LOW-COST CARRIERS, LOCAL ECONOMY AND TOURISM DEVELOPMENT AT FOUR PORTUGUESE AIRPORTS. A MODEL OF COST–BENEFIT ANALYSIS

Vânia Costa
Cláudia Almeida

ABSTRACT

The liberalisation of air transport created a new era in the sector. The entry of low-cost carriers triggered dynamism and consequently changed the behaviours of the demand and supply of air transport services. The volume of traffic at Portuguese airports increased from 17 million passengers in 2002 to more than 30 million in 2012, representing cumulative growth of 75%. The commitment to low-cost carriers (LCCs) was a determining factor for this growth in that, in 2012, these carriers recorded a market share of 33%. This study aims to analyse the evolution of LCC air traffic in Portugal and its impact on regional economic development. Through a model of cost–benefit analysis, we determine the costs, benefits and net welfare in the developmet of the region driven by the LCC routes of 4 Portuguese airports, Faro, Lisbon, Funchal and Porto, between 2005 and 2012. The methodology proves the existence of a positive net impact driven by LCCs on the local economy, directly through job creation and increased consumption in the tourism sector and indirectly by the increased demand from other sectors.

Keywords: Air Transport, Airport, Cost–Benefit Analysis, Low-Cost Carrier, Regional Development, Economic Impact

JEL Classification: L91, L93, D61, R11, F63

1. INTRODUCTION

The air transport industry boosts economic and social progress and increases the connection between people, countries, cultures and markets as well as developed and developing countries. The exponential growth of this sector required new regulation, which was implemented in 1987 and resulted in the liberalisation of European airspace. This process lasted for a decade and began a new era of air transport services, with a new transportation infrastructure based on a competitive market mechanism whereby decisions result from the mutual interaction between supply and demand. Airlines emerged that offered shuttle services at reduced rates, known as low-cost carriers (LCCs). These airlines introduced a new management model based on a higher level of operational efficiency combined with low fares (Donzelli, 2010). In addition to low fares, LCCs are typically characterised by short- and medium-term point-to-point traffic with a minimum service offer (Wittmer and Bieger, 2011). According to Han (2013), passengers readily accept the offer of a minimum service in exchange for lower prices (Francis *et al*., 2004; Mikulic and Prebeac, 2011; Ryan and Birks, 2005; Zhang *et al*., 2008).[1] Han (2013) asserts that in this business model, the practice of low-cost management

[1] Authors cited in Han (2013).

combines various measures, including the kind of aeroplane used, high utilisation of crews, sales made directly to the customer and the exclusion of additional services, such as food and drink.

The market share of these airlines has doubled over the last decade, reaching around 26% of the total seats offered on the world market in 2012 (OAG Aviation, 2012). In Portugal, these airlines have gained a 33% market share and have contributed greatly to the growth in the volume of traffic at Portuguese airports, which have experienced average annual growth of 6% over the last decade (ANA, 2013).

This study aims to analyse the effect of LCC air traffic on Portuguese airports. To compare the LCCs' effect on the Portuguese airport infrastructure, we analysed the evolution of LCC air traffic at all the airports where these airlines are present – in particular the airports of Faro, Lisbon, Funchal and Oporto – and LCCs' impact on regional economic development. Through a model of cost–benefit analysis (CBA), we sought to determine the cost, benefit and net impact of low-cost routes on the development of the areas surrounding these Portuguese airports from 2005 to 2012.

The structure of this article is as follows. After the introduction, Section Two focuses on the relationship between air transport and economic development. Section Three concentrates on the Portuguese airport system. Section Four details the methodology applied in the case study. Section Five presents and analyses the results of the cost–benefit analysis of low-cost carriers operating at the Faro, Lisbon, Funchal and Oporto airports, and, finally, Section Six contains the general conclusions of this study.

2. THE IMPACT OF AIR TRANSPORT ON LOCAL ECONOMIES

Over the past 50 years, air transport has played a pivotal role in economic development, with a resulting strong increase in demand. From 1970 to 2012, the total number of passengers carried by airline companies all over the world multiplied more than 10 times, from 310 million to 2.9 billion passengers (IATA, 2012; ICAO, 2013). This sector employs 32 million people worldwide and contributes greatly to the world's wealth, with an estimated total impact of US$3.56 trillion, which corresponds to about 7.5% of the world gross domestic product (GDP) (ATAG, 2008). Within the European context, approximately 744 million passengers were transported in 2011 (Eurostat, 2011), and, taking into consideration the total number of jobs generated (direct, indirect and induced), there are about 5.1 million jobs in this sector. These jobs contribute more than US$485 billion to the European GDP (ATAG, 2012).

In Portugal, air transport generates a number of economic benefits, in 2009 contributing approximately €2.3 billion, which corresponds to 1.4% of the Portuguese GDP (Oxford Economics, 2011). In addition, an effect of €3.3 billion is estimated in the tourism sector and the air transport sector employs about 59,000 workers in Portugal, 24,000 of which are direct jobs, 20,000 indirect jobs and 15,000 are jobs arising from the expenditures of workers in the air transport sector. On average, the annual salary of the workers in this sector is around €72,000, which, according to the study cited above, corresponds to an average increase in all the earnings in Portugal. In a catalytic effect, about 124,000 jobs have emerged in the tourism sector. The total contribution in taxes, aviation fees and other support sectors is around €264 million. In addition to its contribution to the GDP, employment and tax revenues, by creating multiple connections between cities and markets, air transport increases foreign investment and, therefore, Portugal's productivity.

Despite the economic crisis experienced in recent years, the Portuguese air traffic market has shown a strong capacity for recovery. From 2005 to 2012, the number of

passengers carried grew by about 50% and, according to ANA (2013), the development in the international segment contributed fundamentally to this growth, as it recorded average annual growth exceeding 6%. In 2012, 30.5 million passengers and 137,000 tons of cargo were transported in a total of 280,000 aircraft movements. In the same year, Portuguese airports received 12.6 million passengers on international flights, mainly from the UK, France, Spain, Germany and Brazil (64% being international passengers), of whom about 37% travelled using LCC flights (Turismo de Portugal, 2013). These air links represent the connectivity between Portuguese cities and major towns and markets around the world, reflecting the economic importance of these destinations. Over time, air links have grown in both frequency and destinations, reducing the waiting time and improving the service quality (Oxford Economics, 2011). By the end of 2012, Portuguese airports regularly offered flights to around 140 cities along 161 different routes (ANA, 2013). This improved connectivity has been accompanied by a reduced cost of air transportation, a decrease of about 1% in real terms over the past 40 years, contributing to the growth and competitiveness of the sector compared with other means of transport (Oxford Economics, 2011). In addition to the benefits for passengers, the study cited argues that the greatest economic benefit of the increased links between countries and regions appears in their impact on the long-term performance of the economy as a whole, by increasing the overall level of productivity and generating greater access to foreign markets and freer movement of investment in capital and workers. This study describes some research studies (Oxford Economics Forecasting, 2005 and 2006) that conclude that a 10% increase in connectivity associated with the GDP generates a long-term impact of about 0.5% at the level of economic productivity.

The exponential growth of this sector has generated the need to adjust its structure to cope better with this higher demand. Thus, a process of airspace liberalisation has begun, which has resulted in the adaptation of a free-market mechanism, whereby decisions result from the mutual interaction between supply and demand. This process of deregulation has offered new opportunities to airlines, increased competition and allowed the entry of new airlines into the sector, using a business model based on low cost (Graham, 2013). The new low-cost airlines have primarily fuelled substantial changes in the spatial distribution of short-distance air transport networks and in the servicing of airport infrastructures.

In particular, airports have been affected because LCCs present a business model of demand for services that are different from those usually offered by traditional airlines (Hanaoka and Saraswati, 2011). According to the authors cited, several airports have built low-cost terminals to meet LCCs' specific requests, including the reduction of cost and time. Because of these investments, many of these airports have registered dramatic growth rates in their passenger traffic (Graham, 2013). According to Abrantes (2010), LCCs boosted their provision of services primarily in three market segments: i) clients with greater price sensitivity, ii) clients with leisure motivations and iii) business customers with flexible schedules and frequency of travel. An estimated 59% of LCC traffic carries new passengers (ELFAA, 2004). Thus, LCCs have provided a new segment of demand by creating their own market. According to OAG Aviation (2012), the supply of these airlines in 2012 was twice their 2003 share, with about 25% of the total seats offered worldwide. In Europe, in 2011, 40 LCC airlines operated on 3,173 destination routes with 29,330 workers[2] – accounting for a 35% share of the LCC seats worldwide – reflecting average annual growth of 4.2% in the last decade.

This enlargement of the LCC network has been beneficial to various regions, especially to the most disadvantaged areas, such as southwest Europe. According to the findings of an ELFAA (2004) study, the effects of European LCCs on tourism, regional development and

[2] According to data from LCC airline websites.

other sectors are clearly positive. These airlines have changed travel and leisure habits and, according to this study, can play a key role in stimulating business transport.

Over the past few years, several studies aiming to evaluate and quantify the effects of airports and the airport system on economies have appeared in the literature. These studies have sought to examine, in particular, the role of low-cost airlines (see Table 1). Overall, the findings of these studies have revealed a positive effect, in particular through creating a new demand, increasing the income tax revenue and developing activity sectors that are related, directly and indirectly, to air transport, resulting in a leverage effect on regional economic development.

According to most of the literature, the emergence of LCCs has resulted in the growth of several sectors of activity in various regions, contributing positively to the economic and social development of the regions influenced by airports, especially in the tourism sector.

Table 1. Impact of LCCs on regional economies

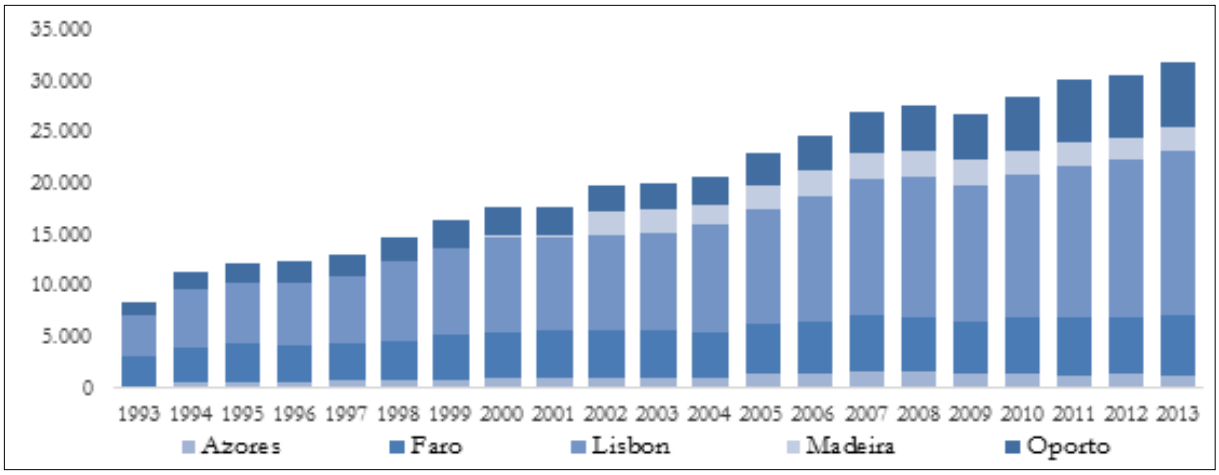
Study	Country, airport	Impact of LCCs
Macário *et al.* (2007)	France, Carcossone Airport	▪ generated new demand of about 230,000 passengers (2003); ▪ total increase in revenue of €584 million (direct effect: €8.4 million; indirect: €253 million; and induced income: €272.4 million).
	Italy, Pisa Airport	▪ creation of new demand of 316,000 passengers (in 2003); ▪ average spending per business passenger landed: €431.40; ▪ average spending per tourism and leisure passenger landed: €496.52; ▪ total economic impact of €149.2 million on the regional economy.
	Germany, Cologne Bonn Airport	▪ paid total taxes of €91 million (2004); ▪ cost and productivity advantage for businesses in the region: €147.6 million; ▪ average spending per passenger disembarking: €285.42.
Huderek (2008)	Poland, Gdańsk Airport	▪ 64.4% of total airport traffic: 1.589 million passengers were transported by LCCs; ▪ passengers stayed, on average, for 4.6 days per visit; ▪ average daily spending per passenger landed: €82; ▪ indirect impact on the local revenue of €114 million.
	Poland, Wroclaw Airport	▪ 59.1% of total airport traffic: 1.137 million passengers were transported by LCCs; ▪ passengers disembarking remained in the region, on average, for 3.7 days; ▪ average daily spending in the region: €109; ▪ total stimulus in the regional economy of €95 million.
	Poland, Katowice Airport	▪ 81.9% of total airport traffic: 1.529 million passengers were transported by LCCs; ▪ passengers disembarking remained, on average, in the region for 2.6 days; ▪ average daily spending in the region: €140; ▪ total stimulus in the regional economy of €123 million.
Donzelli (2010)	Italy, Campino Airport, Bergamo Treviso Airport, Alghero Airport, Brindisi and Lamezia Terme Airport	▪ LCC airlines reduced the rates for seasonal air traffic; ▪ concluded an average net impact of €88 per passenger generated by each LCC in Italy.

Source: Macário *et al.* (2007), Huderek (2008) and Donzelli (2010)

3. THE EVIDENCE FROM THE CASE OF PORTUGAL

Portugal has a peripheral geographical position in Europe. This position means that, within air transport, the country has emerged as a region at the confluence of several international routes and with large-scale entry and exit for the main European markets and for other continents. The Portuguese airport system consists of 5 main airports, located in Lisbon, Oporto, Faro, Funchal and Ponta Delgada, which, in 2013, recorded a total volume of traffic of more than 31 million passengers (see Figure 1).

Figure 1. Evolution of passenger traffic in Portugal from 1993 to 2012 (in thousands)



Source: Eurostat (2012), ANA (2013), ANA (2014a), ANA (2014b), ANA (2014c), ANAM (2013) and ANAM (2014)

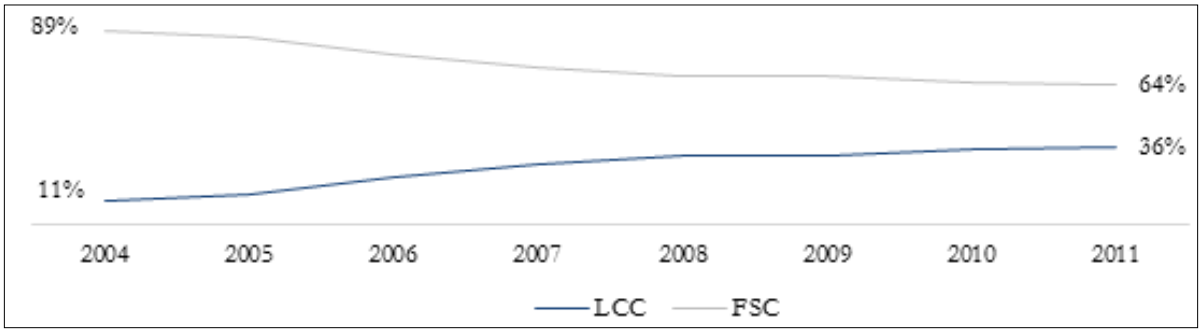
Lisbon Airport is located in Lisbon and, in 2013, represented about 50.4% of the total air traffic in Portugal, with over 16 million passengers. Oporto Airport, located in Oporto and the north, received about 20% (6.4 million passengers), while Faro Airport, located in the Algarve's capital, received about 19% (5.9 million passengers). Funchal Airport, located in the archipelago of Madeira, recorded 2.4 million passengers, which represented about 7.5% of the national traffic. The airport of Ponta Delgada, in the city of that name on the Azores island of São Miguel, carried about 1 million passengers, representing about 3% of the total traffic.

These 5 airports reveal large differences in the passenger volume of traffic. Upon analysis, we determined a Gini index of concentration[3] between the traffic at these airports of 0.6546 in 2000 and a slightly lower one in 2012 of 0.6112, which allowed us to prove the existence of relative inequality between the traffic volumes of the 5 airports under study. Low-cost airlines began operating in Portugal in 1995, with the non-regular business operators Air Berlin and Ryanair; however, the process of liberalisation in the air transport sector did not occur simultaneously throughout Portugal (INAC, 2012). Initially, low-cost airlines began operating from the Algarve airport, then Lisbon Airport, most recently Oporto and, finally, Funchal.[4] According to the study cited above, the initial strategy of these airlines was to gain a market share of the routes already serviced by regular and charter airlines. From 2003 to 2012, these airlines captured a significant portion of passengers, about 25% of the regular market and 33% of the non-regular segment. In the regular segment, according to this study, the routes that stand out are operated by Ryanair from the Faro Airport and Funchal Airport to the United Kingdom and from Oporto Airport to the Spanish market and to Madeira. A milestone in the growth of LCCs in Portugal was passed in 2003, when they doubled

[3] The Gini index is a method for measuring concentration ranging from 0 to 1, according to which the higher the value, the higher the level of concentration of the observed values.
[4] The airport of Ponta Delgada, in the Azores, was not included as a case study since this airport's traffic has not been deregulated.

the number of passengers carried. Subsequently, these airlines gained representation within each airport's infrastructure, and their market share has continued to increase, practically doubling from 2004 to 2011. In 2011, 20 LCC companies operated throughout the country, which together carried about 36% of passengers and represented 23% of the total trade movements (see Figure 2).

Figure 2. Evolution of market share of regular passengers



Source: INAC (2012)

According to the INAC (2012), Faro Airport recorded a large market share of LCCs. In 2011, 13 airlines accounted for approximately 83% of all the aircraft movements recorded at the airport, having transported 87% of the passengers who travelled in the regular segment, of which 72% were disembarking (see Table 2). Oporto Airport is the second-largest airport with LCC representation. In 2011, 4 LCC airlines performed 20,000 movements at this airport, which corresponded to 33% of the total movements, and carried about 50% of the passengers in the regular traffic. At Funchal Airport, 6 LCC airlines accounted for 25% of the total movements and transported 37% of the regular passenger segment and around 15% of the total passengers who disembarked. At Lisbon Airport, 8 LCC companies operated in 2011, carrying out 2 million movements and transporting about 14% of the regular passenger segment.

Table 2. Passenger arrivals and total LCC by airport

	Total disembarking		Passengers disembarking at LCC			
	2005	**2011**	**2005**	LCC %	**2011**	LCC %
Faro	2,317,593	2,775,373	1,117,589	48%	2,010,247	72%
Lisbon	5,511,918	7,383,666	303,483	6%	1,017,268	14%
Funchal	1,223,301	1,192,545	0	0%	181,945	15%
Oporto	1,504,663	2,963,476	162,771	11%	1,613,675	54%
Portugal	10,986,411	14,763,865	1,583,843	11%	4,823,135	33%

Source: Adapted from INAC (2012)

In Oporto Airport and Faro Airport, Ryanair has emerged as a prominent carrier among the LCCs and, in 2011, it held, for each airport respectively, approximately a 39% and a 31% market share of the regular segment of these airport infrastructures. At Funchal Airport, easyJet accounted for approximately 20% of this segment and, at Lisbon Airport, which has a lower presence of these airlines, easyJet is among the most important, with a 9% share of the market. Concerning the routes with the most passengers in the same year, Madrid stands

out for Oporto Airport, Barcelona for Lisbon Airport, Madrid for Faro Airport and Lisbon for Funchal Airport.

Table 3. Top routes and airlines by airports and LCC

	Passengers disembarking at LCC			
	2005	LCC%	**2011**	LCC%
Faro	London – Stansted (Ryanair)	100%	Madrid – Barajas (Ryanair)	58%
	Palma – S.S. Joan (Air Berlin)	95%	Beauvais – Tille (Ryanair)	100%
	Frankfurt (Ryanair)	100%	Barcelona (Ryanair)	77%
Lisbon	Brussels (Virgin Express)	41%	Barcelona (Vueling: 34% and EasyJet: 15%)	48%
	Palma – S.S. Joan (Air Berlin: 86% and Niki: 11%)	97%	Madrid – Barajas (EasyJet)	20%
	Colonia – Koln (Germanwings)	100%	Funchal (EasyJet)	25%
Funchal	Nuremberg (Air Berlin)	93%	Lisboa (EasyJet)	25%
	Munich (Condor)	42%	London – Gatwick (EasyJet)	53%
	Hamburg (Condor)	98%	London – Stansted (EasyJet)	100%
Oporto	London – Stansted (Ryanair)	100%	Madrid – Barajas (Ryanair)	58%
	Palma – S.S. Joan (Air Berlin)	95%	Beauvais – Tille (Ryanair)	100%
	Frankfurt (Ryanair)	100%	Barcelona (Ryanair)	77%

Source: INAC (2012)

According to Oxford Economics (2011), at least one-third of tourists arrive in Portugal by air. Thus, the growth of the tourism sector has accompanied the dynamic expansion of low-cost air travel in Portugal. Over the past five years, the income from tourism has shown a positive growth tendency, indicating a recovery of the revenues lost in previous years (INE, 2012). The revenues from tourism increased in 2011, by about 7.2%, and the expenses only increased slightly, by 0.7%. Therefore, according to this study, the Portuguese tourism income shows a positive growth trend and attained a balance of €2.974 million in 2011, slightly higher than the balance for 2010 (€2.953 million). According to the same study, the main markets, as in previous years, were the United Kingdom (18%), France (17.8%), Spain (13.8%) and Germany (10%). However, some countries recorded even greater increases in tourism revenue, such as Poland (+24.1%), the USA (+21%) and the Czech Republic (+19.9%). Tourism revenues are usually derived primarily from leisure travel, which contributed €15 billion to the global GDP in 2011. In the same year, the investment volume in the sector was approximately €3.6 billion, corresponding to 11.5% of the total investment in Portugal. From 2006 to 2010, the number of passengers disembarking from LCCs nearly doubled, resulting in an increase in foreign guests and in a direct contribution of the tourism sector to employment and the Portuguese GDP of 3.5% and 11.5%, respectively (see Table 4).

Table 4. Evolution of indicators of transport and tourism in Portugal from 2006 to 2010

	2006	2010	Δ %
Foreign guests (million)	6.5	6.9	6.2%
Total disembarking passengers (millions)	11.9	13.9	16.8%
LCC disembarking passengers (million)	2.4	4.7	95.8%
Share of LCC (disembarking) (%)	20%	34%	14pp
Direct contribution of travel and tourism to GDP (€ billion)	7.8	8.7	11.5%
Total contribution of travel and tourism to GDP (€ billion)	20.8	23.9	14.9%
Direct contribution of travel and tourism employment (thousands)	316.8	328	3.5%
Total contribution of travel and tourism employment (thousands)	792.2	841.3	6.2%

Source: MEID (2011) and WTTC (2011)

4. METHODOLOGY

To evaluate the investments from a socioeconomic point of view, thereby assessing the net economic impact of the project, we applied the cost–benefit analysis methodology (CBA). This analysis evaluates the economic or social effects of a particular investment, allowing an assessment of the viability of public or private investment projects from the perspective of the social welfare of a country or region through the sum of the monetary values of the costs and benefits to society. The methodology applied in this study is the same as the methodology applied by Costa (2014), with a similar aim. According to Macário *et al*. (2007), the assessment of the impact on a regional economy can be subdivided into three effects: direct, indirect and induced. Direct effects are caused by the employment and income that are generated directly by the construction and operation of an airport. The indirect impact is caused by the employment and income that derive from the suppliers of goods and the service chain. The induced impact is the employment and income generated by the spending of income from direct and indirect employment. This impact is induced by the direct and indirect effects derived from the multiplier effect of the direct and indirect impacts. To quantify these three effects on the economy – as driven by LCCs operating from the airports of Faro, Lisbon, Funchal and Oporto – two perspectives were considered: supply and demand. To calculate the benefit of added employment, we quantified the direct, indirect and induced employment generated by an increase in LCC traffic at the airports of Faro, Lisbon, Funchal and Oporto. In accordance with Costa (2014), to quantify the tourism revenue, we assessed the expenses of tourists disembarking from LCCs during their stay according to the following functions:

$$NT = PD_{LCC} \times \% \, NT_{LCC} \quad (1)$$

$$D = NT \times TE_{LCC} \quad (2)$$

$$I = \gamma \, D \quad (3)$$

$$N = \alpha(D+\gamma D) \quad (4)$$

$$E = D + I + N \quad (5)$$

$$E = D + \gamma D + \alpha(D + \gamma \, D) \quad (6)$$

$$E = (1+\gamma+\alpha+\alpha\gamma)D \quad (7)$$

assuming the term $(1+\gamma+\alpha+\alpha\gamma)$ as:

$$E = \beta D \quad (8)$$

$$R = E \times W \quad (9)$$

with NT denoting the new air traffic, PD_{LCC} being the passengers landed by LCCs and $\%NT_{LCC}$ being the percentage of new traffic generated by LCCs. TE_{LCC} represents the rate of employment by LCC operators. D is the direct effect on employment, I the indirect effect, N the induced effect and E the total effect on employment. γ is the multiplier direct effect on employment and α the multiplier induced effect on employment. R denotes the income earned by the employment generated. β is the multiplier of the liberalisation of air transport, and W is the average annual wage.

Following the same study, to determine the increase in turnover in the tourism sector, we evaluated the amount spent by LCC tourists who landed and stayed according to the following functions:

$$T = PD_{LCC} \times \%T_{LCC} \quad (10)$$

$$TUR = g \times n \times T \quad (11)$$

$$B = R + TUR \quad (12)$$

with T representing the total number of tourists landed by LCCs and $\%T_{LCC}$ the percentage of new traffic generated by LCCs motivated by tourism. While g is the average spending of tourists per stay, n is the number of nights per stay. TUR denotes the effect on tourism, and B represents the benefit generated by LCCs for the regional economy.

To quantify the negative effects of LCCs operating at the Faro, Lisbon, Funchal and Oporto airports, according to Costa (2014), we must consider the following as negative externalities: accidents, air pollution, climate change, noise, upstream and downstream effects, and effects on nature and the landscape, expressed by:

$$C = c(PD_{LCC} \times Km_{LCC}) \quad (13)$$

where c denotes the cost by passengers transported per kilometre and Km_{LCC} the length of a trip on an LCC.

Finally, the net impacts result from the difference between the LCCs' benefits and their costs for the airports, which reflect the social welfare generated by carriers, in turn translating into the economic impact on the region influenced by the airport. We considered the following:

$$BE = B\text{-}C \quad (14)$$

with BE representing the welfare generated by LCCs.

5. COST–BENEFIT ANALYSIS OF LOW-COST CARRIERS FOR PORTUGUESE AIRPORTS

To assess the effects of low-cost routes on the local economy, we assessed the net economic impact of LCCs for 2005–2012. We adopted a CBA methodology to assess the overall economic well-being generated by LCC routes in the areas that are economically influenced by four Portuguese airports, namely the airports of Faro, Lisbon, Funchal and Oporto.

The airlines easyJet and Ryanair have the largest share of the low-cost market in Portugal. In 2012, they together accounted for about 78% of the total traffic on LCCs, which translates into about 7.6 million passengers (ANA, 2013). easyJet carried approximately 3.8 million passengers (39.2% of the LCC traffic) and Ryanair about 3.7 million passengers (38.8% of the LCC traffic). Therefore, we assumed the details for these airlines as the reference LCC details for our study and considered their weighted average traffic as being representative of all LCC airlines.

The total revenue generated by low-cost airlines can be calculated as the sum of the income from the employment created plus the growth in tourism income, which we considered to be equivalent to tourist spending. To quantify these benefits, we considered only passengers disembarking from LCCs, from which we recorded an increased induced yield through job creation and an increased turnover in the tourism sector. We subdivided the impact on employment into three types of effects: direct, indirect and induced. For the direct impact, we considered the employment generated by the induced increase in passengers, given the employment rate per 1,000 passengers carried by Ryanair and easyJet: 0.11 workers in 2005 and 0.13 in 2012. For the indirect effect, we assumed a multiplier effect on direct employment, while the induced employment emerges from the multiplier effect of the direct and indirect employment generated. These multipliers were estimated in the study by the ACI and York Aviation (2004).[5] The increase in revenue from job creation comes from the average annual salary[6] earned by registered workers in Portugal each year, with positions reflecting employment supported by LCC services.

To quantify the impact of LCCs in the tourism sector, we considered only 59% of new traffic (ELFAA, 2004). We further considered only those travelling for tourism and leisure: about 79% of the Faro Airport traffic (ANA, 2008 and 2011), 79.5% of the passengers in Lisbon (Observatório Turismo de Lisboa, 2013), 81% of the passengers at Funchal Airport (ESTRATUR/ACIF, 2008) and 72.03% of the passengers at Oporto Airport. Given the average number of nights[7] and the average spending of the tourists per stay and per region,[8] we calculated the amount of money generated in the tourism sector.

In 2005, the total benefit gained from LCCs was approximately €307 million. The highest proportion of benefits (82.9%) was concentrated in Faro Airport, and Funchal Airport recorded no value, since the low-cost airline companies only began operating at this airport in 2007. In 2012, the total revenue generated by LCCs in Portugal stood at €1.377 billion (Table 5). The Algarve was the region that showed the greatest benefits from LCCs, with 40% of the total benefits for Portugal, which amounted to approximately €556 million. The north recorded total benefits of €436 million (32% of the total benefits) and the Lisbon

[5] Since the ACI and York Aviation (2004) study does not determine the multiplier effects for the airports under study, we used as our reference points similarities in features, size and traffic, comparing these four airports' infrastructure. For the airports of Oporto and Faro, we assumed the values estimated in the study for Valencia Airport. For the airport of Lisbon, we assumed the estimated multipliers for Malaga Airport. Finally, for Funchal Airport, we took as a comparison Cardiff Airport, given the similarity in the volume of traffic.

[6] We considered the average annual salary of €10,910.40 in 2005 and €13,711.08 in 2012, according to data from the GEP/MSSS (2011 and 2013) studies.

[7] Source: Faro Airport (ANA, 2008 and 2011), Lisbon Airport (Lisbon Tourism Observatory, 2013), Funchal Airport (ESTRATUR/ACIF, 2008) and Oporto Airport (IPDT 2012a, 2012b, 2012c and 2012d).

[8] These data were obtained from the available values and, for the remaining years, we updated the average daily expenditure using an upgrade rate of 6%. This rate was estimated according to the general criteria recommended by the European Commission for cohesion countries (European Commission, 2008). Source: Faro Airport (Pimpão *et al*., 2009); Lisbon Airport (Observatório Turismo de Lisboa, 2013); Funchal Airport (ESTRATUR/ACIF, 2008); and Oporto Airport (IPDT 2009, 2010a, 2010b, 2010c, 2010d, 2011a, 2011b, 2011c, 2011d, 2012a, 2012b, 2012c and 2012d).

region €345 million (25% of the total benefits). Finally, in the region of Madeira, LCCs provided benefits of approximately €40 million (3% of the total benefits).

In addition to the benefits, we quantified the negative externalities, accounting for the negative effects generated by LCC airlines as a result of accidents, air pollution, climate change, noise pollution, urbanisation effects, loss of biodiversity, soil and water pollution and upstream and downstream effects. Our assessment was based on the estimates in Delft and Infras's (2011) study for the year 2008,[9] taking into consideration the possibility of higher estimated costs, adjusted to a total average recorded for Portugal of €51.3 per 1,000 passengers per kilometre (see Table 5).

Table 5. Negative externalities of air transport in 2008

Cost category	Cost p/1000 passenger-kilometre	Cost category	Cost p/1000 passenger-kilometre
1. Accidents	€0.5	6. Nature and landscape	€0.6
2. Air pollution	€0.9	7. Biodiversity losses	€0.1
3. Climate change	€44.3	8. Soil and water pollution	€0.0
4. Noise	€1.0	9. Urban effects	€0.0
5. Upstream and downstream	€3.9	Total	**€51.3**

Source: Adapted from Delft and Infras (2011)

The number of passengers transported per kilometre for each airport were obtained by multiplying the passengers disembarking from LCCs by the weighted average length in kilometres of each low-cost flight.[10] Over the years under study, the negative externalities of the LCC flights at Oporto Airport increased by about 300%, around €107 million in 2005 and €430 million in 2012.

The total net benefit of LCC companies proved to be positive and increased throughout the period studied, translating into greater economic well-being generated by these airlines in the local economy. The total economic welfare generated by LCCs in Portugal amounted to approximately €200 million in 2005 and €948 million in 2012, for a net benefit per passenger of €126.03 in 2005 and €186.52 in 2012 (see Tables 6, 7).

Table 6. Cost-benefit analysis of LCC for Portuguese airports in 2005

	Benefit				
	Faro	**Lisbon**	**Funchal**	**Oporto**	**Total**
Increase in passengers (PD_{LCC})	1,117,589	303,483	0	162,771	1,583,843
Employment created					
Direct effect (*D*)	105	29	0	15	149
Indirect effect (*I*)	46	57	0	7	110
Induced effect (*N*)	740		0		740
[8] Total jobs created (*E*)	**892**	**86**	0	108	1,086
[9] Increase in income (*R*)	**9,731,179.54**	**937,463.46**	**0**	**1,417,295.47**	**12,085,938.47**

[9] We considered the average cost for 2008 as the base year. For the remaining years, we updated the value of the cost at a rate of 6%. This rate was estimated according to the general criteria recommended by the European Commission for cohesion countries (European Commission, 2008).
[10] Faro Airport (1,778 km), Lisbon Airport (1,007 km), Funchal Airport (1,199 km) and Oporto Airport (1,030 km).

Benefit					
[1] New traffic (*NT*)	659,377.51	179,054.97	0	96,035	934,467
[10] Tourists (*T*)	567,065	142,348.70	0	69,169	778,583
Average expenditure per day (*g*) (€)	€47.95 47.95 €	€33.53	€0	€45.99 €45.99	€51.20
Average overnight stay (*n*)	9	5.21	0	8	7.4
[11] Increase in turnover of tourism (*TUR*)	**€244,695,570**	**€24,866,311**	**€0**	**€25,447,046**	**€295,008,927**
[12] **Total Benefits**	**€254,426,750€**	**€25,803,774**	**€0**	**€26,864,341**	**€307,094,864**
%	**82.9%**	**8.4%**	**0%**	**8.7%**	**100%**
Cost					
	Faro	**Lisbon**	**Funchal**	**Oporto**	**Total**
Accidents	846,019.68	130,148.22	0	71,388.27	1,047,556.17
Air pollution	1,522,835.42	234,266.80	0	128,498.89	1,885,601.11
Climate change	74,957,343.67	11,531,132.41	0	6,325,001.07	92,813,477.15
Noise	1,692,039.36	260,296.44	0	142,776.55	2,095,112.35
Upstream and downstream	6,598,953.51	1,015,156.13	0	556,828.54	8,170,938.18
Nature and landscape	1,015,223.62	156,177.87	0	85,665.93	1,257,067.42
Biodiversity losses	169,203.94	26,029.64	0	14,277.65	209,511.23
[13] **Total Cost**	**€86,801,620**	**€13,353,208**	**0**	**€7,324,437**	**€107,479,264**
%	**80.8%**	**12.4%**	**0%**	**6.8%**	**100%**
[14] **Economic welfare generated by LCC** (*BE*)	**€167,625,130**	**€12,450,567**	**0**	**€19,820,385**	**€199,896,082**
%	**84.0%**	**6.2%**		**9.8%**	**100%**
Economic welfare generated in local economy by each passenger	**€149.99**	**€41.03**	**€0**	**€121.8**	**€126.21**

Source: Authors

Table 7. Cost-benefit analysis of LCC for Portuguese airports in 2012

Benefit					
	Faro	**Lisbon**	**Funchal**	**Oporto**	**Total**
Increase in passengers (PD_{LCC})	2,032,834	1,173,883	209,252	1,664,079	5,080,048
Employment created					
Direct effect (*D*)	294	131	30	210	665
Indirect effect (*I*)	128		2	91	222
Induced effect (*N*)	2,064	261	2	1,472	3,799
[8] Total jobs created (*E*)	2,486	392	35	1,773	4,686
[9] Increase in income (*R*)	**€27,065,065**	**€5,544,579**	**€378,415**	**€19,297,445**	**€42,445,825**

[1] New traffic (*NT*)	1,199,372	692,591	123,459	981,807	2,997,229
[10] Tourists (*T*)	947,504	550,610	100,002	707,146	2,305,228
Average expenditure per day (*g*) (€)	€69.75	€118.32	€61.56	€84.20	€83
Average overnight stay (*n*)	8	5	6,5	7	7
[11] Increase in turnover of tourism (*TUR*)	**€528,675,566**	**€339,421,883**	**€40,013,193**	**€416,800,296**	**€1,324,910,938**
[12] **Total Benefits**	**€555,740,631**	**€344,966,462**	**€40,391,608**	**€436,097,741**	**€1,377,196,443**
%	**40%**	**25%**	**3%**	**32%**	**100%**
Cost					
	Faro	**Lisbon**	**Funchal**	**Oporto**	**Total**
Accidents	2,238,554	732,312	155,386	1,061,674	4,187,924
Air pollution	4,029,396	1,318,161	279,694	1,911,012	7,538,264
Climate change	198,335,841	64,882,806	13,767,182	94,064,279	371,050,108
Noise	4,477,107	1,464,623	310,772	2,123,347	8,375,849
Upstream and downstream	17,460,717	5,712,030	1,212,009	8,281,054	32,665,811
Nature and landscape	2,686,264	878,774	186,463	1,274,008	5,025,509
Biodiversity losses	447,711	146,462	31,077	212,335	837,585
[13] **Total Cost**	**€229,675,590**	**€75,135,168**	**€15,942,583**	**€108,927,709**	**€429,681,050**
%	**53%**	**17%**	**4%**	**25%**	**100%**
[14] **Economic welfare generated by LCC** (*BE*)	**€326,065,041**	**€269,831,294**	**€24,449,025**	**€327,170,033**	**€ 947,515,392**
%	**34%**	**28%**	**3%**	**35%**	**100%**
Economic welfare generated in local economy by each passenger	**€160.40**	**€229.86**	**€116.84**	**€196.61**	**€186.52**

Source: Authors

6. CONCLUSION

This study aimed to analyse and quantify the effect of low-cost airlines in Portugal, specifically in the regions of the Algarve, Lisbon, Madeira and northern Portugal, where the airports of Faro, Lisbon, Funchal and Oporto are located. In 2005, the economic welfare generated by LCCs totalled almost €200 million, corresponding to €126 per new passenger disembarking from LCCs. Faro Airport shows higher values than the other airports, since this was the first airport to receive these airlines. In 2005, this airport attracted 84% of the total economic welfare generated by LCCs in Portugal. The airports of Lisbon and Oporto accounted for 8.4% and 8.7%, respectively. The LCCs operating from Faro Airport generated net economic welfare per passenger of approximately €150, those operating from Oporto €122 and those operating from Lisbon Airport €41.

From 2005 to 2012, the airports in this study increased their low-cost flights, which resulted in a positive effect on each region. In 2005, traditional airlines (FSC) controlled 86% of the market share of the volume of air traffic, while LCCs only held 14%. However, in 2011, FSC's share decreased by 22% points, dropping to 64%. That market share transferred

to low-cost airlines, which increased their share to 36%. As a result, the economic welfare generated by low-cost airlines in the Portuguese economy gradually increased over the study period, representing cumulative growth of 78.9% from 2005 to 2012. By 2012, the average impact of LCCs per passenger at each airport was €186.5.

Lisbon Airport, in particular, recorded tremendous growth in the benefits of LCCs. Throughout the study period, the total LCC benefits grew by 96.2% and the benefits per passenger increased from €41 to €230 (+461%). This growth stems from the fact that this region is where tourists show the highest average daily spending per day of their stay (€118). In addition, the economic costs of flights are relatively lower, since the distance in kilometres of low-cost routes, weighted by the most representative routes of this airport, is lower than that of the other airports in the study. The distance for Lisbon is 1,007 kilometres, while at Faro Airport it is 1,778, at Funchal Airport it is 1,199 and at Oporto Airport it is 1,030. In 2011, 8 LCC airlines operated from Lisbon Airport, with a market share of 14% in the regular traffic segment.

Faro Airport, the first Portuguese airport to offer flights on low-cost airlines, reveals an especially large market share of LCC airlines. In 2011, 13 LCC airlines carried out 83% of all the aircraft movements recorded at this airport, having transported 87% of the passengers who travelled in the regular traffic. In 2012, the LCC traffic resulted in a benefit of €326 million for the Algarve region and €160 per passenger, reflecting growth of 7% over 2005.

Oporto Airport is the second-largest airport in terms of LCC traffic. In 2011, 4 LCC airlines performed 20,000 movements at this airport, corresponding to 33% of the total movements, and LCCs carried about 50% of the passengers in the regular traffic. In 2012, the economic welfare generated by LCCs totalled €327 million and €197 per passenger, reflecting growth of almost 64% compared with the benefits generated in 2005.

This study supports the conclusion reached in other studies in the literature on the economic impact of low-cost airline companies: the entry of these airlines has resulted in significant economic benefits for the regions influenced by these four airports. Specifically, this study demonstrated a positive net impact generated directly by LCCs through job creation and increased consumption in the tourism sector and indirectly through the increased demand in other sectors. However, it is evident that the LCCs' effect is distinct in each region under study. In some cases, the entry of LCCs clearly created a new demand, as seen in the airports of Lisbon and Oporto. Regarding Faro Airport, although the LCCs' entry has generated a new demand, it has also generated widespread transfer of demand, in which passengers who usually travel with traditional airlines fly on low-cost airlines. Funchal Airport benefited the least, which can be explained by the special characteristics of the Madeira archipelago. This is a region with a mature and consolidated tourism industry, so the airport does not function as the main engine of regional economic growth.

Based on these results, and as advocated by most of the literature, it can be concluded that low-cost carriers play a key role in regional economic development and tourism in particular in countries with a lower gross domestic product (GDP) and the potential for tourism development.

REFERENCES

Abrantes, A. (2010). Novo modelo de negócio no transporte aéreo de passageiros. As LCC – filosofia, práticas e mercado. *Cogitur: Journal of Tourism Studies,* 3, 79-100.

ACI and York Aviation. (2004). *The social and economic impact of airports in Europe*. Airports Council International and York Aviation. Ginebra, Switzerland: Airports Council International World Headquarters.

ANA. (2008). *FAO Passenger Profile 2007*. Lisboa: ANA Aeroportos de Portugal.

ANA. (2011). *FAO Passenger Profile 2010*. Lisboa: ANA Aeroportos de Portugal.

ANA. (2013). *Relatório de gestão e contas 2012.* Lisboa: ANA Aeroportos de Portugal.

ANA. (2014a). *FAO Passenger Profile 2013*. Lisboa: ANA Aeroportos de Portugal.

ANA. (2014b). *Relatório de Tráfego ao Aeroporto de Lisboa 2013*. Lisboa: ANA Aeroportos de Portugal.

ANA. (2014c). *Relatório de Tráfego ao Aeroporto do Porto 2013*. Lisboa: ANA Aeroportos de Portugal.

ANAM. (2013). *Estatísticas de tráfego aéreo - dezembro de 2012*. Santa Cruz: ANAM Aeroportos da Madeira.

ANAM. (2014). *Estatísticas de tráfego aéreo - dezembro de 2013*. Santa Cruz: ANAM Aeroportos da Madeira.

ATAG. (2008). *Air transport drives economic and social progress – The economic and social benefits of air transport 2008.* Air Transport Action Group, 2008 Edition. Retrieved December, 30, 2011 from http://www.iata.org/pressroom/Documents/atag_economic_social_benefits_2008.pdf.

ATAG. (2012). *Aviation/Benefits Beyond Borders*. Air Transport Action Group. Retrieved May, 8, 2013 from http://www.aviationbenefitsbeyondborders.org/sites/default/files/pdfs/ABBB_Medium%20Res.pdf.

Costa, V. (2014). *Regional Portuguese Airports, Local Economy and Tourism Development.* Ph.D. Thesis. Facultad de Ciencias Económicas e Empresariales, Universidad de Vigo. 158 pp.

Delft, C.E. and F.I. Infras. (2011). External Costs of Transport in Europe, Update Study. Retrieved May, 8, 2013 from http://www.cedelft.eu/publicatie/external_costs_of_transport_in_europe/1258.

Donzelli, M. (2010). The effect of low-cost air transportation on the local economy: Evidence from Southern Italy. *Journal of Air Transport Management,* 16, 121-126.

ELFAA. (2004). *Liberalisation of European Air Transport: The Benefits of Low Fares Airlines to Consumers, Airports, Regions and the Environment.* European Low Fares Airlines Association, Brussels.

ESTRATUR/ACIF. (2008). Low cost carriers: high success, high impact? Cenários prospectivos de desenvolvimento turístico da RAM. 162 p.. Price Waterhouse Coopers.

European Commission. (2008). Guide to Cost-benefit analysis of investment projects Structural Funds, Cohesion Fund and Instrument for Pre-Accession. The CBA Guide Team.

Eurostat. (2011). *Turism Trends*, European Commission, Luxemburgo. Retrieved May, 8, 2013 from http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Tourism_trends.

Eurostat. (2012). *Air passenger transport – monthly statistics - Data 2012*, European Commission, Luxemburgo. Retrieved May, 1, 2013 from http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Air_passenger_transport_-_monthly_statistics.

GEP/MSSS. (2011). Séries Cronológicas Quadros de Pessoal 1999-2009, Gabinete de Estratégia e Planeamento do Ministério da Solidariedade e da Segurança Social, Lisboa. Retrieved April, 2, 2013 from http://www.gep.msss.gov.pt/estatistica/gerais/serieqp_1999_2009.pdf.

GEP/MSSS. (2013). Boletim Estatístico, Gabinete de Estratégia e Planeamento do Ministério da Solidariedade e da Segurança Social, Lisboa. Retrieved April, 2, 2013 from http://www.gep.msss.gov.pt/estatistica/be/bedez2012.pdf.

Graham, A. (2013). Understanding the low cost carrier and airport relationship: A critical analysis of the salient issues. *Tourism Management*, 36, 66-76.

Han, H. (2013). Effects of in-flight ambience and space/function on air travelers' decision to select a low-cost airline. *Tourism Management*, 37, 125-135.

Hanaoka, S. and B. Saraswati. (2011). Low cost airport terminal locations and configurations. *Journal of Air Transport Management*, 17, 314-319.

Huderek, S. (2008). Socio-economic impact of Low-cost carriers on the Central-eastern European market: Exemplification of Poland. *Poznan University,* Poland.

IATA. (2012). Annual Review 2012, International Air Transport Association Economics. Retrieved April, 2, 2013 from http://www.iata.org/about/Documents/annual-review-2012.pdf.

ICAO. 2013. (2013). Safety Report, International Civil Aviation Organisation. Retrieved April, 2, 2013 from http://www.icao.int/safety/Documents/ICAO_2013-Safety-Report_FINAL.pdf.

INAC. (2012). *O Impacto das Transportadoras de Baixo Custo no transporte Aéreo Nacional [1995-2011].* Lisboa: Instituto Nacional de Aviação Civil.

INE. (2012). *Estatísticas do Turismo 2011.* Lisboa: Instituto Nacional de Estatística.

IPDT. (2009). *Perfil dos turistas de Lazer do Porto e Norte Portugal.* Porto: Instituto de Planeamento e Desenvolvimento do Turismo.

IPDT. (2010a). *Perfil dos turistas do Porto e Norte Portugal 1º trimestre de 2010*. Porto: Instituto de Planeamento e Desenvolvimento do Turismo.

IPDT. (2010b). *Perfil dos turistas do Porto e Norte Portugal 2º trimestre de 2010*. Porto: Instituto de Planeamento e Desenvolvimento do Turismo.

IPDT. (2010c). *Perfil dos turistas do Porto e Norte Portugal 3º trimestre de 2010*. Porto: Instituto de Planeamento e Desenvolvimento do Turismo.

IPDT. (2010d). *Perfil dos turistas do Porto e Norte Portugal 4º trimestre de 2010*. Porto: Instituto de Planeamento e Desenvolvimento do Turismo.

IPDT. (2011a). *Perfil dos turistas do Porto e Norte Portugal 1º trimestre de 2011*. Porto: Instituto de Planeamento e Desenvolvimento do Turismo.

IPDT. (2011b). *Perfil dos turistas do Porto e Norte Portugal 2º trimestre de 2011*. Porto: Instituto de Planeamento e Desenvolvimento do Turismo.

IPDT. (2011c). *Perfil dos turistas do Porto e Norte Portugal 3º trimestre de 2011*. Porto: Instituto de Planeamento e Desenvolvimento do Turismo.

IPDT. (2011d). *Perfil dos turistas do Porto e Norte Portugal 4º trimestre de 2011*. Porto: Instituto de Planeamento e Desenvolvimento do Turismo.

IPDT. (2012a). *Perfil dos turistas do Porto e Norte Portugal 1º trimestre de 2012.* Instituto de Planeamento e Desenvolvimento do Turismo, Porto.

IPDT. (2012b). *Perfil dos turistas do Porto e Norte Portugal 2º trimestre de 2012.* Porto: Instituto de Planeamento e Desenvolvimento do Turismo.

IPDT. (2012c). *Perfil dos turistas do Porto e Norte Portugal 3º trimestre de 2012.* Porto: Instituto de Planeamento e Desenvolvimento do Turismo.

IPDT. (2012d). *Perfil dos turistas do Porto e Norte Portugal 4º trimestre de 2012.* Porto: Instituto de Planeamento e Desenvolvimento do Turismo.

Macário, R., V. Reis, J. Viegas, H. Meersman, F. Monteiro, E. Van de Voorde, T. Vanelslander, P. Machenzie-Williams and H. Schimidt. (2007). *The consequences of the growing European low-cost airline sector*, CESUR.

MEID. (2011). *Plano Estratégico Nacional do Turismo. Propostas para Revisão no Horizonte 2015 - Versão 2.0*. Lisboa, Portugal: Ministério da Economia, Inovação e Desenvolvimento. Turismo de Portugal.

OAG Aviation. (2012). *October Executive Summary*. Retrieved April, 2, 2013 from http://www.oagaviation.com/OAG-FACTS/2012/October-Executive-Summary.

Observatório Turismo de Lisboa. (2013). *Perfil do passageiro Low-cost de Lisboa – Inverno 2012-2013*. Observatório Turismo de Lisboa, I.P. Lisboa.

Oxford Economics Forecasting (2005). *The Economic Catalytic Effects of Air Transport in Europe*.

Oxford Economics Forecasting (2006). *The Economic Contribution of the Aviation Industry in the UK*.

Oxford Economics. (2011). Economic Benefits from Air Transport in Portugal. Retrieved August, 1, 2013 from http://www.benefitsofaviation.aero/Documents/Benefits-of-Aviation-Portugal-2011.pdf.

Pimpão, A., A. Correia and M. Moital. (2009). *Perfil do Turista nacional que visita o Algarve*. Universidade do Algarve e Turismo do Algarve.

Turismo de Portugal. (2013). *Os resultados do Turismo 2012*. Lisboa: Turismo de Portugal, I.P.

Wittmer, A. and T. Bieger. (2011). *Fundamentals and structure of aviation systems*. In Wittmer, A.; Bieger, T. and R. Müller. 2011. Aviation systems. Management of the integrated aviation value chain, Springer, London, New York, 05-38.

WTTC. (2011). *Travel & Tourism Economic Impact 2011 Portugal,* World Travel & Tourism Council.