FLYING FROM EUROPE TO THE ALGARVE: THE GEOGRAPHICAL IMPACTS OF THE GROWTH OF LOW-COST CARRIERS (1996–2013)[1]

David Ramos-Pérez
José Ignacio Izquierdo-Misiego

ABSTRACT

The replacement of non-scheduled traffic by scheduled services is one of the main impacts that the liberalisation of the European Common Aviation Area has had on tourist airports. In the case of Faro, between 1996 and 2013, this shift led to both fewer routes served and reduced catchment areas in the source markets for tourists visiting the Algarve. The strategy pursued by Ryanair, the airport's main carrier, focuses on connections that already channelled a greater volume of traffic when charter airlines dominated. Therefore, the impact of low-cost carriers on diversifying the number of airports of origin and source markets is limited. Moreover, using the spatial analysis functions of GIS software, we verified that the population linked to the theoretical catchment areas of airports with a non-stop flight to Faro in 2013 was smaller than that of the airports with such connections in 2000. The decision-making process involved in the policy incentives for introducing new routes could benefit greatly from this type of analysis.

Keywords: Low Cost, Airports, Tourism, Algarve

JEL Classification: L93, L83, R12

1. INTRODUCTION

Since the end of the 1990s, numerous studies have detected significant changes in tourist behaviour, including those related to mobility patterns. As regards this latter aspect, the emergence of low-cost carriers is considered to be one of the more salient vectors of this transformation, as they have reduced fares independently of the package tours that had channelled the bulk of the demand since the 1960s.

The levels of intensity and stability reached by the demand for transport on a considerable number of tourist routes and the changes in habits affecting the demand itself, increasingly more prone within a post-Fordist context to the individual organisation of holidays, shorter stays and a higher number of trips, explain the interest that low-cost carriers have shown in these routes (Ioannides and Debbage, 1997; Graham, 2008). It is no wonder, therefore, that the business model of low-cost carriers seems to suit the demands for flexibility associated with this new tourist profile better. Furthermore, the introduction of the European Single Market in 1993, reducing the restrictions on the purchase of property in other EU countries by EU citizens, has boosted the purchase of holiday homes in mature tourist destinations along Europe's Mediterranean coastline, driving an increase in international residential

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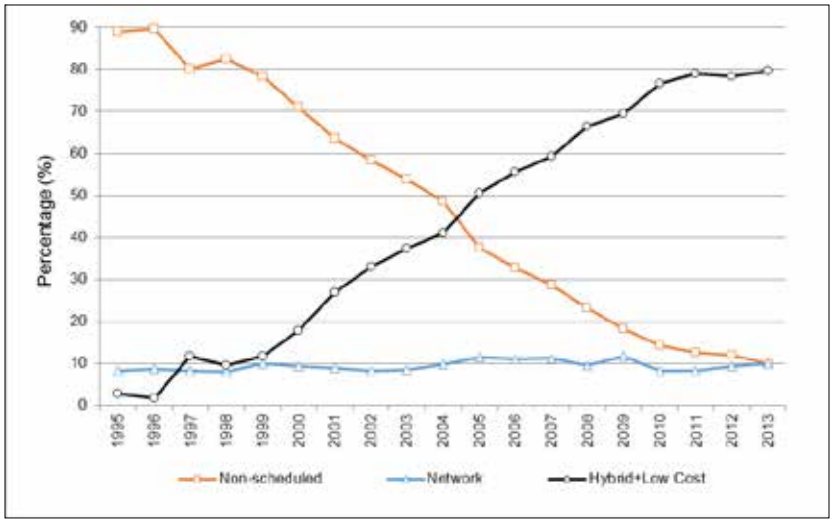
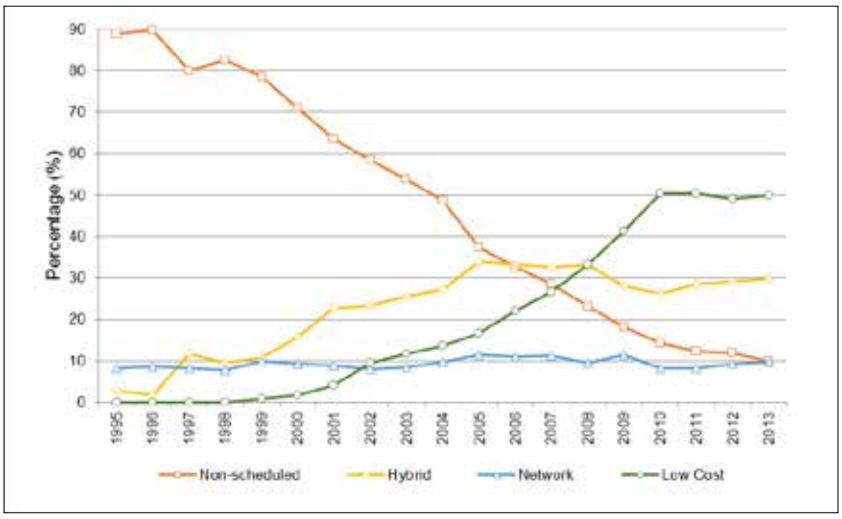
tourism (Mantecón, 2008). The Algarve is clearly part of this dynamic, as repeatedly shown in different studies (Williams and Patterson, 1998; Baron-Yellès, 2006).

Foreign residents along the Mediterranean seaboard are no longer mostly retired migrants, as they now respond to a complex mosaic of profiles, ranging from people who are actively looking for new career opportunities to those working from home for their companies in the United Kingdom, including those who distribute their lives between two countries or those who simply buy a property for short getaways that are taken with a variable frequency (fortnightly, monthly, etc.) (King *et al.*, 1998; O'Reilly, 2000). This has therefore given rise to the appearance of new segments of consumers in the demand for air transport, for whom the purchase of a package tour is pointless and the availability of a scheduled supply, such as that provided by low-cost carriers, significantly improves their possibility of reaching their destination.

Figure 1. Trend in international passenger traffic (1995-2013). Comparison of two segmentations



A) Segmentation of traffic according to ANA



B) Segmentation of traffic according to Ramos and Almeida (2015)

Source: Unpublished Official statistics sourced by ANA

Although there are discrepancies when matching the different air carriers to specific business models, an analysis of Faro Airport's recent trend in traffic reveals a sharp drop in its non-scheduled operations, as can be seen in figure 1, which compares the results of methodologies that apply different criteria to the segmentation of traffic. Figure 1B, based on the method formulated by Ramos-Pérez and Almeida (2015), helps to qualify the widely held notion that charter operators have simply been replaced by low-cost carriers, showing that the latter's dominance is not as obvious as is commonly assumed. What is more, the so-called hybrid operators – those carriers that have moved from the charter segment to scheduled flights – have managed to retain a significant market share of 30% of the overall international traffic.

Nevertheless, over and above the prevalence of one or other business model, there are only a handful of studies on the changes that these transformations have introduced into the supply and demand for flights at airports located in mature tourist areas, defined mainly by their product offer of sun and sand. One of the lacunas detected involves the need to look beyond the overall aggregate figures and proceed to a detailed geographical segmentation, which places the routes and the catchment areas of the airports of origin at the heart of the analysis. Only in this way can we discover the extent to which the progressive replacement of charter operators by other low-cost or hybrid ones can be linked to the diversification of the airports of origin or to a simple replacement of some airports by others. The only study published on this topic, drawn up by the INAC (2011), is based on a relatively short time frame (2000–2009) and does not cater for a breakdown by types of operators or by markets. On the other hand, an analysis should also be made of the catchment areas of those airports located in source markets, with the aim of assessing the impacts that the appearance and disappearance of routes have on the volume of population served in those countries. In the summers of 2010 and 2011, Turismo de Portugal issued a series of reports that linked the supply of scheduled flights to the socio-economic conditions of the regions that they served, albeit without providing a detailed analysis of the catchment areas. Both these lacunas are even more significant when we take into account the substantial financial aid that Portugal's public authorities give to low-cost carriers at Faro Airport, which are considered vital for avoiding the stagnation of tourism in the Algarve.

The research presented here constitutes an initial approach to the issues raised. This theoretical discussion is followed by a brief presentation of the methodology and sources used. This is followed by a yearly record of the routes opened and closed, which includes an analysis of the airport's routes supplied over the 1996–2013 period using two different methodologies for the calculation, as well as a more detailed study of the two main source markets for tourists travelling to the Algarve. The fourth section quantifies the volume of population served in the source markets according to the network of routes available in 2000 and 2013, the aim being to gauge the possible impact of the appearance of low-cost carriers and the transition of charter operators to hybrid models. The fifth section examines Ryanair's route network, the dynamics of which have conditioned the airport as a whole following the opening of the operating base there in 2010. The paper ends with a discussion of its findings, and mention is made of certain aspects that should be addressed by further research.

2. METHOD AND SOURCES

This paper is based on the case-study method; in other words, it conducts an in-depth analysis of an example that may be considered representative of others of its kind. Such is the case of Faro with regard to all the other airports along Europe's Mediterranean seaboard. We adopt

a diachronic perspective to process the statistical data available by routes, characterising their dynamics over the 1996–2013 period.

Portugal does not have any official publications that cover the demand for flights broken down by routes and airlines. Nevertheless, some summary information can be found in the yearbooks issued by the airport management company (ANA) and by the civil aviation institute – the Instituto Nacional de Aviação Civil (INAC), the country's highest authority in civil aviation. We therefore submitted a direct request for data to both these organisations, although in certain specific cases we also used data provided by the UK's Civil Aviation Authority (CAA) and the EUROSTAT statistics server. All this enabled us to work with detailed data at the route level for the 1996–2013 period, each route being broken down by carrier for the 2000–2013 period.

The annual figures for the appearance and disappearance of routes need to be identified accurately. For our purposes, we consider a route to be one that records at least 1,280 passengers per year. This figure is obtained by applying a coefficient of 85% occupancy to the operation of at least four 4 flights in a 189-seat aircraft. This threshold allows the discarding of flights operated on an occasional basis at some times during the year, while at the same time it includes seasonal flights to destinations such as Reykjavik that only operate on a weekly basis in August. We only consider intra-EU international routes, as they are the ones that are affected by the liberalisation process and for which it is meaningful to study the decline in non-scheduled flights and the emergence of low-cost carriers. Accordingly, the calculation does not consider domestic flights (Lisbon, Porto and Funchal), flights to Canada (Toronto) and Russia (Moscow and St. Petersburg), and scheduled routes with a triangular structure that largely involve Spanish airports.

Our analysis also distinguishes between the routes involving the pairing of airports and those involving the pairing of cities. This is not a minor difference given the profusion of multi-airport systems in Europe following the emergence of low-cost carriers and their choice of secondary or alternative airports. Furthermore, this distinction permits an initial approach to the fact that although there is no scholarly consensus on the thresholds of distance and time that allow a decision on whether an airport belongs to a specific metropolitan area, here we combined two criteria: a maximum distance of 100 km from the centre of the city in question and/or its marketing by a low-cost carrier under the name of that city. The 100 km threshold is based on an analysis conducted by the European Commission prior to a decision on the proposed merger between the companies Ryanair and Aer Lingus (European Commission, 2007; Copenhagen Economics, 2012), whereby it is reasonable to consider that all those airports that are less than 100 km away from a given city provide it with a service. Nevertheless, the Commission itself admitted that this might be a conservative threshold in some cases, as some case studies have shown (Pantazis and Liefner, 2006). We therefore apply a second criterion based on the airport's marketing, which enables us to associate Hahn with Frankfurt, Torp Sandefjord with Oslo, Västerås with Stockholm and Reus with Barcelona. The multi-airport systems considered are listed in annex 1.

The calculation of the potential population living in the theoretical catchment area of the airports of origin studied is a simple exercise of combining spatial analysis functions, which we performed using the Geographic Information System ArcGIS (v. 9.3) from ESRI. This analysis uses a previously prepared database that links the administrative level LAU2, corresponding to the maximum breakdown in the gathering of census data in most European countries, with population data from censuses held from 1961 to 2011. A catchment area is considered to fall within a radius of 100 kilometres around the airports involved at each date, a threshold that is commonly used in the existing academic literature, as mentioned earlier. Regarding other proposed methods, such as the one using the population data arising

from the CORINE project (Suau-Sánchez et al., 2014), in this case the calculation of the population is more accurate, as it uses census data rather than estimates.

In short, the following sequence of operations was followed:

- The generation of circular buffers with a radius of 100 km from the airports of interest on two reference dates (2000 and 2013).
- The merging of the resulting circles and calculation of the overall population associated with the centroids of the centres of population included in each one of the two major areas, which represent the joint catchment area of all the airports, by means of a spatial aggregation and superimposition function.
- The calculation of the differences in the population affected between the dates by applying an intersection and subtraction function to the geometries of the general catchment areas and associated centroids.
- Additional detailed calculations by countries for the final comparative result between the two dates.

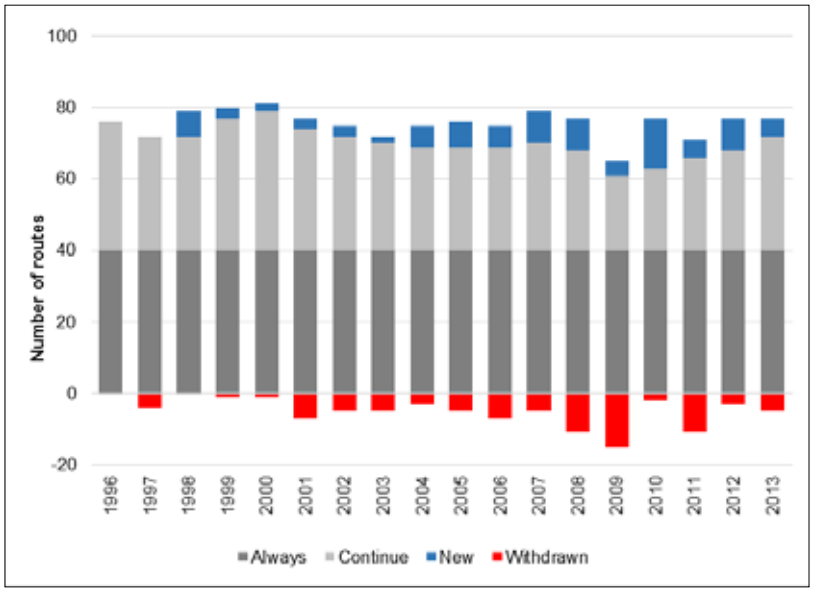
These operations ultimately enabled us to identify certain regional effects of the changes in the supply of direct flights to Faro; in other words, they allowed us to discover not only which areas cease to fall within the supply's catchment area and which ones are incorporated, but also to estimate the volume of the population that has also fallen outside the catchment area and the corresponding volume that has been incorporated.

3. THE TREND IN THE SUPPLY OF INTRA-EU INTERNATIONAL ROUTES

3.1. General outcome

Although the headlines in the press and official statements on the deployment of low-cost carriers at any airport always mention the introduction of new routes, only rarely is reference made to those routes that are withdrawn. Nevertheless, the final result between the two is the factor that determines whether the supply of routes is expanding or shrinking (figure 2). In Faro's case, an analysis of the data provided by the official sources mentioned earlier reveals that the deployment of low-cost carriers has not brought about any significant changes regarding the number of intra-EU international routes operated between 1996 and 2013. The average for this period, 75.3 annual routes, provides a useful snapshot of the airport's reality, as the graph clearly shows few variations, except for the minimal one in 2009. Indeed, the standard deviation recorded is 3.7, and the coefficient of variation does not reach 5%. This stability is also apparent when computing the opening and closing of routes during this time frame, as it enables us to confirm that 40 routes have operated on an uninterrupted basis for over 14 years. Moreover, a considerable number of routes are operated over at least two consecutive years, so the changes in the arrangement of the supply of routes have been minimal and highly influenced by a carrier's appearance on the scene, as was the case with Ryanair's new base in 2010. Furthermore, the network adjustments made by Ryanair are the ones that have had the biggest impact on the yearly results in terms of the number of routes.

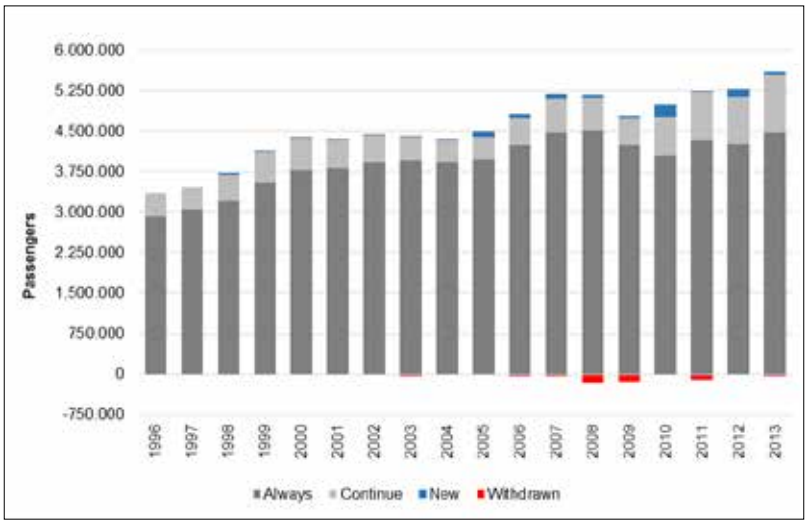
Figure 2. General dynamics of Faro Airport's routes (1996-2013)



Source: Authors' own work based on unpublished data from ANA and EUROSTAT (2003)

On the other hand, these 40 routes are extremely important for the airport in terms of the flow of traffic that they record: in 2013, they channelled 79.8% of intra-EU international passengers (figure 3). Between 2009 and 2010, however, that market share fell suddenly from 88.4% to 81.1%, coinciding with the aforementioned opening of Ryanair's base. The carrier's decision to create a network of links that incorporated airports that had not hitherto had any flights to Faro largely helps to explain this situation. As of that moment, there are no significant variations in the weight of the traditional routes, so only the coming years will tell whether new links will corner a bigger market share.

Figure 3. Passengers transported in Faro by types of routes according to their dynamics (1996-2013)

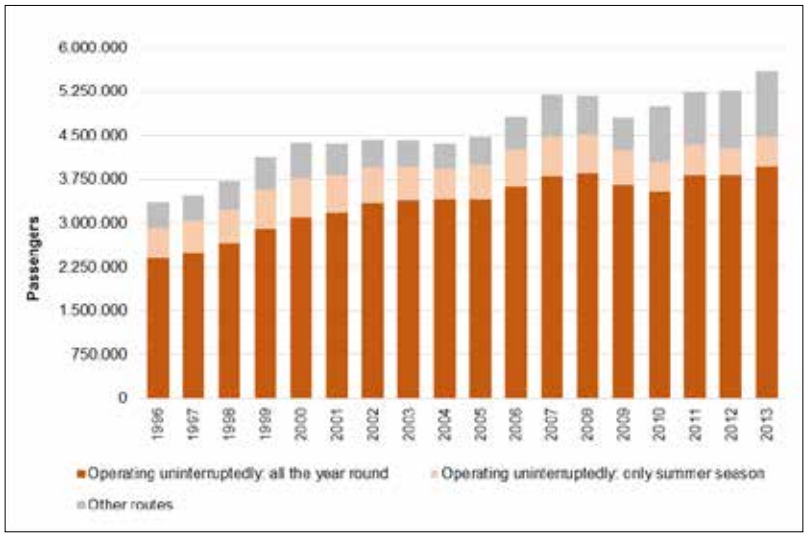


Source: Authors' own work based on unpublished data from ANA and EUROSTAT (2003)

Given the airport's markedly seasonal nature, there is obviously a significant fluctuation in routes between summer and winter. While the number of routes peaks in August, which coincides with the figure shown in the graph, the lowest figure is recorded in January, with 29 connections in the last winter season. Out of these 29 links, a total of 23 were part of the

group of 40 connections that have remained stable throughout the entire period analysed, being operated all the year round, albeit adapting their frequencies and seating capacity to the fluctuations in demand. In 2013, they accounted for almost 71% of the airport's intra-EU international traffic (figure 4), which gives a good idea of their importance in terms of the tourist demand that they channel: the 17 remaining routes in this group of 40, which have a much more seasonal profile, account for only 9% of the airport's traffic. Although that proportion varied over the period under study, peaking at 78.1% in 2004, it never fell below 70%.

Figure 4. Segmentation according to the seasonality of the routes operating in Faro (1996-2013)

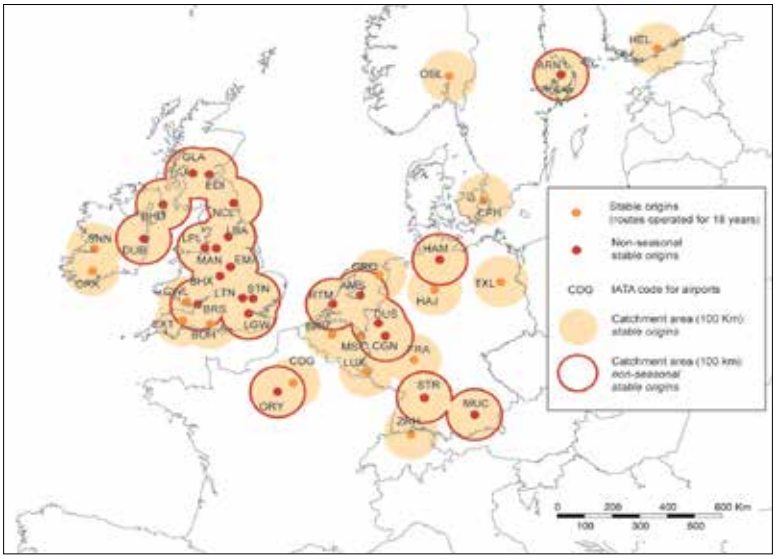


Source: Authors' own work based on unpublished data from ANA and EUROSTAT (2003)

Besides reflecting changes in the airlines' business model, this shows that the routes always prioritise a well-defined set of tourist source locations that can be considered crucial for the Algarve (map 1). Thus, the 40 stable routes cover a potential population of 184.4 million people within the catchment area of the airports of origin, which in terms of the route network operated in 2013 means 76.1%. However, the fact is that the 23 connections that are not of a seasonal nature provide a service for 132 million people, and they alone covered 54.5% of the population served in 2013. Furthermore, these figures have risen since 2000, when they stood at 67.2% and 48.1%, respectively, confirming the trend towards polarisation of the supply from this perspective as well.

Finally, a handful of routes are defined by their ongoing intermittent nature: in other words, they appear and disappear frequently. The connection with Madrid is possibly the most unstable of all, as it was withdrawn and then reinstated 3 times over the 18-month period considered. What is more, when we consider the years 2014 and 2015, we note there is even a fourth reinstatement, which is quite a remarkable development for a route that is considered to be strategic for increasing the number of Spanish tourists visiting the region. The links with Lyon, Rome and Verona record three withdrawals and two reinstatements, clear examples of the difficulties in consolidating the tourist flow from the French and Italian markets. The links with the German cities of Dortmund and Karlsruhe were also withdrawn twice, but have since been reinstated for a third time, remaining on the airport's schedule of routes. A further thirteen routes, among which those with the UK prevail, were withdrawn twice during these years.

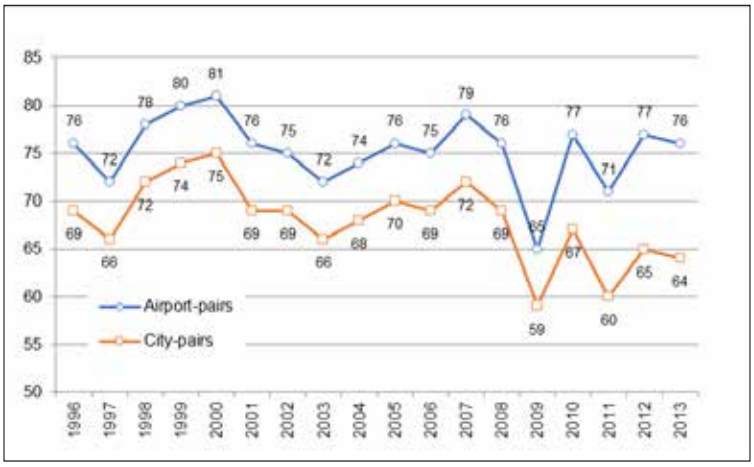
MAP 1. Origin and catchment area of the routes operating on a stable basis with Faro between 1996 and 2013



Source: Authors' own work based on unpublished data from ANA and EUROSTAT (2003)

As regards the origin of the intra-EU international routes operated between 1996 and 2013, it is also noted that the launch of low-cost carriers has not led to any particularly significant changes. A report drafted by the INAC (2012) on the impact of low-cost carriers in Portugal reached much the same conclusion, indicating that their strategy was based not so much on the opening up of new routes, but instead on doubling up the already-existing ones through secondary and/or alternative airports. Indeed, if instead of quantifying the routes as links between pairings of airports, we do so as pairings of cities, considering all the facilities that provide a service for an urban area as a single one, following the criteria described earlier in the method section, the resulting number of links would be 64 in 2013 (figure 5). Furthermore, since 2009, the gap has widened between the results provided by these two calculation methods, indicating that the connections with Faro are now provided by a higher number of secondary and/or alternative airports. This process is linked to the opening of Ryanair's base, which until recently has shown a clear preference for these kinds of airports due to their lower operating costs compared with the more traditional hubs.

Figure 5. Difference in the number of routes operated in Faro (1996-2013) depending on the method of calculation



Source: Authors' own work based on unpublished data from ANA and EUROSTAT (2003)

In sum, it is clear that within the new scenario dominated by low-cost carriers and hybrid operators, the connections between city pairings are far from recording the figures that they attained towards the end of the 1990s. At that time, when the supply provided by non-scheduled flights and charter companies accounted for between 80% and 90% of the airport's international traffic, the highest figure was recorded for the period analysed, with a total of 75 links in 2000.

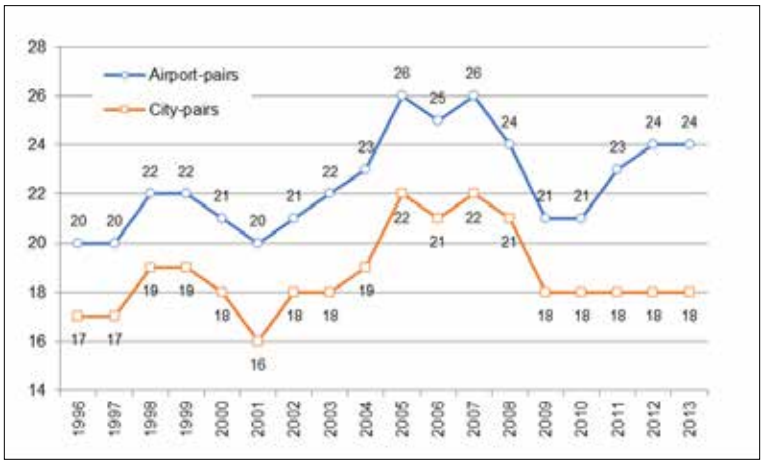
3.2. Results by markets

The overall assessment made of the airport's supply of routes should be complemented by a scale analysis of the source markets, with the aim of detecting specific patterns of behaviour over this period in which low-cost carriers have consolidated their positioning. We present individual analyses for the two main source markets, the UK and Germany, as in 2013 they originated 51% of the airport's connections and accounted for almost 70% of its traffic.

3.2.1. The UK market

In the UK's case, by 1996, Faro was already connected with 18 UK airports serving 15 cities. By 2013, the number of airports had risen to 24 and the number of cities to 18, although the diversification of cities peaked in 2005 (figure 6). Nevertheless, the shift from non-scheduled to scheduled operations and the emergence of low-cost carriers are marked by remarkable stability in the routes operated, as the 16 connections between airport pairings operating uninterruptedly throughout all the years in the period under study only saw a slight reduction in their market share: whereas in 1996 they accounted for 95% of the traffic between Faro and the UK, in 2013 they slightly exceeded 90%. Nevertheless, the traffic records a more balanced distribution across the routes operated (the Gini coefficient fell from 0.65 in 1998 to 0.52 in 2013), a situation that has been reached following a highly heterogeneous trend in the volume of passengers that each of them channelled as of 1996.

Figure 6. Difference in the number of UK-Faro routes (1996-2013) depending on the method of calculation



Source: Authors' own work based on unpublished data from ANA and EUROSTAT (2003)

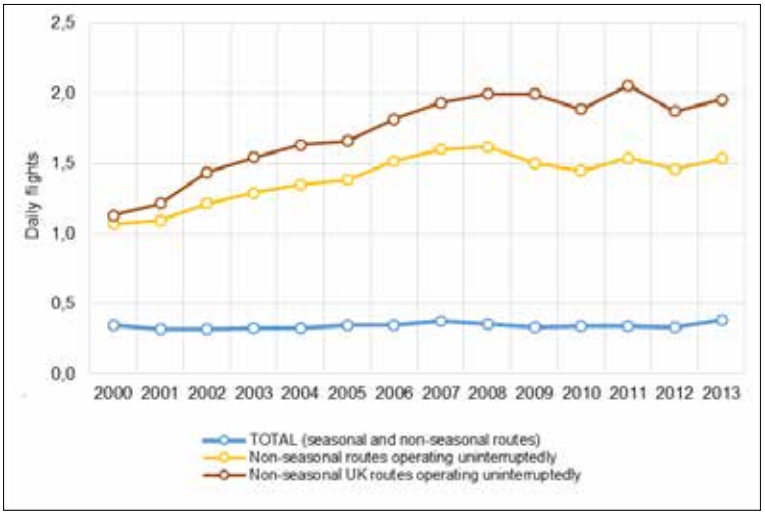
Certain routes have proven to be remarkably unstable, being withdrawn only shortly after opening (Coventry, Humberside, Norwich and Kent), even though in some cases they managed to attract high volumes of traffic (Coventry exceeded 50,000 passengers in 2006). Following an initial stage of sharp growth, other airports, such as Bournemouth, Exeter, Doncaster and Cardiff, in 2007–2008 began a steady downturn that in some cases led to the loss of almost half of their traffic. In fact, only in the cases of Bristol, Liverpool, Leeds,

Belfast International and Glasgow Prestwick can it be stated that there was a clear process of growth and consolidation of routes that was secondary back in 1996. In Belfast's case, the trend is also linked to the general strengthening of the flows between Faro and Northern Ireland following the opening of Ryanair's base in 2010, including the diversification of the routes operated, with flights to Londonderry and Belfast's second airport. On the other hand, the growth recorded by Prestwick and Liverpool is linked to the lower figures for Manchester and Glasgow, reflecting a clear redistribution of the air traffic between airports with a significant overlap in their catchment areas. The same applies to Greater London, where Gatwick lost ground to Luton and Stansted, while for the time being Heathrow has dropped off the map, with the incorporation of London City and the refurbished airport in Southend. In short, a redistribution of traffic occurred that nonetheless has not stopped a loss in London's overall market share with Faro; while by 2013 it accounted for barely 34.1% of the traffic between the Algarve and the UK, in 1996 the figure was close to 49%. This fits the pattern posited by Pearce (1987) for mature tourist destinations, where ground is steadily gained by connections with regional airports in the more consolidated source markets at the expense of the links with the capital.

Therefore, low-cost carriers have adapted their operations to the pattern of routes built up over decades by the non-scheduled supply, with the instability noted in certain connections being related to the process of adjusting those routes to the operating bases of the foremost low-cost carriers (Luton and Stansted are the main bases for easyJet and Ryanair), to the opening of new bases by carriers that have made the move from charter flights to scheduled services (Monarch in Leeds Bradford) or to the specific strategy at certain airports (Liverpool has awarded generous incentives to low-cost carriers, while Manchester has been more inclined to favour network operators). The replacement process has almost concluded, which means that by 2013 the only links provided solely on a non-regular basis were those with Cardiff and Doncaster, with a further eleven airports providing both types of supply and the remaining eleven now only marketing scheduled flights.

On the other hand, the 40% difference noted between the number of UK visitors that officially stay in the region and the number arriving at the airport is a clear indication of the surge in residential tourism from the UK. This phenomenon helps to explain the consolidation of a more stable and frequent supply of flights on some of the busiest routes. Indeed, out of the 23 intra-EU international routes that over the past 18 years have been available from January to December, a total of 13 involve UK airports, being those in which, together with Dublin, the weekly supply of flights has grown more quickly, rising on average from 1 to 2 daily flights, while the figure for the overall number of routes involving the airport has hardly varied between 2 and 3 weekly flights, the traditional pattern of non-scheduled operations (figure 7).

Figure 7. Daily flights depending on the type of routes operated in Faro (2000-2013)



Source: Authors' own work based on unpublished data from ANA

3.2.2. The German market

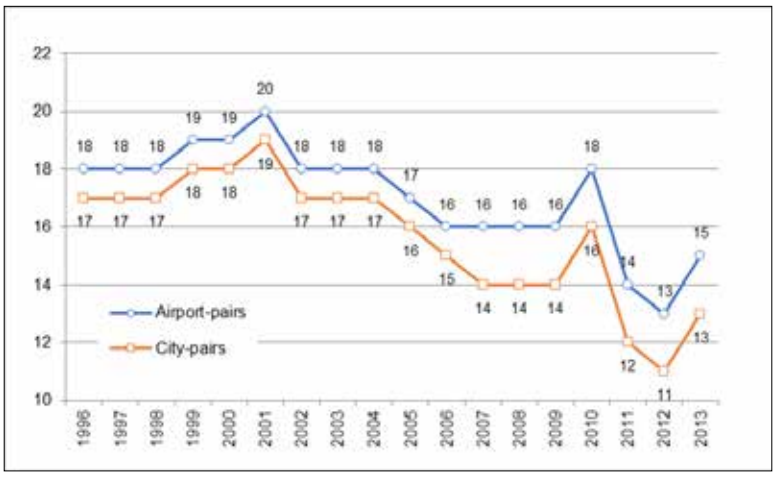
Turning to Germany, the drop in the number of tourist arrivals recorded since the mid-1990s has not led to a significant reduction in the number of routes operated: 17 airports had a direct connection to Faro in 1995, while the figure was 15 in 2012, which in terms of cities served means a drop from 16 to 13. The number of routes operated peaked in 2001, coinciding with the culminating point in a 3-year period of growth for incoming German passengers (figure 8). As regards the distribution of passengers across the different routes, there is less stability than that observed for the UK: the eight routes operated uninterruptedly between 1995 and 2013 lost more than 20 points of market share over that period, accounting on the last date for 61% of the traffic between Germany and Faro. What is important is that this drop materialised as of 2005, and at that time it accounted for 81% of the demand.

Ryanair's appearance on the scene in 2010, following the opening of its Faro base, simply reduced the dominance of those 8 main routes, as the Irish carrier operated in Germany from a significant number of secondary airports, at which the presence of charter companies and/or connections with Faro had been scarce or non-existent (which explains the upturn in the number of routes in 2010). The growth of Weeze, Hahn, Karlsruhe and Memmingen are clear examples of this. Quite the opposite applies to the airports at Dresden, Erfurt, Münster, Nuremberg, Paderborn and Saarbrücken, where after a period of stable connections with Faro that had lasted for over 10 years, and even as long as 15, recording as many as 20,000 passengers, by 2013 there were longer any direct flights to the Algarve. Although there appears to be a balanced outcome between the withdrawn routes and the new connections, there are two significant implications: on the one hand, a tendency towards an increase in the supply at secondary airports close to the country's main urban centres, as Hahn and Weeze operate largely as alternatives to Frankfurt and Düsseldorf, and on the other, the instability observed on certain routes, basically those operated by Ryanair on its own, as revealed by the prompt withdrawal of Faro's connections with Lübeck, Leipzig and Karlsruhe, which in the first two cases were restricted to a single summer season (2010 and 2013, respectively). The addition of Dortmund, and especially of Cologne, to Ryanair's network seems to suggest a change in its strategy that prioritises those cities that were traditionally active in the charter era.

It is still too early to say whether the upturn in the number of German tourists arriving in the Algarve between 2012 and 2013 is purely circumstantial, as had already been the

case in 2009 and 2010, or whether it is related to the consolidation of hybrid and low-cost operators. It is, nonetheless, a fact that 80% of the increase in the influx of German visitors to Faro originated from airports at which Ryanair operates, especially Cologne, Dortmund and Leipzig.

Figure 8. Difference in the number of Germany-Faro routes (1996-2013) depending on the method of calculation



Source: Authors' own work based on unpublished data from ANA and EUROSTAT (2003)

Although the residential behaviour of German passengers is not as extended as that of the British, the difference between tourists accommodated and passengers disembarking even exceeds 20% in some years. There are, moreover, several routes on which the proportion of passengers that report owning a home exceeds 15%, such as Dusseldorf, Hamburg, Stuttgart, Munich, Niederrhein/Weeze, Hahn and Lübeck (Almeida, 2009; Pimpäo *et al*., 2012). Nevertheless, this has not led to a general increase in the weekly flights on the different routes operated, as is indeed the case in the UK. In fact, there are few connections involving a daily flight in the summer months, with the winter simply involving the flight to Dusseldorf.

4. THE POPULATION LIVING IN THE CATCHMENT AREAS OF THE AIRPORTS OF ORIGIN: WHAT CHANGES BETWEEN THE CHARTER AND THE LOW-COST ERA?

The variation in the number of routes supplied by Faro Airport over the 1996–2013 period also permits a more complex spatial reading that is crucial for assessing the impact that these changes exert on the coverage of the population living in the regions that send tourists to the Algarve. Although an analysis of the dynamics of the opening and closing of routes may provide important data from a geographical perspective, they do not cater for the inclusion of certain major qualifications. For example, the new connections with secondary airports involve not only an overlap with catchment areas already covered by routes originating at other airports, but also the incorporation of regions that had hitherto been over 100 km away from a direct flight to Faro.

A simple cartographic analysis enables us to compare the changes taking place between 2000 and 2013. We chose these two years because they are representative of two different traffic structures: the non-scheduled supply still prevailed in 2000 and the airport recorded

the highest number of routes operated; and in 2013 the regularisation of the traffic had almost concluded, with low-cost carriers prevailing over their so-called hybrid counterparts.

Maps 2 and 3 show the catchment areas extending 100 km around the airports that in 2000 and 2013 had a direct flight with Faro. Using the latest population data (2011 censuses) and the methodology described earlier, we find that in 2000 those catchment areas covered a population of 274.3 million people, while in 2013 that figure stood at 242.3 million (table 1).

Table 1. Population covered by the network of routes operating with Faro in 2000 and 2013

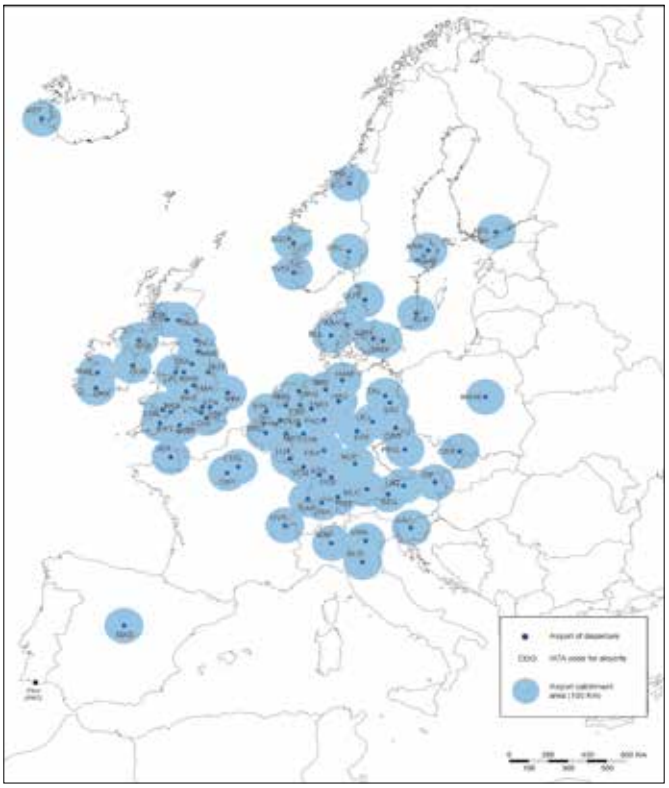
		2000			2013		
Code	**Country**	**Population served**	**TOTAL Population**	**Coverage**	**Population served**	**TOTAL Population**	**Coverage**
AT	Austria	6.844.922	8.404.252	*81,4*	972.032	8.404.252	*11,6*
BE	Belgium	10.508.309	10.951.266	*96,0*	10.951.266	10.951.266	*100,0*
CH	Switzerland	7.679.185	7.938.877	*96,7*	7.232.809	7.938.877	*91,1*
CZ	Czech Republic	7.639.742	10.479.469	*72,9*	8.804.775	10.479.469	*84,0*
DE	Germany	78.894.974	81.752.483	*96,5*	70.432.595	81.752.483	*86,2*
DK	Denmark	4.929.674	5.557.201	*88,7*	4.516.290	5.557.201	*81,3*
EE	Estonia	43.870	1.298.814	*3,4*	43.870	1.298.814	*3,4*
ES	Spain	7.263.942	46.234.392	*15,7*	844.503	46.234.392	*1,8*
FI	Finland	1.925.415	5.375.276	*35,8*	1.925.415	5.375.276	*35,8*
FR	France	23.176.706	65.131.082	*35,6*	29.314.853	65.131.082	*45,0*
HR	Croatia	213.352	4.287.700	*5,0*	0	4.287.700	*0,0*
HU	Hungary	564.750	9.952.571	*5,7*	0	9.952.571	*0,0*
IE	Ireland	3.840.298	4.555.978	*84,3*	4.319.619	4.555.978	*94,8*
IS	Iceland	243.913	318.452	*76,6*	243.913	318.452	*76,6*
IT	Italy	21.445.048	59.227.871	*36,2*	10.439	59.227.871	*0,0*
LI	Liechtenstein	36.149	36.149	*100,0*	36.149	36.149	*100,0*
LT	Lithuania		3.053.338	*0,0*	1.440.619	3.053.338	*47,2*
LU	Luxembourg	511.840	511.840	*100,0*	511.840	511.840	*100,0*
NL	Netherlands	16.573.829	16.574.989	*100,0*	16.573.829	16.574.989	*100,0*
NO	Norway	3.086.387	4.920.305	*62,7*	2.283.876	4.920.305	*46,4*
PL	Poland	9.425.680	38.501.195	*24,5*	16.417.452	38.501.195	*42,6*
SE	Sweden	5.905.055	9.415.570	*62,7*	4.454.710	9.415.570	*47,3*
SI	Slovenia	1.371.925	2.050.189	*66,9*	0	2.050.189	*0,0*
SK	Slovakia	1.907.480	5.395.469	*35,4*	1.059.210	5.395.469	*19,6*
UK	United Kingdom	60.294.075	63.121.595	*95,5*	59.897.633	63.121.595	*94,9*
	TOTAL	**274.326.520**	**465.046.324**	**59,0**	**242.287.697**	**465.046.324**	**52,1**

Note: Population data always refers to year 2011.

Source: Results of the GIS analysis

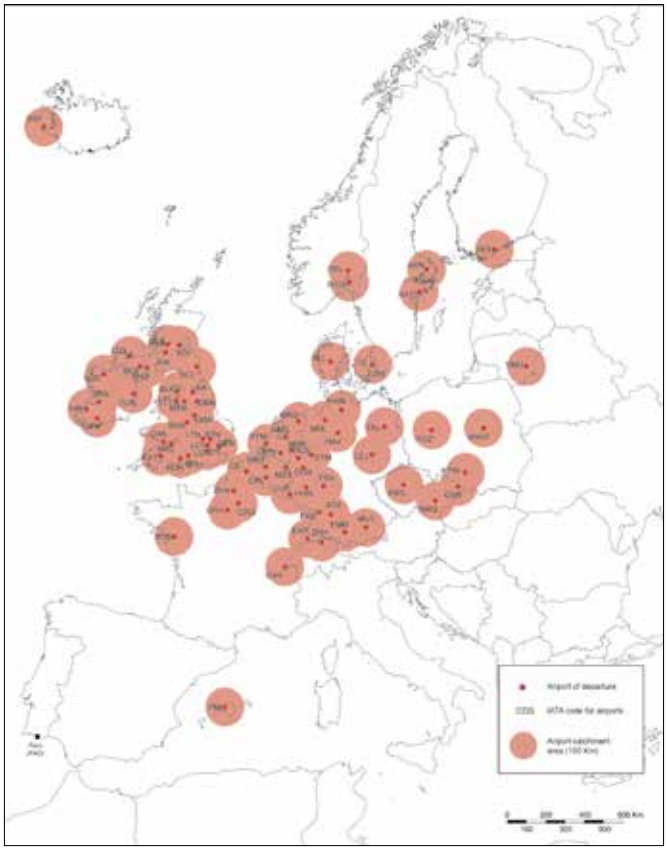
This reduction of 32 million may seem small, as it is no more than 12%, yet it is indicative of a process: following the transition from a model dominated by non-scheduled operators to one in which hybrid carriers prevail, and especially low-cost airlines, the network of connections with Faro has ended up catering for a smaller population volume.

MAP 2. Origin and catchment area of the routes operated with Faro in 2000



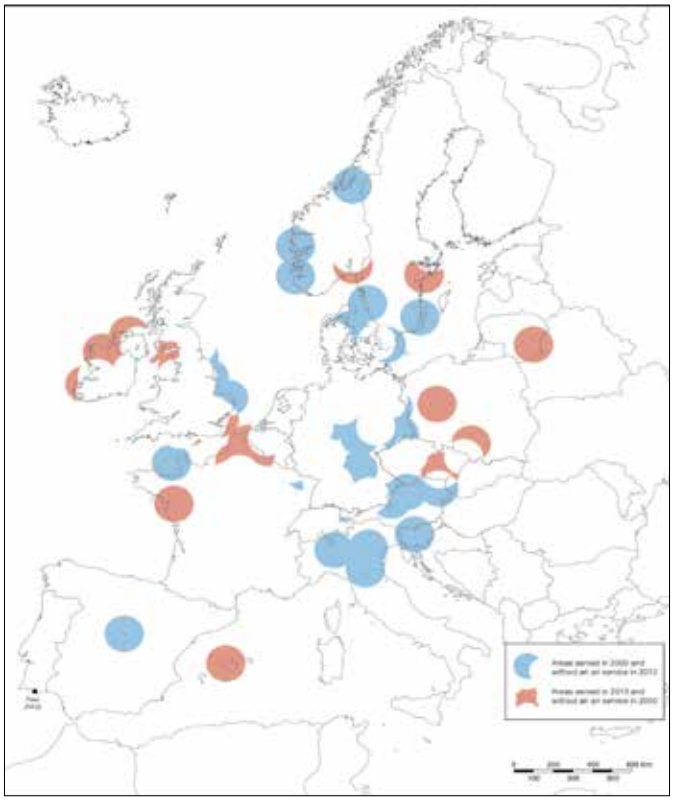
Source: Authors' own work based on unpublished data from ANA

MAP 3. Origin and catchment area of the routes operated with Faro in 2013



Source: Authors' own work based on unpublished data from ANA

MAP 4. Difference between the regions served by the network of routes operated with Faro: 2000 vs. 2013



Source: Authors' own work based on unpublished data from ANA

Table 2 shows that the regions encompassing the new routes' catchment areas have 21 million inhabitants, a figure that far from compensates for the 53 million people now living in areas that are no longer served by the supply of direct flights to Faro. Therefore, the scheduling of routes with airports that previously did not have a direct connection with Faro does not always imply better regional coverage of the source markets or stimulate an increase in demand. If those airports have significantly overlapping catchment areas with others that already have direct links with the Algarve, the final outcome may be a simple sharing of the demand across several infrastructures, as occurs within the backbone of Europe, in the Ruhr Basin and South-East England. Therefore, to gauge the impact of these new routes, it is important to focus on more peripheral areas in geographical terms. Map 4 shows that the connections with Eastern Europe (mostly non-scheduled services) and with the French region of Nord-Pas-de-Calais (through the airports Paris-Beauvais and Brussels-Charleroi) are those that account for the biggest gains. The most significant losses are recorded by Scandinavia and Southern Europe.

Table 2. Difference in the population coverage of the network of routes operated in 2000 and 2013

Country	Population in unserved areas	Population in served areas	Difference
Poland	-189.764	7.181.536	6.991.772
France	-1.478.209	7.616.356	6.138.147
Lithuania		1.440.619	1.440.619
Czech Republic	-325.245	1.490.278	1.165.033
Ireland		479.321	479.321
Belgium		442.957	442.957
Croatia	-213.352		-213.352
United Kingdom	-704.344	307.902	-396.442
Denmark	-413.384		-413.384
Switzerland	-446.376		-446.376
Hungary	-564.750		-564.750
Norway	-1.306.779	504.268	-802.511
Slovakia	-933.308	85.038	-848.270
Slovenia	-1.371.925		-1.371.925
Sweden	-1.970.169	519.824	-1.450.345
Austria	-5.933.238	60.348	-5.872.890
Spain	-7.263.942	844.503	-6.419.439
Germany	-8.512.244	49.865	-8.462.379
Italy	-21.434.609		-21.434.609
TOTAL	-53.061.638	21.022.815	**-32.038.823**

Note: Population data from 2011.

Source: Results of the GIS analysis

5. THE CASE OF RYANAIR

When we discussed the overall outcome of the dynamics of the routes operated at Faro Airport, we mentioned the significant impact that the opening of Ryanair's new base had on that result in 2010, given the high number of routes that the Irish carrier has operated and the constant opening and closing of destinations within its network. Although in 2010 Ryanair was no stranger to the airport, it significantly reinforced its presence there: its supply jumped from 11 to 31 intra-EU international routes, which in terms of the supply of seats meant multiplying the prior year's figures by 2.3. This gave the airport such a boost that it managed to close its business in 2010 with a sharp increase in the volume of passengers carried that more than made up for the sharp drop recorded in 2009. Furthermore, between 1996 and 2015, the Irish airline operated as many as 39 different international routes, although at the same time it recorded a peak of 31 during the 2010 summer season, a figure that to date it has yet to exceed. Ryanair has therefore been the main beneficiary of several programmes of public subsidies designed to introduce new air routes, and it ended 2014 as

the airport's leading operator in terms of passenger numbers. Accordingly, a more detailed analysis of the regional impact associated with the network of routes operated by Ryanair in Faro will help us to gauge better the impact linked to the prevalence of low-cost carriers at tourist airports.

Although the figures presented in the previous paragraph are considered exceptional by the leading tourist agents in the region, an objective appraisal of the impact of Ryanair's base should not ignore the fact that out of the 20 new routes opened, only 10 were not provided by another operator, and in only three cases (Madrid, Marseille and Milan-Bergamo), there was no significant overlap with the routes operated by other carriers from nearby airports (map 5). In fact, those 10 links operated solely by Ryanair incorporated 22.6 million people into the population served with direct flights in 2010, barely 8.4% of the 270 million included in the catchment areas of the airports of origin in that year. What is more, when we consider that the route with Madrid affects 7.2 million people, the case of Milan-Bergamo 7.7 million and Marseille 5 million, the contribution made by all the other connections is wholly irrelevant from that perspective. This confirms that Ryanair has focused on a direct concurrence in those corridors in which there was a significant traffic potential, rather than in the real opening of new routes. In addition, however, it reveals that in terms of the population served, there are few variations besides those of the three genuinely new routes, which on the other hand were also withdrawn shortly after being opened (Marseille and Milan-Bergamo the following year and Madrid in 2013).

On the other hand, although Ryanair is frequently opening and closing routes, the phenomenon in Faro is no way near to being on a par with the rate recorded in the overall network operated by the Irish carrier (de Wit and Zuidberg, 2012). Further still, it might easily be said that Ryanair has been highly selective when defining the routes that it operates from its Faro base. Of the 31 routes operated at the start of 2010, a total of 22 are still operating in 2015, with 11 of them being part of the small group of connections that have operated uninterruptedly over the past 18 years, while 3 have been operating for more than 12 years at Faro, since 1996. A further 4 links are operations with alternative airports in large metropolitan areas (Charleroi, Weeze, Hahn and Beauvais). We are therefore dealing with a majority of origins with a proven capacity to send tourists to the Algarve, in terms of both their track record and the size of their populations. The 4 remaining routes have very specific characteristics: 3 Irish airports (Kerry, Knock and Derry) are peripheral and have little capacity for sending tourists, but Ryanair's low fares manage to generate a significant amount of traffic, and Memmingen, in the south of Germany, is at the midway point between several large cities, such as Munich, Stuttgart and Zurich, which means a high potential demand. Over this period of time, Ryanair has also ended up withdrawing several routes, with the more noticeable cases being the few months that the links lasted with Lübeck, Marseille and Bergamo. These are the cases that reflect Ryanair's trademark approach to opening new routes that has been identified by Wit and Zuidberg (2012): rather than prior market studies, the process appears to follow a simple strategy of trial and error, whereby if the route does not generate enough income, it is automatically removed during the next scheduling.

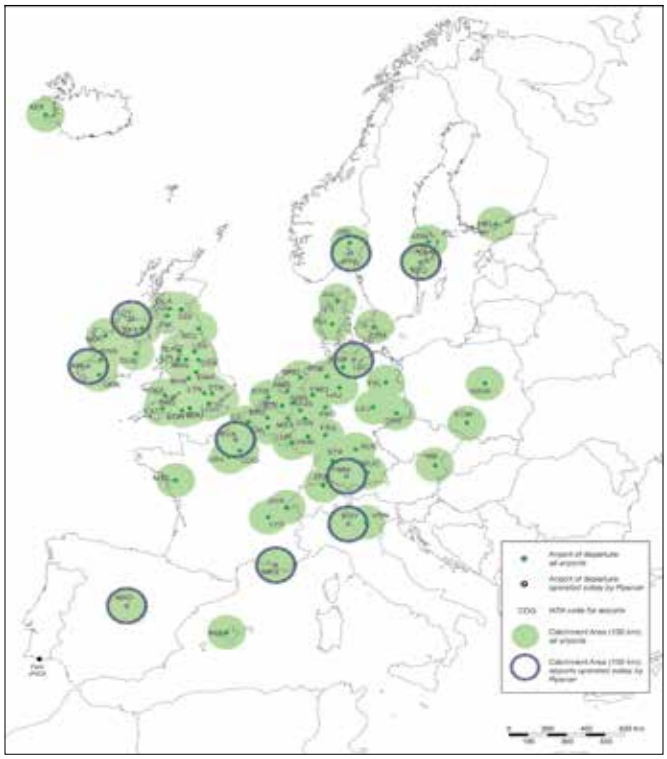
Nevertheless, following the withdrawal of all the links to Scandinavian countries in the summer of 2015, it is obvious that the network operated by Ryanair at Faro tends towards greater spatial concentration, reinforcing as noted the traditional source regions for tourists.

6. CONCLUSIONS

The reduction in the population served by airports with direct flights to Faro has not led to a decrease in the arrival of tourists staying in the Algarve or a reduction in the airport's traffic over the time frame considered, with the exception of 2009. This permits a double-sided reading: a positive one, as it shows how appealing the Algarve is as a tourist destination, especially in a series of significant tourist source markets (United Kingdom, Germany and the Netherlands); and a negative one, as it shows that the region is somewhat incapable not only of diversifying its source markets, but even also of ensuring a certain variety of airports of origin within these very heartlands. This overdependence on a handful of markets within the current context of intense competition among destinations is a major weakness that may have a bearing on the trend in demand over the medium term.

The path followed by low-cost carriers leads to a situation of shadows and light from the perspective considered in this paper. Although it is clear that their presence allows a better adjustment of the supply to the changes detected in the behaviour of tourist demand – the individual organisation of holidays – and new routes being opened with airports that previously had no direct flights with Faro, the analyses conducted reveal that the regional coverage of the network currently operated caters for a smaller population volume than in 2000. The quality of the service has largely been improved (number of weekly flights, range of carriers) in those regions that already had a significant supply, while all the other areas have seen their supply reduced or even cancelled completely.

MAP 5. Catchment areas of Ryanair's new routes at Faro in 2010. A limited regional impact?



Source: Authors' own work based on unpublished data from ANA

Elsewhere, the analysis presented here shows the potential of the Geographic Information System (GIS) as an instrument for supporting the decision-making process in tourism-related and airport management matters. It is clear that one of the criteria to be considered in the incentive-based opening of new routes is better coverage of those areas with a greater

potential for sending tourists to the Algarve, especially when the quality of the flight supply with consolidated markets, such as the UK and Germany, is already very high. A spatial analysis of the data is therefore extremely valuable. Furthermore, this paper has linked the regional coverage of the catchment areas of airports of origin with a single variable, namely population, but others of great significance from a tourism perspective could also be included, such as level of income, or by giving different weightings to air links depending on the weekly flights operated.

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ANNEX 1. Multi-airport systems considered for the calculation of routes between city pairings

Metropolitan Area	Airports	Code	Distance from centre (Km)	Metropolitan Area	Airports	Code	Distance from centre (Km)
Barcelona	Barcelona	BCN	19	**Hamburg**	Hamburg	HAM	14
	Girona	GRO	93				
	Reus	REU	103		Lübeck	LBC	69
Berlin	Tempelhof	THF	6,5	**Katowice-Cracovia**	Katowice	KTW	10
	Tegel	TXL	12				
	Schönefeld	SXF	20		Cracovia	KRK	79
Belfast	City	BHD	10	**London**	City	LCY	11
					Heathrow	LHR	29
					Gatwick	LGW	45
	International	BFS	27		Stansted	STN	52
					Luton	LTN	52
					Southend	SEN	67
Brussels	Brussels	BRU	13	**Lyon**	Lyon	LYS	29
					Saint Etiénne	EBU	77
	Charleroi	CRL	50		Grenoble	GNB	86
Düsseldorf	Düsseldorf	DUS	8,5	**Milan**	Linate	LIN	13
	Mönchengladbach	MGL	21		Malpensa	MXP	48
	Niederrhein	NRN	67		Bergamo	BGY	51
Stockholm	Bromma	BMA	10	**Oslo**	Gardemoen	OSL	56
	Arlanda	ARN	40		Rygge/Moss	RYG	69
	Skavsta	NYO	99		Sandfjord/Torp	TRF	103
	Västerås	VST	104				
Strasbourg	Strasbourg	SXB	12	**Paris**	Orly	ORY	16
					Charles de Gaulle	CDG	26
	Karsruhe	FKB	41		Beauvais	BVA	79
Frankfurt	Frankfurt	FRA	13	**Rome**	Ciampino	CIA	15
	Hahn	HHN	121		Fiumicino	FCO	30
Glasgow	Glasgow	GLA	14	**Vienna**	Vienna	VIE	20
	Prestwick	PIK	48		Bratislava	BTS	76
Gothenburg	Säve	GSE	15				
	Gothenburg	GOT	24				

Source: Authors' own work. Distances by road calculated using the application www.viamichelin.com