. In terms of regulation of provision of air transport services we draw attention to the Law nº 138/99 regulates public service obligations in terms of

TABLE 6

Market shares of airlines companies operating at Madeira's Airport

Commercial traffic				Passenger traffic			
	Air carrier	Total	Share		Air carrier	Total	Share
1	TAP	8662	39.5%	1	TAP	918117	38.0%
2	SATA	2184	9.9%	2	SATA Internacional	229679	9.5%
3	SATA International	2082	9.5%	3	Air Berlin	120147	5.0%
4	PGA	993	4.5%	4	First choice	110278	4.6%
5	Air Berlin	75	0.3%	5	Condor	96115	4.0%
6	GB Airways	604	2.8%	6	GB Airways	87900	3.6%
7	First Choice	588	2.7%	7	SATA	74663	3.1%
8	Air Condor	556	2.5%	8	Thompson Fly	73034	3.0%
9	Thompson Fly	418	1.9%	9	PGA	60932	2.5%
10	Austrian Airlines	330	1.5%	10	Austrian Airlines	45917	1.9%
	Other	5462	24.9%		Other	601707	24.9%
	Total	21954	100.0%		Total	2418489	

Source: ANAM

TABLE 7

Main routes from/to Madeira

Take-offs/ landings				Passengers			
	Airport	Total	Share		Airport	Total	Share
1	Lisbon	5663	25.8%	1	Lisbon	779507	32.2%
2	Porto Santo	2124	9.7%	2	London Gatwick	209450	8.7%
3	London Gatwick	1502	6.8%	3	Oporto	182214	7.5%
4	Paris Orly	1081	4.9%	4	Manchester	81099	3.4%
5	Frankfurt	1005	4.6%	5	Porto Santo	72711	3.0%
6	Amsterdan, Schipol	950	4.3%	6	Dusseldorf	60406	2.5%
7	Madrid Barajas	724	3.3%	7	Munich	57849	2.4%
8	Barcelona Le Prat	703	3.2%	8	Amsterdan, Schipol	55409	2.3%
9	Manchester	435	2.0%	9	Nuremberg	47745	2.0%
10	Dusseldorf	407	1.9%	10	Helsinji, Vantaa	45010	1.9%
	Other	7360	33.5%		Other	827089	34.2%
	Total	21954	100.0%		Total	2418489	100.0%

Source: ANAM

air transport. Local inhabitants benefits from reduced fares when travelling between Funchal and Mainland. A Porto Santo inhabitant has a double advantage: reduced fares for Porto Santo – Mainland routes and Porto Santo-Funchal route.

We analyze now the operations at airport and passenger traffic variable in order to make dynamic forecasts. Our dataset has 44 observations on the annual number of landings and take-offs and the same number of observations on the passenger traffic at the Airport from 1964 through 2007. As the data show a clear upward trend, we apply the augmented DF test with constant and trend option included in order to test whether the variables had a unit root. Results are show in Table 8 and Table 9 (in annex). As expected the results suggest we cannot reject the null hypothesis that the variable both the variable operations at Airport and passenger traffic exhibits a unit root. Both the ACF and PACF plot also suggest non-stationary data (see figures 10 and 11). The first partial autocorrelation is very dominant and close to 1. The ACF plot suggest as mixture of exponential decay and sine-wave pattern. All this information suggests an AR(1) specification in operation to model the data. One common application of ARIMA errors model

concerns the inclusion of the variable time trend as an explanatory variable, when we are dealing with non stationary data. So the full model to be analyzed is:

$$V_t = a_0 + a_1 T + N_t \quad (1)$$

in which V is the variable, T means time and

$$N_t = \theta_1 N_{t-1} + \varepsilon_t$$

The results of the linear trend model are show in Table 10, concerning the regression errors. Based on the predicted values it is possible to estimate an annual growth rate of 25 for the 2007-2010 period for both variables: 2.65% for the take-off and landings and 2.07% for the passenger traffic variable (see figures 12 and 13). However, as we reach the stagnation phase, our predictions should consequently be viewed with an appropriate degree of caution

5 CONCLUSIONS

This section summarizes some important issues concerning the link between airports on islands and economic growth and addresses some implications for policy-making and for further research on the subject. As a one size fits all approach is not available to accurately understand islands problems, we can not generalize about the results from cases studies focused on core regions.

Banister and Berechman (2001, pg. 209) discusses what they call “principal unresolved challenges to transport researchers”. This paper cannot provide further evidence to solve the ‘unresolved challenge’ as airports on islands cannot be analyzed based solely on economic and financial data. As stated above the likely impact of further investments is different in remote and peripheral regions in comparison with core regions (Vickerman, 1996; Banister and Berechman, 2001).

Despite the increasing amount of evidence suggesting a positive relationship between investments in airport infrastructure and GDP growth, the impact of the transportation infrastructure on economic development is still open to discussion. Our results suggests that the expected (substantial) increase in terms of passenger arrivals and overnights stays didn’t materialize yet even having new routes came into effect as expected. However, it is also possible to argue that the alternative course of the economic dynamics of the region if the investment was not made would be a worst one. The tourism industry in Madeira saw an increase in the number of serious competitors in the 2000-2007 period.

Further research is needed in terms of identifying a number of strengths and threats to the Airport core strategy of development. As the Airport performance is clearly linked to island growth prospects and tourism industry performance threats may include the impact of high oil prices on low-cost carriers and consequently on the number of arrivals and visitors; the impact of the economic crisis in countries of origin of most visitors; and the possible effects of the changing demands of the typical European tourist to the extent it impacts the overall perception of the island visitors. Finally, this paper concludes that the airport development strategy is clearly conditioned by (‘almost’ out of control events from the Airport Administration point of view) the developments in the air travel industry in terms of low-cost carriers, key events in the tourism industry and the on-going economic success of the regions it serves.

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ANNEXES

TABLE 8

Augmented Dickey-Fuller test for unit root (variable: take-offs/landings)

Augmented Dickey-Fuller test for unit root			**Number of obs = 40**			
Test statistic	1% Critical	5% Critical	10% Critical	MacKinnon approximate		
-2,096	-4.242	-3.540	-3.204	p-value for Z(t) = 0.5486		
Var. tol	**Coef.**	**Std. Err.**	**T**	**P>[t]**	**95% Conf. Interval**	
L1.	-.3642417	.173818	-2.10	0.044	-.7174823	-.0110011
LD.	-.0063671	.2013486	-0.03	0.975	-.4155566	.4028225
L2D.	-.1261368	.1857805	-0.68	0.502	-.5036882	.2514146
L3D.	.2137071	.1798194	1.19	0.243	-.1517299	.5791441
_trend	2.401.431	1.174.549	2.04	0.049	1.445.992	4.788.402
_cons	1.609.529	5.976.037	0.27	0.789	-1.053.524	1375.43

Source: own calculations

TABLE 9

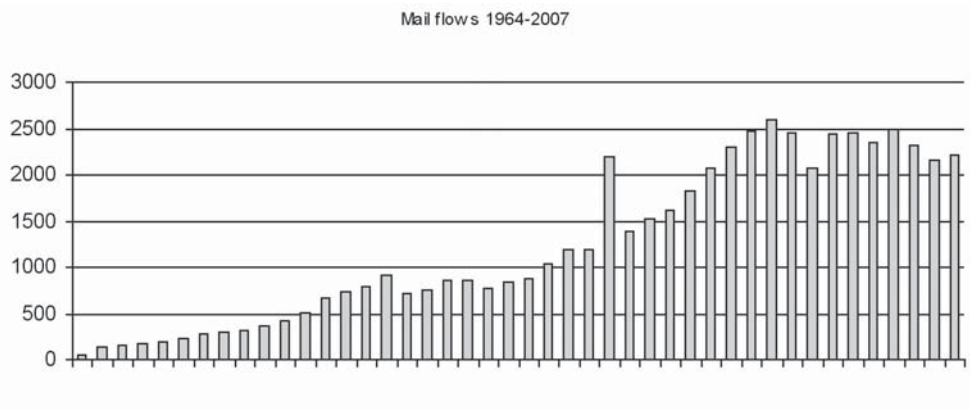
Augmented Dickey-Fuller test for unit root (variable: passenger's traffic)

Augmented Dickey-Fuller test for unit root			**Number of obs = 40**			
Test statistic	1% Critical	5% Critical	10% Critical	MacKinnon approximate p-value for Z(t) = 0.745		
-1.711	-4.242	-3.540	-3.204			
Var. p	**Coef.**	**Std. Err.**	**T**	**P>[t]**	**95% Conf. Interval**	
L1.	-.1008035	.0589022	-1.71	0.096	-.2205073	.0189002
LD.	.3858561	.1619743	2.38	0.023	.0566848	.7150274
L2D.	-.2875607	.1627888	-1.77	0.086	-.6183874	.0432659
L3D.	.297661	.164635	1.81	0.079	-.0369176	.6322396
_trend	6628	3.465.755	1.91	0.064	#########	13671.26
_cons	-12346.56	28492.74	-0.43	0.668	-70250.78	45557.65

Source: own calculations

FIGURE 10

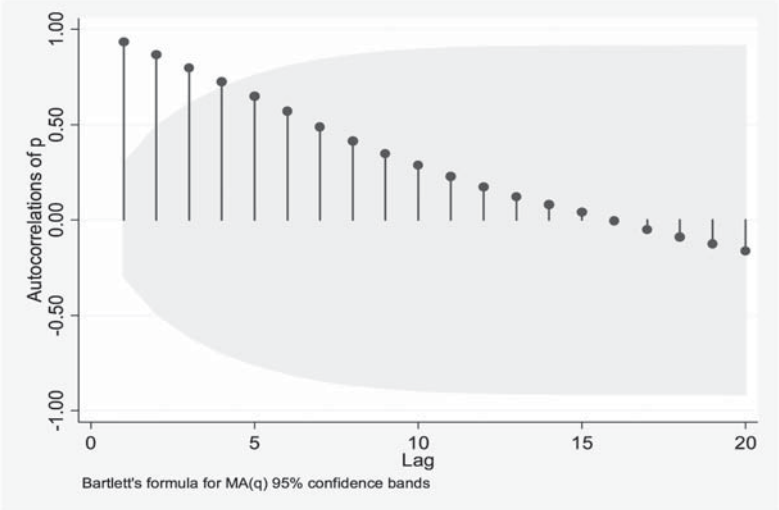
ACF plot (take-offs/landings variable)



Source: own calculations

FIGURE 11

PACF plot (take-offs/landings variable)



Source: own calculations

TABLE 10

Estimated parameters of the model specification (passengers traffic variable)

Var. p (passengers)	Coef.	Std. Err.	Z	P>[t]
Time	500054,6	6256,8	8,96	0
Const.	-148905,1	221595,1	-0,67	0,502
Ar(1)	0,904	0,0643	14,67	0
Sigma	54801,5	6598,5	8,31	0
Log.	-543,62			

Source: own calculations

TABLE 11

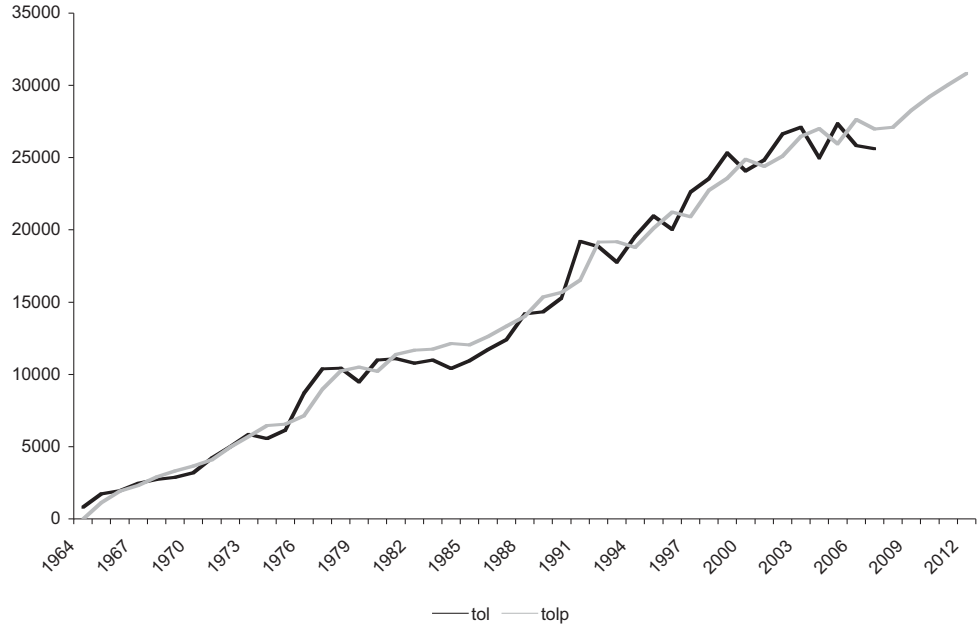
Estimated parameters of the model specification (take-offs/landings variable)

Var. tol (take-offs/landings)	Coef.	Std. Err.	Z	P>[t]
Time	635,9	43,4	14,67	0
Const.	-515,5	1399,6	-0,37	0,713
Ar(1)	0,633	0,139	4,57	0
Sigma	1068,4	144,8	7,38	0
Log.	-369,55			

Source: own calculations

FIGURE 12

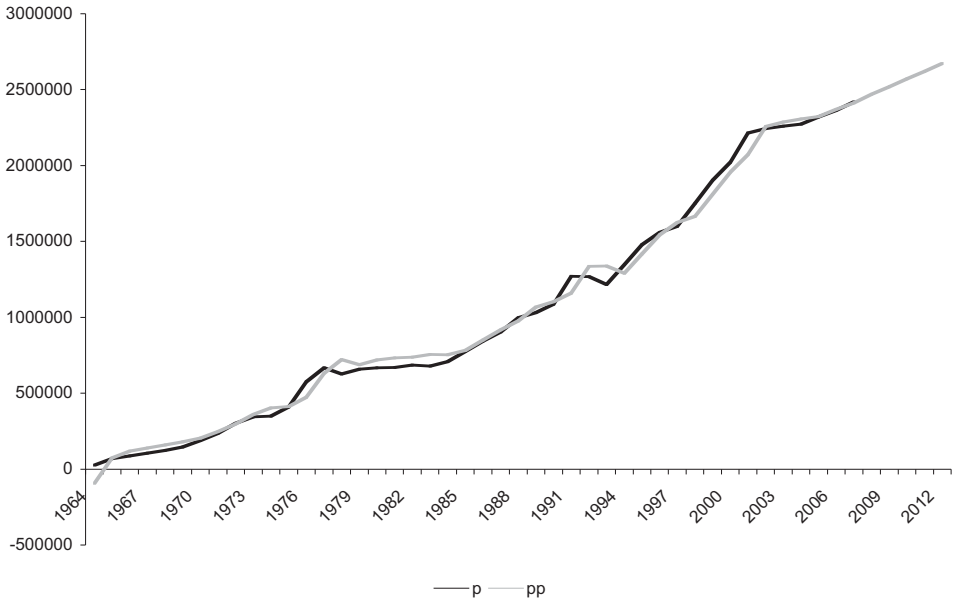
Dynamic forecast of take-offs and landings (2007-2012)



Source: own calculations

FIGURE 13

Dynamic forecast of passenger traffic (2007-2012)



Source: own calculations