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Mercado único europeo del transporte aéreo: un enfoque empírico sobre la eficiencia y sostenibilidad de las obligaciones de servicio público en las rutas domésticas en España

The European Single Air Transport Market: An Empirical Approach on the Efficiency and Sustainability of Public Service Obligations in the Spanish Domestic Routes

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A mis padres, Antonio y María Teresa.

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Mercado único europeo del transporte aéreo: un enfoque empírico sobre la eficiencia y sostenibilidad de las obligaciones de servicio público en las rutas domésticas en España.

The European Single Air Transport Market: An Empirical Approach on the Efficiency and Sustainability of Public Service Obligations in the Spanish Domestic Routes.

Resumen: La movilidad sostenible del transporte de mercancías y de las personas utilizando modos de transporte eficientes es un factor clave para lograr el reto de la transformación fundamental del transporte a la que se enfrenta la Unión Europea (UE) hacia la consecución de los Objetivos de Desarrollo Sostenible (ODS) de la Agenda 2030 abordada por las Naciones Unidas (ONU). El refuerzo de los sistemas de transporte intermodal es un elemento crucial para gestionar una movilidad más eficiente de acuerdo con la política común de transportes de la UE, estimulando así un sector de transporte competitivo dentro del mercado interior europeo. El transporte público también desempeña un papel vital en el logro de una mayor cohesión territorial y, por tanto, en la lucha contra la despoblación rural. Sin embargo, algunas comunidades situadas lejos de los principales centros de transporte han sufrido tradicionalmente la falta de medios de transporte accesibles y asequibles, en particular los situados en regiones periféricas. Además, en el caso de los territorios insulares y las zonas remotas, el transporte aéreo es a menudo la opción óptima, entre todos los modos de transporte posibles, en términos de tiempo de viaje y frecuencias de vuelo, cuando no existe una alternativa razonable, y la mayoría de las veces es el único enlace con el continente para necesidades de movilidad esenciales. Considerando que el transporte aéreo es un servicio esencial para estas comunidades, especialmente las que viven en territorios especiales de la UE, el sistema de libre mercado no siempre es capaz de garantizar modos de transporte adecuados en términos de disponibilidad, continuidad y precios. Dado que la mayoría de los transportistas son en su mayoría empresas privadas, no pueden ser obligados a operar rutas no rentables. Y, dado que el mercado único de la aviación de la UE se ha liberalizado plenamente desde el 1 de abril de 1997, la prestación comercial de servicios de transporte aéreo de pasajeros no entra dentro de su ámbito de competencia de los Estados miembros, debido a la escasez de recursos de aviación. Para resolver esta deficiencia del mercado, se ha introducido el esquema de obligaciones de servicio público (OSP) a partir de los artículos 16 a 18 del Reglamento de servicios aéreos 1008/2008. Por lo tanto, la OSP puede diseñarse en una ruta aérea para garantizar servicios de transporte regular, ya sea para personas o mercancías, en casos debidamente justificados por la autoridad responsable de imponer por razones de necesidades esenciales en la región de que se trate (región de desarrollo o periférica, y ruta delgada). El objetivo de esta investigación es evaluar el uso eficiente del sistema de OSP, en combinación con otras formas de acciones públicas en el mercado de la aviación, para garantizar servicios adecuados de transporte regular de pasajeros al servicio del mercado nacional en España. Con este fin, se han analizado dos formas principales de intervención (compensación económica y subvención residente). Además de las dos acciones públicas apoyadas con fondos estatales con arreglo a la legislación europea, el estudio ha examinado ampliamente otras interferencias públicas a nivel regional en el mercado libre, como los contratos de comercialización para promover el turismo y las conexiones aéreas. Todas estas formas de sostenimiento pueden considerarse, de hecho, instrumentos jurídicos para garantizar la libre circulación de personas y mercancías dentro del mercado único europeo. A tal fin, el esquema de OSP se ha utilizado hasta ahora como remedio a la falta de servicios de transporte aéreo regular en 176 rutas aéreas de trece Estados miembros de la UE (al 18 de septiembre de 2019). En el caso del sistema de OSP implementado hasta el momento en España, se han analizado 23 rutas aéreas en el periodo entre 2004 y 2019, mostrando que, en el tema de la movilidad sostenible, el esquema de OSP puede ser extremadamente útil para el mantenimiento de servicios esenciales de transporte aéreo en determinadas circunstancias por razones socioeconómicas en regiones desfavorecidas. Estas obligaciones, incluso en combinación con las subvenciones a los residentes, son más que suficientes para garantizar la conectividad aérea básica sin necesidad de licitar contratos de publicidad a nivel regional. Además, es importante señalar que España se ha centrado hasta ahora en las rutas periféricas e interinsulares. El estudio también indica que el aumento de la subvención de residencia se produjo en 2018 hasta un total del 75% sobre las tarifas existentes puede tener ciertos efectos no deseados en las tarifas aéreas para los pasajeros no residentes que visitan tanto las Islas Canarias como las Islas Baleares, así como los dos territorios de ultramar españoles en el norte de África, Melilla y Ceuta. Las conclusiones sugieren que el desafío futuro debe abordarse estimulando la competencia en el sistema de transporte regional, incluso mejorando la intermodalidad entre el transporte aéreo y el marítimo (por ejemplo, mediante un billete combinado). Además, debería estudiarse más a fondo el actual sistema de subvenciones para residentes en España, con el fin de adaptarlo a un sistema basado en diversos descuentos en función del nivel de ingresos de cada persona elegible, en lugar del actual descuento aplicado sin distinción. Por lo que se refiere a la sostenibilidad, en este estudio se llegó a la conclusión de que los turbohélices se han utilizado en su mayor parte en lugar de los turborreactores, al tiempo que se han reducido las emisiones contaminantes por pasajero, ya que este tipo de aeronave suele ser mucho más eficiente para operar servicios de transporte regional, como rutas de corta distancia de hasta 500 km, incluso con baja demanda. En cuanto al impacto de las rutas aéreas de OSP en la eficiencia del transporte en España, esta investigación también ha encontrado una fuerte relación entre la existencia de rutas caracterizadas por una fuerte estacionalidad debido al efecto turístico y la necesidad de contratos de OSP mediante la licitación de servicios aéreos regulares en períodos de baja demanda. Sin embargo, aparte de la ruta aérea entre Madrid y Menorca (ES03), todas las rutas hasta ahora licitadas (un total de 11) con contratos de OSP se han adjudicado para la prestación de servicios regulares sin restricciones en términos de estacionalidad. Por último, esta investigación también ha analizado el impacto del COVID-19 en la demanda de pasajeros de servicios regulares de transporte en determinadas rutas de OSP en España, especialmente en lo que respecta a la entrada en vigor del estado de excepción desde todo el territorio español debido a la pandemia de 2020. El efecto perturbador de este acontecimiento mundial en el sector del turismo es especialmente dramático en el sector de la aviación, causando la pérdida de varias rutas aéreas, algunas de ellas esenciales para las economías regionales. Los resultados sugieren que varios de ellos deberán ser objeto de una OSP, y muy probablemente licitados para la prestación de servicios de transporte de pasajeros en zonas menos desarrolladas, así como en territorios remotos e insulares. Además, este estudio debería arrojar algo de luz sobre los detalles de cómo el esquema de PSO se puede enfrentar al desafío de avanzar hacia un nuevo escenario bajo condiciones sanitarias estrictas.

Abstract: *Sustainable mobility of freight and people (individuals) using efficient modes of transport is a key factor to achieve (overcome or triumph) the challenge of fundamental transport transformation faced by the European Union (EU) towards Sustainable Development Goals (SDGS) from the 2030 Agenda addressed by the United Nations (UN). The strengthening of intermodal transportation systems is a crucial element to running more efficient mobility according to the EU common transport policy; thus, stimulating a competitive transport industry within the European internal market. Public transportation also plays a vital role in achieving greater territorial cohesion, and therefore combating rural depopulation. However, some communities situated far from main transport hubs have traditionally suffered from the lack of accessible and affordable transportation, particularly those situated in peripheral regions. In the case of island territories and remote areas, air transport is often the optimal choice, among all possible transport modes, for its travel time and flight frequencies as it is often the only link to the mainland for essential mobility needs. Considering that air transportation is an essential service for such communities, especially those living in EU special*

territories, the free market system is not always capable of guaranteeing adequate transport modes in terms of availability, continuity, and prices. Since most carriers are mostly private-owned companies, they cannot be compelled to operate non-profitable routes. And, because the EU single market in aviation has been fully liberalized since 1 April 1997, the commercial provision of passenger air transport services is not within its sphere of competence of member states, due to a shortfall in aviation resources. To solve this market failure, the Public Service Obligation (PSO) schema has been introduced from the Articles 16-18 of the Air Services Regulation 1008/2008. Hence, the PSO may be designed on an air route in order to ensure scheduled transport services, either for people or goods, in cases duly justified by the public authority responsible for imposition on the basis of essential needs in the region concerned (either development or peripheral region, and thin route). This research aims to assess the efficient use of the PSO system, in combination with other forms of public actions in the aviation market, in order to ensure adequate regular passenger transport services for the domestic market in Spain. For this purpose, two main intervention forms (economic compensation and resident subsidy) have been analyzed. In addition to both public actions supported with state funding under European law, the study has extensively examined other public interferences at the regional level in the free market such as marketing contracts for promoting tourism and air links. All these ways of sustaining may be considered, in fact, legal instruments to guarantee freedom of movement for individuals and goods within the European Single Market. To that end, the PSO schema has been used so far as a remedy for the lack of scheduled air transport services on 176 air routes across thirteen EU state members (as of 18 September 2019). In the case of the PSO system so far implemented in Spain, 23 air routes have been analyzed in the period between 2004 and 2019, showing that, on the issue of sustainable mobility, the PSO schema can be extremely useful to maintain essential air transport services under certain circumstances for socioeconomic reasons in disadvantaged regions. These obligations, even in combination with resident subsidies, are more than sufficient to ensure basic air connectivity without the need to tender advertising contracts at a regional level. Furthermore, it is important to note that Spain has focused so far on peripheral and interisland routes. The study also indicates that the increase of resident subsidy occurred in 2018 up to a total of 75% over existing rates may have certain undesired effects on airfares for those non-resident passengers visiting both the Canary Islands and the Balearic Islands, as well as the two Spanish overseas territories in Northern Africa, Melilla, and Ceuta. The findings suggest that the future challenge should be addressed by stimulating the concurrence in the regional transportation system, even enhancing the intramodality between air and sea transport (for instance, through a combined ticket). Additionally, the existing resident subsidy system in Spain should be further studied to be amended towards a system based on various discounts depending on the income level of each eligible person instead of the current discount applied without distinction. With regard to sustainability, this study found that turboprops have been mostly operated rather than turbojets, while reducing pollutant emissions per passenger, as this type of aircraft is often much more efficient operating regional transport services, as short-haul routes up to 500 km, even with low demand. Regarding the impact of PSO air routes on the efficiency of transportation in Spain, this research has also found a strong relationship between the existence of routes characterized by strong seasonality due to the tourism effect and the need for PSO contracts by tendering regular air services in low demand periods. However, apart from the air route between Madrid and Menorca (ES03), all routes so far tendered (a total of 11) with PSO contracts have been awarded for the provision of regular services without restrictions in terms of seasonality. Finally, this research has also analyzed the impact of the COVID-19 on the passenger demand for regular transport services on certain PSO routes in Spain, particularly regarding the entry into force of the state of emergency from entire territory in Spain due to the pandemic during 2020. The disruptive effect of this worldwide event on the tourism sector is being particularly dramatic in the aviation sector, causing the loss of several air routes, some of them essential for regional economies. The findings suggest that a number of them shall need to be imposed with a PSO, and most likely tendered for the provision of passenger services serving less developed areas, as well as remote and island territories. This study should also shed some light on the details of how the PSO schema can face the challenge of moving towards a new scenario under stringent sanitary conditions.

Chapter 1

OVERALL INTRODUCTION

Introducing a system based on public service obligations to ensure essential transportation services in the EU single market in aviation

Starting from these lines, and under the title "European single air transport market: an empirical approach on the efficiency and sustainability of public service obligations on domestic routes in Spain", I am preparing to address the present doctoral thesis resulting from the EHEA doctoral degree (R.D. 99/2011) under the doctoral program in the European Union (9616). The thesis has been drafted in English since it is the usual language for scientific communication in the field of knowledge subject to it, and which, furthermore, aims to obtain international mention. The research work, during these last years of Ph.D., has been carried out around the main objective of collecting as much data as possible that, from primary sources, could be obtained in the subject matter of research. Given that the transport market is often regarded as an essential service in socio-economic terms, it is essential to know in advance the dynamics of the sector, the applied regulation, and the existing market regime.

Since the 1990s (the end of the Cold War, after the collapse of the Soviet Union and the fall of the Berlin Wall) we have been witnessing an expansion of international trade in a flat world where several access barriers have been removed, thus opening the market to more market players. The business fabric of the old continent has had, therefore, in its internalization something more than the simple reaction to the concurrent pressure, but a way to diversify the geographical areas of the business to reduce the dependence on the consumption of its internal markets, thus mitigating the impact of the last economic contraction that took place. Then, the commitment to the mobility of goods, efficiently and effectively, has allowed developing a real transport industry as a fundamental basis for economic growth. While the break-in of low-cost carriers in the 90s has profoundly transformed the air transport market, thus contributing to the strong growth experienced over the past 20 years in the mobility of people and goods both within the European single market and beyond its external borders. In no other transport mode (shipping, rail, etc.) there has been a great business expansion such as the one that occurred in air transportation which is only the fruit, as already pointed out, of the opening of the market to operators more efficient in terms of optimization of resources. The traditional companies, better know as legacy carriers, heirs of the former monopolies in the operation of passengers and air cargo saw new actors appear, not only competed in their natural market of performance but also with well adjusted and optimized structures. They were positioned in a more favorable position due basically to their particular cost structures. This has forced legacy airlines to face these new challenges since the end of the 1990s. Hence, mainline carriers had to change substantially their business model in order not to lose the competitive ability and even something much worse like being out of the market. Transport modes (sea, land, and air) falls within the so-called "single market for services" under the system of provision of services under Articles 49 and 56 of the Treaty on the Functioning of the European Union (TFEU). This only provides a framework for stability so that economic operators in the transport sector can operate within the European internal market, either in the Community country of origin or in any of the Member States, but with no obligation to stay with him. In the case of air transport, absolute freedom of operation only subject to the availability of take-off and landing rights (slots) within the internal market, not only to operate flights from one Member State to another but, most significantly, to operate flights within another Community country. In this sense, the EU’s action, under the well-known objective of ensuring the proper functioning of the single market in services, has been developing efforts to improve the free movement of people and goods in those so-called "cross-border" crossings; now "intra-Community.

Although the process of consolidating the common transport market has not been easy over the last 20 years, it is nevertheless true that the progress achieved has gone far beyond a simple consolidation of the internal market, but has also made it possible to establish rules, legal and organizational aspects of the aviation sector, both from the point of view of the air operation itself and from the point of view of the management of air infrastructure and air navigation. The creation of a common market is based on open-ended processes, in order, inter alia, to facilitate the free movement of goods and persons. The role played by the means of transport, besides the rapid technological progress, especially in the air transport sector, has been decisive in ensuring access to affordable transportation (air and high-speed rail), once affluent layers of the population can reach these transport services. The "democratization" is in part due to the liberalizing process applied to the European air transport market, and thus facilitating the entry of new operators, as well as to the efficiency in the control of air traffic flows, thus optimizing commercial air routes. Over the past years, moreover, the aeronautical industry has made considerable savings in aeronautical operating costs (i.e., categorization of preventive and corrective maintenance, reduction of fuel consumption, optimization of life cycles, etc.). Since the creation of the European Community, through the Treaty of Rome (1957), the common transport policy has been one of the founding elements. In the beginning, concerning land and sea transport; later, in the 1970s, with regard to air transport. With the entry into force of the Treaty on European Union (TEU), initialed in Maastricht in 1992, new provisions were put in place in order to make transport policy objective on three axes: promoting safety, promoting a genuine pan-European network, and protecting the environment. The common transport policy was thus brought to fruition from the formation of a common European market since from the outset it became clear that a comprehensive approach was needed to establish a common market for air operations, which would make it possible to: Firstly, the entry of new operators and, secondly, the emergence of private operators as alternatives to legacy companies, the revitalization of the single European airspace with the irruption of low-cost companies. Community transport policy is currently centered on the objective of ensuring the mobility of persons and goods within the European internal market and establishing a common position (regulation, policy, and legislation) in the aviation sector, against other external markets to establish more "open skies" or, in the worst case, bilateral agreements that include more traffic rights. Nowadays, the European Union (EU) is a geopolitical reality made up of almost all the countries that make up the European continent, and that in itself generates a common economic space of very diverse member states with a total of a population of more than 500 million citizens. However, while it is true that the number of achievements in the complex process of political and economic integration in the EU has been enormous, phased, and sustained over time, such a process has never been without difficulties due to the complexity of aligning the different national legislative frameworks towards the achievement of a market unity.

In light of the foregoing, the doctoral thesis has been structured as follows:

- Chapter 1 is precisely this introduction whose intention is nothing more than an exposition of the objectives and methodology applied in doctoral research, as well as a brief description of the parts that make up this doctoral thesis.
- Chapter 2 comprises background information for a better understanding of the research topic. Some aspects of the aviation industry relating to entrepreneurship

and innovation and airline alliances have been briefly described since they could affect the Public Service Obligations (PSO) schema.

- Chapter 3 is the core of the thesis, as this contains the findings of the study on each PSO air route imposed so far in Spain. The routes considered have been grouped into case studies according to their geographical location of the related transport services. The chapter begins with a description with plenty of supporting graphic material for a better understanding of the issue and then showing an overview of the current PSO system in the domestic aviation market in Spain. Finally, several subsections have been used in order to structure properly the case studies considered. Many subsections also bring particular conclusions on the routes considered.
- Chapter 4 summarizes the most important conclusions from the findings obtained in each case study.
- Chapter 5 contains full materials of those communications so far presented at various international events, such as meetings, congresses, or even lectures. Due to the complexity of the research topic, the attached appendices can help visualize the key aspects carried out from the analysis of the study.
- Chapter 6, finally, contains the list of references used throughout the thesis. While they have been listed in most subsections, it is useful if a summarized list can be now shown.

Ultimately, the present work is aimed to provide the first general study on the PSO system concerning the domestic air transport market so far carried out in Spain. This could serve as a basis for improving understanding of the PSO fact and can pave the way for finding further results, particularly those relating to sustainability and efficiency of public transportation. In the event of getting further information about past fares data from reliable sources concerning each mode of transport, future researches might go beyond in order to identify any mathematical relationship among variables affecting the intermodality of public transport. Nevertheless, the effects of the pandemic due to COVID-19 have caused significant distortions in interpreting the results of research when establishing a model to determine market trends.

CHAPTER 2: BACKGROUND

Subsection 2.1

A brief outlook of airline alliances in the worldwide air transport market

Framework

- Airline alliances (AA) usually include not only world's top aviation companies but also smaller regional airlines.
- Memberships within the same AA may have different frequent-flyer programs.
- Airline Alliances are global partnership agreements, and therefore it should not be confused with other purposes strictly limited to codeshare agreements.
- Beyond the extended route maps and service, airline alliances also benefit passengers with their loyalty programs, award mile earnings, and lounge offerings for qualified frequent flyers.
- When moreover, delays or cancelations happen, member airlines often offer to re-ticket you on partner airlines to ensure passengers reach their intended destination.

Alliance alliances (as of October 2019)	oneworld	SKYTEAM	STAR ALLIANCE
Trade name	oneworld Management Company, Inc. ("oneworld")	SkyTeam Airline Alliance Management Coöperatie U.A. ("SkyTeam")	Star Alliance Services GmbH ("Star Alliance")
Headquarter	2 Park Avenue, Suite 1100, New York, NY 10016, USA	Schiphol Boulevard 367, 1118 BJ Schiphol, The Netherlands	Frankfurt Airport Centre, Main Lobby, 60546 Frankfurt/Main, Germany
Number of member airlines	13	19	26
Destinations / Countries	1,000 / 180	1,150 / 175	1,294 / 190
Total fleet size	3,500	3,265	4,056
Total Annual Passengers (2018) Source: AA, 31.03.2019	550m	630m	762m
% of total scheduled traffic worldwide (in RPKs) (2018) Source: IATA, 31.07.2019	15.4	18.8	21.9
Strengths	strong presence in the American continent	only alliance with a cargo element	consistency of rules and perks (free luggage, lounge access, etc); strong African network.
Weaknesses	almost null presence in the African market	scarce presence in the African market	difficult to manage all members: imbalanced internal competition
Current alliance slogan	*Travel Bright*	*Caring more about you*	*The Way the Earth Connects*

Source: Own work based on data collected from AA's official webpages.

Relevant Agencies	Membership	Mandate
	last State members (2019): non-member:	The International Civil Aviation Organization (ICAO) is an UN specialized agency to manage the administration and governance of the Convention on International Civil Aviation (Chicago, 1944), which is also the basis of Public International Air Law.
EASA European Aviation Safety Agency		This is an agency of the EU that, among other tasks, ensures the highest common level of both safety and environmental protection for EU citizens, and whose technical regulation becomes compulsory for all EU member States.
EUROCONTROL		The European Organization for the Safety of Air Navigation (EUROCONTROL) is an intergovernmental organization that is committed to manage a legislative framework for European aviation through the Single European Sky (SES), which has been launched by the European Commission in order to meet future capacity and safety needs in its Air Traffic Management (ATM).

Source: Own elaboration (as of 2019).

Entity	IATA	
Official Name	International Air Transport Association	International Civil Aviation Organization
Headquarter	800 Place Victoria, Montreal	999 Robert-Bourassa blvd, Montreal
Founded	La Habana, 19 April 1945	Chicago, 4 April 1947
Form of establishment	International trade association	UN specialized agency
Full members	290 airlines of 120 countries (82% of the world's air traffic)	193 countries (as of 13/4/2019)

Source: Own elaboration (as of 2019)

Full members list of SkyTeam (as of IATA Northern Summer Season 2019)

	Country	Fleet size (as of 2019)	Founded	Destinations/ Countries [2018]	Joined SkyTeam	Average Fleet Age (as of 2019)	Operating Revenue [FY2018]	Annual Passengers [FY2018]
AEROFLOT Russian Airlines		250	1932	146 / 52	April 2006	4.9	RUB446.6m	32.8m
Aerolíneas Argentinas		56	1949	58 / 13	August 2012	9	USD2.04bn	13.1m
AEROMEXICO		70	1934	92 / 24	June 2000	7.8	MXN61.5bn	20.7m
AirEuropa		64	1986	53 / 23	September 2007	9	EUR1.9bn	10.6m
AIRFRANCE		223	1933	195 / 93	June 2000	13.8	EUR25.8bn	97.8m
Alitalia		117	1946	95 / 44	July 2010	12.7	EUR3.0bn	21.8m
中華航空 CHINA AIRLINES		89	1959	156 / 29	September 2011	9.6	TWD139.8bn	15.1m
中國東方航空 CHINA EASTERN		552	1988	257 / 35	June 2011	6.5	RMB93.6bn	103.1m
CSA CZECH AIRLINES		13	1923	49 / 26	October 2000	13.2	CZK9.1bn	2.9m
DELTA		916	1924	324 / 57	June 2000	15.1	USD41.3bn	180m+
Garuda Indonesia		142	1949	90 / 14	March 2014	7.8	USD4.2bn	24m
Kenya Airways The Pride of Africa		41	1977	52 / 40	June 2010	7.8	KES106.3m	3.7m
KLM		120	1919	164 / 73	September 2000	11.8	EUR10.3bn	32.7m
KOREAN AIR		164	1962	123 / 43	June 2000	9.7	KRW11.8tn	26.7m
MEA		18	1945	32 / 23	June 2012	8.3	LBP1.0bn	3m
السعودية SAUDIA		149	1946	90 / 37	May 2012	6.8	SAR20.5bn	31.2m
TAROM		25	1954	40 / 23	June 2013	16.3	USD252.4m	2.4m
VietnamAirlines		89	1956	49 / 17	June 2010	5.9	VND88.4bn	26.5m
厦门航空 XIAMENAIR		167	1984	94 / 16	November 2012	6	RMB23bn	27.2m

Source: Author, based on data collected from airlines

Full members list of Star Alliance (as of IATA Northern Summer Season 2019)

STAR ALLIANCE	Country	Fleet size (as of 2019)	Founded	Destinations/ Countries [2018]	Joined Star Alliance	Average Fleet Age (as of 2019)	Operating Revenue [FY2018]	Annual Passengers [FY2018]
AEGEAN		49	1999	134 / 44	June 2010	11	EUR98.6m	14m
AIR CANADA		182	1937	199 / 63	May 1997	13.2	CAD4,246m	50.9m
AIR CHINA 中国国际航空公司		422	1988	189 / 42	December 2007	7.3	RMB136,774m	611m
AIR INDIA		127	1932	123 / 31	July 2014	7.7	INR239bn	21m
AIR NEW ZEALAND		64	1939	31 / 19	May 1999	7	USD323m	8.5m
ANA		238	1952	98 / 23	October 1999	8.6	YEN1.97tr	44.15m
ASIANA AIRLINES		86	1988	90 / 27	March 2003	11.5	KRW6252bn	18.4m [2016]
Austrian		82	1957	130 / 58	March 2000	15.4	EUR2.2bn	13.9m
Avianca		107	1919	102 / 27	June 2012	6.8	USD1.9bn	30.5m
brussels airlines		54	2006	118 / 49	December 2009	15.2	USD1.557bn	10.03m
CopaAirlines		95	1944	81 / 33	June 2012	8.5	USD2,68bn	16.2m
CROATIA AIRLINES		13	1989	39 / 24	December 2004	14.6	HRK1.7bn	2.17m
EGYPTAIR		67	1932	72 / 47	July 2008	8.6	EGP35,778m	8.46m
Ethiopian		118	1945	126 / 75	December 2011	6.4	USD3.7bn	10.6m
EVA AIR		83	1989	58 / 18	June 2013	5.2	USD4.1bn	13.13m
LOT		76	1929	90 / 50	October 2003	8.7	USD1.51bn	8.8m
Lufthansa		300	1926	214 / 75	May 1997	11.9	EUR15.9bn	142.3m
SAS		158	1946	126 / 30	May 1997	10.2	SEK44,7m	28.7m
深圳航空 Shenzhen Airlines		184	1992	84 / 10	November 2012	7.1	CNY31,119m	110m
SINGAPORE AIRLINES		137	1947	63 / 32	April 2000	6.8	USD16,323m	20.7m
SOUTH AFRICAN AIRWAYS		47	1934	32 / 22	April 2006	12	ZAR30,7bn [2017]	9.7m [2017]
SWISS		89	2002	100 / 44	April 2006	9.9	CHF5.3bn	17.9m
TAP AIR PORTUGAL		106	1945	99 / 36	March 2005	10.6	EUR3.251bn	15.8m
THAI		82	1960	76 / 31	May 1997	10.2	THB199,500m	76.1m
TURKISH AIRLINES		301	1933	311 / 124	April 2008	7	TRY62.85bn	75.2m
UNITED		789	1926	353 / 58	May 1997	15.6	USD41.3bn	158m

Source: Author, based on data collected from airlines

Full members list of oneworld (as of IATA Northern Summer Season 2019)

oneworld	Country	Fleet size (as of 2019)	Founded	Destinations/ Countries [2018]	Joined oneworld	Average Fleet Age (as of 2019)	Operating Revenue [FY2018]	Annual Passengers [FY2018]
American Airlines		941	1930	350 / 50	1999	11	USD44.5bn	203.7m
BRITISH AIRWAYS		277	1924	250 / 90	1999	13.8	GPB13bn	126.2m
CATHAY PACIFIC		154	1946	90 / 35	1999	8.5	TWD2.3bn	35.4m
IBERIA IBERIA EXPRESS IBERIA REGIONAL AIRNOSTRUM		89 23 50	1927 2011 1994	130 / 47	1999	9.8 15.8 8.2	EUR4.6bn (as of 2016)	26.2m
LATAM		328	2012 (1929 as LAN, and 1975 as TAM)	143 / 26	1999	9.1	USD9.89bn	68.8m
FINNAIR		71	1923	150 / 45	1999	10.3	EUR2.8bn	13.2m
malaysia airlines		84	1947	55 / 17	2013	7.2	MYR8.7bn (as of 2017)	77.4m
QANTAS QANTASLINK		136 84	1920 2001	80 / 20	1999	12.1 16.9	USD17,060m	55.2m
QATAR AIRWAYS القطرية		231	1993	200 / 100	2013	6.1	QAR42bn	29.1m
الملكية الأردنية ROYAL JORDANIAN		25	1963	45 / 30	2007	9.6	JOD653m	3.26m
S7 Airlines		102	1992	196 / 33	2010	10.1	RUB117.7bn	15.96m
SriLankan Airlines		27	1979	111 / 48	2014	9	USD100.1m	15.28m

Source: Author, based on data collected from airlines

KEY QUESTIONS CONCERNING THE AIRLINE ALLIANCES

Why several main airlines have been involved in AA?

They are seeking to overcame restrictive barriers to entry in international markets.

What is the main purpose thereof?

These alliances attempt to introduce service in those regions or countries where there have been legal or market restrictions for non-local airlines.

When was the first AA?

In 1986, one of the first international airline alliance was signed between former Air Florida and British Island Airways (BIA). Hence, a passenger feed was paid by Air Florida for BIA´s scheduled air services on the LGW-AMS route.

How these coalitions provide their benefits for passengers?

They aim at simplifying the procedures for accessing to more destinations, streamlined connections, and competitive pricing due to smaller operational costs.

Subsection 2.2

Some Considerations about Value Creation in Regard to Entrepreneurship and Innovation from Public Service Obligations on Scheduled Air Transport

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Chapter 14
Some Considerations About Value Creation in Regard to Entrepreneurship and Innovation From Public Service Obligations on Scheduled Air Transport

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ABSTRACT

Airlines are open to and enjoy a high standard of regulations within the EU Internal aviation market. However, scheduled air services are at times restricted to the access of single markets due to the imposition of public service obligations. This situation is regarded as market failure so this chapter addresses some key aspects in which these impositions can provide elements to create value in regional economies and the private sector through entrepreneurship and innovation. To this end, authors analyze the importance of such fundamental concepts in the transportation sector in regard to air routes not sufficiently covered by carriers in a free market regime despite business opportunity or lack of profitability. This chapter suggests how to improve participation of entrepreneurial companies in tender processes and award of contracts for these specific impositions.

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INTRODUCTION

As a result of the intense liberalization process of the air transport carried out by the European Union (EU) between 1993 and 1997, airlines have been able to accomplish the conformation of a genuine single European market in this sector. In addition, the air transportation industry had in the past made enormous efforts to cut operating costs and improve performance efficiency. Simultaneously, this has been influencing the costs of likely air services to continue to result in further advantages for consumers. The effective opening of the European Single Market in aviation became effective on April 1, 1997, which has nonetheless brought a more substantial competition in the airline industry with the entrance of new competitors, as this has had a direct impact on airfares.

Despite all this, the internal air transport market does not always present a sufficient level of competition as expected, or sometimes do not even meet the needs of the population as airlines are missing on certain routes. Such market failure may therefore occur and cause a lack of supply of air transport in the territories concerned. When this happens, any Member State can decide whether or not to impose a Public Service Obligation (PSO) on particular scheduled air service, to evaluate whether this imposition can adequately serve transport needs of a given region. In fact, such impositions are usually requested by regions to national aviation authorities, which are in turn responsible to analyze the need for this transportation in their territories, as well as to ensure tender process and award of contracts for this, and obviously to communicate this to the DG MOVE[1]. While not all imposed PSOs are subject to tendering procedure, all impositions must be at least notified to the European Commission through DG MOVE. Hence, information about each PSO like the imposition, the invitation to tender, or even any modification to which this may apply, shall be published in the Official Journal of the European Union (OJEU).

For several years, certain regional governments have been advocating improvements in transport connectivity in order to ensure the population mobility, thus contributing to the integration of the territory by means of public transport services. Nevertheless, not all routes within the deregulated European aviation market have always been covered from private initiative due to operational circumstances, and even by reason of a lack of profitability. When this happens, national civil aviation authorities are free to intervene within the EU Single Market in air transport by allowing residencias subsidies or impositions of public service obligation on scheduled air services in order to keep the supply of transport public services. Thus, typically, PSO air routes serve remote locations, or not so well connected, and so that it acts as a vital socio-economic lifeline in those regions particularly concerned by this issue.

Given the fact that transportation is a key element of development, which in turn contributes to the integration of territories, insufficient transport connectivity has a considerable impact at the regional level both socially and economically. Likewise, when possible, the development and promotion of public means of transport to the detriment of the use of the private car is highly desirable in terms of environmental sustainability. Therefore, transportation has a key role in achieving this goal, as it is considered as public service. In this regard, some aspects related to service assessment of transportation has also been considered in previous studies, such as the implication role of demographic characteristics (Yaya et al., 2015) or the level of satisfaction (Vicente & Rey, 2016) on this matter.

Thus, in the above context, the present chapter aims to consider some aspects involved in PSO air routes through an approach at a regional level in terms of value creation, and how this may relate to factors such entrepreneurship and innovation. Throughout this chapter attention will be drawn to certain issues worthy of attention on those imposed PSO routes, which act as generators of supply of air services, such as the capacity to attract investment and tourism in those territories, whose airports are linked by them. Due to this, this particular topic can shed some light on how competitive advantage of the imposition of PSOs on concerned regions may also helpful act to stimulate entrepreneurial activity. In summary, the main objective of this approach is to contribute to a better understanding of PSOs, and how this may contribute to solving a specific market failure within a liberalized market such as EU Single Market in aviation.

Background

Since its establishment in 1997, the EU Single Market in aviation has led to the creation of the flexible free market environment which carriers have high levels of legal certainty on the principle of entrepreneurial freedom within the whole internal market. In this matter, the air transport sector has undergone an intensive process of cutting costs, especially since the economic Great Recession in 2008. On this basis, airlines have been focusing on cost reduction and efficiency in order to suit operations in a changing business environment. As a result, there has been a deep reordering of this industry. While some companies have managed to survive and grow, successfully merging to create large corporate conglomerates, such as Lufthansa Group[2], IAG[3] or Air France-KLM[4], other mainlines did not share the same luck, and had to leave the market such as Spanair (1986-2012) and Malév Hungarian Airlines (1954-2012), as well as Air Berlin (1978-2017) and Monarch (1967-2017), and, more recently, Primera Air (2003-2018), Germania (1978-2019), Flybmi (1987-2019) and WOW air (2011-2019). Meanwhile, some new entrants to the market had already begun its operations at the dawn of the liberalization, such as Ryanair DAC (1984) and easyJet Airline Company Ltd. (1995), and later Wizz Air Hungary Ltd. (2003), Vueling Airlines, S.A. (2004), and Volotea, S.A. (2011). In fact, this is particularly important given the impact that the entry of these new companies into the aviation market, and will continue to have, on the air sector.

In this context, specialized authors have focused their researches on particular case studies, whose scope has been mainly aimed to study some business issues of particular relevance to new entrants. Thus, for the Ryanair case, it has been analyzed the evolution of its business model (Diaconu, 2012), as well as its pricing strategies (Malighetti et al., 2009) or the sustainability of its model (Barrett, 2004). And, as for easyJet, other interesting issues have been studied on this topic, such as quantity price discrimination (Cattaneo et al., 2016) or price elasticity for leisure and business destinations (Morlotti et al., 2017), as well as analyzing changes in given both frequencies and prices (Cattaneo et al., 2018). Similarly, a few articles have aimed to focus their analysis on more recent airlines based on ultra-low model with a high entrepreneurial component at its origin[5], such as both case studies of Wizz Air (Buyck, 2016) or Vueling (Fageda, 2014). Nevertheless, it should be noted that none of them has so far been able to give considerable thought to what entrepreneurial airlines may contribute to impositions of PSO on scheduled air routes, and how these carriers can contribute to the ability to create value in air services. Particularly, some aspects of value and strategy, even innovation, have been considered on this matter (Law & Breznik, 2018), but not necessarily focused on entrepreneurship.

During the latest years, as previously mentioned, some companies disappeared while others were created, driving new challenges into the air market and increasing competition in several European airports. It can be argued that a real free market in this sector had been launched for the so-called "low-cost" carriers, while "legacy" airlines tried to adapt quickly to changing market circumstances. In comparison with other means of transport, such as bus or railway transportation, the airline industry has achieved the maturity of its business due to the opening of the market to more efficient operators in terms of resource optimization.

Clearly, incumbent operators have had to adapt in order to survive the new business and regulatory environment and co-exist with the low-cost carriers (LCC) within the EU Internal Market in aviation. While several legacy brands have known to adapt quickly to a new reality market due to dynamics prevailing in the European airline industry (such as both Iberia and British Airways through creating IAG), in some other cases there are reasonable doubts about its future and whether drastic changes in its business model will hold sustainability with the lack of state supports. This is the case, for instance, with the Alitalia case, which gives rises to serious concerns about "complaints against alleged State aid to Alitalia" from the SA.48171 proceeding published in the issue 2018/C 256/02[6].

As many legacy airlines have been successfully privatized, either totally or partially, it has made them more economically functional, and thus enabling them to confront challenges of the air industry. Likewise, regarding the EU's internal market for aviation specifically, the European Commission (EC) has played a leading role in order to focus attention on this issue. Hence, the creation of the European single market has achieved total liberalization of air services by opening up its aviation sector, allowing any EU airline to operate scheduled air services on any route within the internal market. However, internal air market opening by itself has not often been sufficient to ensure meaningful competition in those routes serving remote locations, or even in depressed regions. That is precisely why the imposition of PSO has come to fill this particular gap and meet air transportation needs in concerned airports. However, because the PSO system is considered as a form of state aid that applies to scheduled air services, PSO impositions must be duly justified and documented to avoid incurring any restriction to one carrier, as well as any subsidies, when there are equivalent means of transport under suitable conditions.

While some EU citizens, living in peripheral regions, are entitled to resident subsidies on flights through discounts that are authorized and controlled by EU Member States, the imposition of PSO allows economic compensation, in accordance with both national laws and EU regulations, whose corresponding air service is restricted to one carrier. However, it is to be noted that there is no restriction in applying both subsidies and compensations under current European law on imposed PSO air routes. In fact, from a thorough reading of Articles 16-18 of the Regulation (EC) No 1008/2008 of the European Parliament and of the Council of September 24, 2008, it seems that this authoritative rule on Air Services into the EU Single Market does not place any restriction unilaterally on this issue.

Considering that PSO air routes may also act as a vital lifeline both socially and economically in concerned regions, it is useful to bear in mind that impositions of PSOs have relevant impacts on regional aviation regarding sustainability of future growth of aviation in the air EU Single Market. Whilst it is true that imposing PSOs will make regions more satisfied with transport connectivity, it may not always have any economic justification, particularly as regards those PSO routes restricted to one carrier that is usually subject to economic compensation by a tendering process. In this connection, there may also be so some inconsistencies related to social air services provision, which would also be inappropriate to keep broader policy initiatives regarding mobility and accessibility (Williams & Pagliari, 2004). Additionally, it must also be noted approaches the issue abroad the EU, such as similar subsidizing programmes from both USA, so known as Essential Air Service (EAS), and Australia (Hromadka, 2017).

In view of the broad scope of some issues related to the PSO impositions on scheduled air services, some researches have preferred to discuss on certain regional cases, such as the potential impact of removing PSO on particular Italian schedules air routes (Francesco & Pagliari, 2012) or how regional airports are losing ground to main airports in Norwegian case[7] (Lian & Rønnevik, 2011), and even analyzing efficiency and sustainability of the imposed PSO air route between Seville and Almeria (Martínez Raya & González-Sánchez, 2019). In this regard, the concept of PSO has been extensively discussed within the European Commission. The main objective of this form of state is to improve the air transport across its internal market, as many regions would have serious difficulties in accessing and linking to transport networks with cities and more populated areas. This could be the sensitive case, for instance, about air routes linking island territories where there no other transportation means, apart from sea transport.

With regard to the concept of innovation, based on varied aspects thereof, such as product, process, and organizational innovation (Palomo Zurdo (Ed.), 2010, pp. 6154-6155), the airline sector is undergoing major structural change by implementing massive technological tools, not only for fields directly related to organizational and process management (e.g. maintenance, scheduling, etc.), but also those related to products (e.g. pricing, customer experience). In this regard, it should also be mentioned that innovation is intimately linked to factors such as technologies and entrepreneurship, while information technology and entrepreneurial activity are drivers of European economic growth (González-Sánchez, 2013). Likewise, regarding some aspects related to value creation on this topic, it is of note that the scheduling system of the airline industry is highly linked to tourist season. At the same time, information technology (IT) has deeply influenced the tourism industry (Cabiddu et al., 2013). Because value creation has traditionally been considered as a generator of utility for enterprises with regard to a starting situation (Palomo Zurdo (Ed.), 2010, pp. 2770-2771), the aviation sector is a classic example of co-creation generating value among companies in the airline industry. Given the fact that strong capital flows have been invested to develop and restructure the air market on which business development is being accomplished by creating its own ecosystem of innovation, most European airlines have already prepared plans to face future challenges, particularly in terms of environmental sustainability and cost-efficiency.

MAIN FOCUS OF THE CHAPTER

A Particular Framework to Understand the Issue: PSO Impositions on Scheduled Air Routes in the EU Single Market

Imposition of PSO on scheduled air routes is a form of public intervention in the air sector to remedy market failures in air transport. This market intervention created by the EU Member States often constitute a form of disruption against free competition, and even breach the rules of free market. Therefore, concerned national civil aviation authorities gave special attention to those arguments and evidences that are often adduced in submission of PSO justifications, such as peripheral region, development region or thin route. The attention given to those impositions restricted to one carrier, usually bringing some form of financial compensation to offset any losses from awarded airlines. Consequently, member state countries are obligated to launch corresponding tender procedures according to EU laws, and particularly as contained in Regulation (EC) No 1008/2008 in order to compensate the carrier's losses through imposition of PSO on scheduled air routes, regardless of the amount of public aid requested.

Given the fact that the common EU aviation policy has aimed at introducing high level of competition during the formation of its internal market for air services, whilst regions have intensively sought to achieve adequate transport connectivity, and State Members have imposed PSOs on concerned air scheduled routes. Imposition of PSOs represents a useful way of creating value on regional economy by encouraging the increased use of public transport, as opposed to private transport. Moreover, it brings to positive synergies for the regional environment. However, such impositions may be insufficient to cope transportation needs in some regions due to the lack of carriers interested in bidding in PSO tender

Table 1. The PSO domestic market concerned by each EU Member State (as of 09/27/2018)

Country	Imposed PSO air routes	Unsuccessful tender (U) / Not operated (N) / Cancelled (C)	PSO routes operated as restricted to one carrier	Total amount (€) of annual compensation
France	40	5 (N)	25	94,094,094.32
Greece	28	none	17	8,419,886.75
United Kingdom	22	none	22	14,476,746.30
Portugal	20	none	16	29,756,961.20
Spain	20	none	9	3,950,956.50
Italy	14	3 (U)	14	52,082,826.55
Sweden	11	none	11	13,674,266.00
Croatia	10	none	10	12,589,832.08
Ireland	3	none	3	8,028,034.00
Estonia	3	none	3	2,601,766.00
Finland	2	none	2	3,223,268.67
Cyprus	1	none	none	n/a
Czech Republic	1	1 (C) [a]	1	1,486,480.00
Lithuania	1	none	n/a	n/a
TOTAL EU	176	9	132	244,385,118.37

Source: Compiled by authors based on figures provided from DG MOVE (2018). Explanatory note: (a) The PSO air route Brno-Munich (BRQ-MUC) was cancelled on February 15, 2019, as the awarded carrier (flybmi) went bankrupt on February 16, 2019. Concerned state aid under this PSO was paid by South Moravian Region to the airline monthly in advance. The debt is the amount of support paid from 02/01/2019 to 02/15/2019, hence the whole amount of debt is currently expected to be collected by the regional government.

process invited by EU Member States and announced in both national official journals and the Official Journal of the European Union (OJEU). Indeed, this directly results in some way to reinforce the transparency of PSO tender process. In this respect, Table 1 illustrates some of the current PSO impositions across the EU Single Market for air services and how much has been supported from public finances.

Given that the airline industry has been highly fragmented, despite the liberalization of the EU's internal air market, it is unavoidable that there is nowadays a tendency for carriers to concentrate and merge with other enterprise groups, even entering into worldwide alliances. In this regard, some authors have wondered whether major airlines has been urged to accomplish merging process as an indispensable form of restructuring of the air industry (De Wit, 1995), others have provided an overview of merger decisions between 1996 and 2009 in aviation (Németh & Niemeier, 2012), while others have focused their researches on specific case studies, such as of Vueling (Fageda, 2014) or of Air France-KLM (Veldhuis, 2005). Theoretically, surveillance authorities for the EU Single Market have not encountered any barriers to market entrance including transnational companies. Because the air market is currently in hands of a few large carriers most being LCC (Ryanair, Easyjet, Vueling, Eurowings, Wizzair, etc.), entrepreneurial airlines are struggling to reach economic survival and in turn seek cost reduction as a main priority. A clear example of all those airlines which went out of business, despite strong staffing cuts, is summarized in Table 2.

Table 2. Some airlines that recently ceased operations in the European Aviation Market (as of 8/12/2019)

CALLSIGN (IATA code) [OACI code]	Trading name	Started operations / Ceased operations	AOC approved by national civil aviation authority in	Fleet size (at closure)
PRIMERA	Primera Air Scandinavia A/S	August 2009 October 2018	Denmark	14: A321neo, B737-700, B737-800.
GERMANIA	Germania Fluggesellschaft mbH	September 1978 February 2019	Germany	30: A321-200, A319-100, B737-700.
WOW AIR	WOW air hf.	May 2012 March 2019	Iceland [c]	10: A321-200, A321neo.
AIR BERLIN	Air Berlin PLC & Co. Luftverkehrs KG	April 1979 October 2017	Germany	124: ATR72-600, DHC-8-400, A319-100, A320-200, A321-200, A330-200, A330-300, B737-800.
SPANAIR	Spanair S.A.	December 1986 January 2012	Spain	29: A320-200, A321-200, MD-82, MD-83. MD-87.
MIDLAND	British Midland Regional Limited (flybmi)	August 1987 February 2019	United Kingdom	17: ERJ-135, ERJ-145.
MALEV	Magyar Légiközlekedési Vállalat (MALÉV Hungarian Airlines)	November 1956 February 2012	Hungary	22: B737-600, B737-700, B737-800, DHC-8-400.
MONARCH	Monarch Airlines Ltd.	April 1968 October 2017	United Kingdom	35: A320-200, A321-200, B737-800.
CYPRUS	Cyprus Airways Ltd.[a]	April 1948 January 2015	Cyprus	5: A320-200.
APOLLO	Cobalt	June 2016 October 2018	Cyprus	6: A319-100, A320-200.
STERLING	Sterling Airways A/S	1962 October 2008	Denmark	27: MD-83, B737-500, B737-700, B737-800.
OLYMPIC	Olympic Airlines [b]	April 1957 September 2009	Greece	43 (estimated)
RED COMET	Air Comet	December 1996 December 2009	Spain	4: A330-200
ALADA AIR	Air Madrid	May 2003 December 2006	Spain	9: A310-300, A319-100, A330-200, A330-300, A340-300

Source: Compiled by authors. Explanatory notes: a) referred to the former Cypriot public-owned airline; b) referred to the former Greek public-owned airline. Once this was privatized, Olympic Air took over part its operations, as well as its logo and brand name; c) as a Member State of the European Common Aviation Area (ECAA).

An Approach to the Issue: How PSO Air Routes May Create Value for regional Economies from Innovation and Entrepreneurship Within the EU Single Market

As stated previously, imposition of PSO on scheduled air routes is a form of public intervention in the transport sector to remedy a particular gap in the liberalized European air transport industry. In fact, this market failure can be considered as one of the early issues that the EU authorities have had to deal with, since the liberalization of the EU Single Market in aviation services was launched. To achieve this, in avoid to either any form of grant of direct subsidies to promote tourism, “PSO restrictions may lead to a situation close to social optimum if wisely chosen” (Bråthena & Eriksen, 2018).

Thanks to PSO imposition on scheduled air routes, peripheral airports can be linked with hub airports in order for remote territories to attract both human and financial resources, granting citizens mobility from major cities out to rural areas. This contributes significantly to the integration of the national territories by improving economic and social cohesion across the EU Single Market. This is precisely where entrepreneurship may find market opportunities through PSO impositions, particularly in those PSO air routes restricted to one carrier.

Considering the fact that entrepreneurial initiatives can be divided into two general categories, such as by necessity or by opportunity (Palomo Zurdo (Ed.), 2010, p. 4114), it is clear in this chapter that the approach to the issue from entrepreneurial factor is related to business opportunity from sectorial context as entrepreneurship is closely associated with economic growth and innovation (Aparicio et al., 2016) (Wennekers & Thurik, 1999). Although air transport sector is currently undergoing a process of cost cut, this industry is very exposed to both local and global market fluctuations. By contrast, flight fares in the EU internal market are very competitive and therefore the cost of air scheduled routes is perceived as a competitive transport service in comparison with other means of transportation. For that reason, airlines have been seeking to look for alternative ways of revenue. Nowadays, ancillary revenues often place a significant additional income for airlines. Despite all the above, the air market is extremely dynamic. While new entrants have recently arrived on the market, others had to leave. For instance, airlines that have recently commenced air operations are summarized in Table 3.

A Case Study Related to the Issue: PSO Air Routes in Spain

As shown in Table 1, the total of PSO impositions on scheduled air routes in Spain does not represent a high impact on EU figures on this matter. In fact, this form of public imposition has not been broadly implemented across the Spanish air market, despite its large territory, both mainland and island. Although

Table 3. Some airlines that commenced operations in the European Aviation Market since 2000

Callsign (IATA code) [ICAO code]	Trading name	Commenced operations	AOC approved in (registration prefix)	Fleet size (as of July 2019)
VOLOTEA (V7) [VOE]	Volotea, S.A.	April 2012	Spain (EC, EI)	37: B717-200, A319-100.
IBERIA (IB) [IBE] AUSTROJET (VK) [FOO] [b] MISTRAL (LV) [BOS] [c]	LEVEL (as brand name) [a]	June 2017 (EC) July 2018 (OE) June 2008 (F)	Spain (EC) Austria (OE) France (F)	12: A330-200, A321-200, A320-200; 6: A321-200, A320-200; 2: A330-200.
LAUDA MOTION	LaudaMotion GmbH [d]	March 2018	Austria (OE)	22: A320-200, A321-200.
JOON (JN) [JON]	Joon SAS [e]	December 2017 [f]	France (F)	16: A320-200, A321-200, A340-300.
WIZZAIR (W6) [WZZ]	Wizz Air Hungary Ltd.	September 2003	Hungary (HA)	104: A320-232, A321-200, A321neo.

Source: Compiled by authors. Explanatory notes: a) LEVEL is an international low-cost brand that operates three air carriers from the EU (Iberia LAE SA, Anisec Luftfahrt GmbH and OpenSkies SASU) that are headquartered, respectively, in Spain, Austria and France, and are themselves subsidiaries of IAG; b) subsidiary of Vueling (VY), itself owned by IAG; c) formerly owned by British Airways European Limited, currently owned by IAG; d) Austrian subsidiary of RYANAIR Holdings; e) owned by AIR FRANCE; f) ceased operations on 27 June 2019.

scheduled air services in Spain cover a vast territory with rarely dispersed populations, as its population density is a bit below the European average[8], a few airlines with a certain entrepreneurial spirit at their corresponding beginnings have seen the opportunity to expand the air business by bidding for public contracts related to impositions of PSO on scheduled air routes.

As can be seen in Table 4, all of these airlines are regional carriers headquartered in Spain. Consequently, no other State Members are currently operating any PSO in Spain. However, most of these Spanish carriers are European players, including Air Nostrum (YW), the largest regional carrier across the EU air market. The other regional airline group, Binter (NT), leads the regional market of Canary Islands. In other words, in such regional territories there is a dominant market player specialized in each of them.

The Volotea (V7) case is especially interesting given that no other European carrier has been identified in the EU Single Market by applying a similar business model of this particular airline. In the case of Spain, this fact is especially relevant, because V7 would be likely to become an adequate player to bid for the PSO tendering process. This airline case has been used here as an example to illustrate how PSO impositions may attract more carriers interested in presenting a bid for tendering process of public contracts on this issue. Moreover, regarding this specific case, it has to be underlined that this carrier commenced operations on 5 April 2012 thanks to the innovative spirit of the founders of Vueling (VY), the entrepreneurs Carlos Muñoz y Lázaro Ros. Currently, this recent entrant has 16 operating bases and the current fleet size has a total of 36 aircrafts (as of 7/31/2019). As matter of fact, V7 operates mainly in medium airports, which are neither small airports nor hubs.

While it is true, however, that most regions served by PSOs in Spain are remote, even economically deprived, there are some PSO routes linking airports with mainland Spain, such as the scheduled route

Table 4. List of carriers operating PSO imposition on scheduled air routes in Spain (as of 7/31/2019)

Carrier	Callsign (IATA code) [ICAO code]	Starting date	AOC approved in (registration prefix)	Number of PSO air routes in operating	Fleet size as per aircraft model
Aeronova S.L.U. (since 2015 branded as Air Europa Express) [a]	AERONOVA (X5) [OVA]	1996	Spain (EC)	see below [e]	11: E190-200 7: ATR72-500
Air Europa, S.A. [b]	AIREUROPA (UX) [AEA]	1986	Spain (EC)	3 (often operated by OVA)	21: B737-800 8: B787-8 4: B787-9 10: A330-200 2: A330-300
Air Nostrum L.A.M. S.A.	AIR NOSTRUM (YW) [ANE]	1994	Spain (EC)	10	8: ATR72-600 16: CRJ-200 11: CRJ-900 22: CRJ-1000
BINTER CANARIAS S.A.	BINTER (NT) [IBB]	1989 [c]	Spain (EC)	10 (often operated by RSC)	3: CRJ-1000 20: ATR72-600
Canarias Airlines Compañía de Aviación, S.L. [d]	CANAIR (NT) [RSC]	2005	Spain (EC)	see above [e]	10: ATR 72-600
Canary Fly, S.L.	CANARY (PM) [CNF]	2008	Spain (EC)	10	5: ATR72-600

Source: Authors, based on information from both DGAC (2019) and AESA (2019).[9] Explanatory notes: a) b) this forms part of the leading enterprise group, GLOBALIA CORPORACIÓN EMPRESARIAL, S.A., registered in Palma de Mallorca (Spain); c) from 1989 to 2002 as subsidiary of IBERIA LAE; d) currently owned by Grupo BINTER; e) flights operated to other carrier in code-sharing.

between Sevilla and Almeria as well as between Badajoz and Barcelona, or between Badajoz and Madrid. Regarding the entrepreneurial aspect, the PSO imposition on scheduled air route between Sevilla and Almeria had two bids in the first tender process, such as both two Spanish carriers, the former Al-Andalus (EA) and the current Air Nostrum (YW). However, in further tendering process only one bid was submitted to tender by the previously awarded carrier (Martínez Raya & González-Sánchez, 2019).

For the other case studies, both in the Canayfly (PM) and in the Canarias Airlines (NT, as subsidiary of BINTER), it is pretty interesting to note that both carriers are small-sized, because they serve specific routes strictly limited to the operating regional routes, often for larger carriers, such as Binter (NT) or Air Nostrum (YW). Furthermore, both Air Nostrum (YW) and Binter (NT) have specialized in operating efficiently regional routes thanks to the optimization of commercial air transport by harmonizing fleets and resources, as shown in Table 4. In addition to these, a common denominator appears to be that PSO impositions are mostly operated by the large carrier groups, as shown in Table 5. Although airlines often seek to operate based on corresponding strategic markets or what is most profitable, it seems that entrepreneurship does not play any key role on this matter. However, operative aspects, such as the size of the fleet, the number of operatizing bases, or even the type of aircraft, continue to be the key issue in relation to PSO impositions in Spain. For this reason, entrepreneurial airlines may suffer from a lack of resources to achieve necessary economies of scale in helping to overcome economic barriers to air market entry.

SOLUTIONS AND RECOMMENDATIONS

Given the fact that incumbent air carriers (also known as legacy airlines) are usually located in main airports, PSO impositions are often required to operate on scheduled air routes between both regional and hub airports, thereby enhancing connectivity of passengers from remote territories to the main locations Although some of the key issues related to PSO air routes have been broadly discussed throughout this chapter, it must be stressed that European air carriers are not strictly required to link airports to meet the demands of regional territories regarding transportation needs of their populations. Sometimes, by contrast, specific rules for procurement tendering process may not meet expectations of those airlines involved to an PSO invitation to tender, whose bidding processes would then be declared void, and therefore their corresponding allocations canceled. In order to increase the number of bids in the PSO tendering process, it would be highly recommended to render more flexible service level agreements by promoting the entry of new carriers, particularly in the case of entrepreneurial transport operators.

Given the nature of public passenger transport, as noted in the preceding section, it is vital for the European Commission (EC) to promote the use of public transport, both efficiently and sustainably. In order to achieve environmental sustainability in the transportation industry, eight research questions have been identified, among others (Centobelli, at al., 2017). To ensure such aspects into transport sector, some goals may be achieved from a value creation perspective of innovation management in civil aviation. Nevertheless, the economic scale of airlines and management play a fundamental role in the business success of legacy airlines and thus present obstacles for small and medium sized carriers whom are trying the to enter into the aviation market. While it is true that PSO practices forces to compensate the airlines' losses through their corresponding impositions, it can consider expanding the air sector by promoting new entrants into its internal market in aviation. At the same time, it reflects the tendency to perceive the PSO system as a rigorous process for awarding PSO contract, but whose great paradox

Table 5. The PSO domestic market in Spain (as of 7/31/2019)

PSO route number	Airport (IATA code)	Airport (IATA code)	Open or Restricted PSO route (O/R)	Airlines operating (IATA code)	Is there economic compensation? (Y/N)
Spain – 01	Almeria (LEI)	Seville (SVQ)	R	YW	Y (annual)
Spain – 02	Menorca (MAH)	Ibiza (IBZ)	O	YW, UX	N
Spain – 03	Menorca (MAH)	Madrid (MAD)	R	YW	Y (seasonal)
Spain – 04	Palma de Mallorca (PMI)	Ibiza (IBZ)	O	YW, UX	N
Spain – 05	Palma de Mallorca (PMI)	Menorca (MAH)	O	YW, UX	N
Spain – 06	Gran Canaria (LPA)	El Hierro (VDE)	O	NT, PM	N
Spain – 07	Gran Canaria (LPA)	Tenerife South (TFS)	O	NT, PM	N
Spain – 08	Gran Canaria (LPA)	Fuerteventura (FUE)	O	NT, PM	N
Spain – 09	Gran Canaria (LPA)	Lanzarote (ACE)	O	NT, PM	N
Spain – 10	Gran Canaria (LPA)	Tenerife North (TFN)	O	NT, PM	N
Spain – 11	Gran Canaria (LPA)	Santa Cruz de la Palma (SPC)	O	NT	N
Spain – 12	La Gomera (GMZ)	Gran Canaria (LPA)	R	NT	Y (annual)
Spain – 13	La Gomera (GMZ)	Tenerife North (TFN)	R	NT	Y (annual)
Spain – 14	Santa Cruz de la Palma (SPC)	Lanzarote (ACE)	O	NT, PM	N
Spain – 15	Tenerife North (TFN)	El Hierro (VDE)	O	NT, PM	N
Spain – 16	Tenerife North (TFN)	Fuerteventura (FUE)	O	NT, PM	N
Spain – 17	Tenerife North (TFN)	Lanzarote (ACE)	O	NT, PM	N
Spain – 18	Tenerife North (TFN)	Santa Cruz de la Palma (SPC)	O	NT, PM	N
Spain – 19	Badajoz (BJZ)	Madrid (MAD)	R	YW	Y (annual)
Spain – 20	Badajoz (BJZ)	Barcelona (BCN)	R	YW	Y (annual)
Spain – 21	Melilla (MLN)	Almeria (LEI)	R	YW	Y (annual)
Spain – 22	Melilla (MLN)	Granada (GRX)	R	YW	Y (annual)
Spain – 23	Melilla (MLN)	Sevilla (SVQ)	R	YW	Y (annual)

Source: Compiled by authors based on information provided from both DG MOVE (2019) and Spanish Ministry of Public Works and Transport [FOM] (2019).

resided precisely in the fact that does not permit an automatic renewal of any PSO concession contract once it is completed.

Another interesting point in this context to discuss about is how the number of bids can be increased in the PSO tender process, hence leading to higher competition amongst the national authorities. On the basis of the PSO inventory list supplied from DG MOVE, only 17 of 176 PSO air routes (as of 9/27/2018) have been awarded to an EU air carrier from another Member State. Hence, it is obvious that improvement efforts to enhance the current PSO system should be implemented. Taking into account that tender calling procedures should be strictly influenced only by considering technical rules, value creation should have special relevance in this regard. A lean process is now proposed to enhance impositions of PSO as follows.

A Process-Adapted Framework for Lean Imposition of PSO on Air Scheduled Routes

Stage 1.1: Evaluating the need of PSO air route to be duly justified
Stage 1.2: Analyzing public transport alternatives.
Stage 2.1: Investigating the need for developing a service level agreement
Stage 2.2: Determining the content of the service level agreement
Stage 3.1: Publishing information notice regarding the imposition
Stage 3.2: Publishing information notice regarding the invitation to tender (if necessary)
Stage 3.3: Publishing information notice regarding the awarded airline (if necessary)
Stage 4.1: Commencing the scheduled operations on the PSO air route
Stage 5.1: Putting the service level agreement into practice
Stage 5.2: Monitoring the essential terms of the agreement
Source: 2.1-2.2; 5.1-5.2 (Chlomoudis et al., 2011); all the other stages mentioned here (Authors).

FUTURE RESEARCH DIRECTIONS

The content of the present chapter provides some suggestions with regards to the types of future research related to the matter of PSO system on scheduled air services within the EU Single Market. It will also look at how value creation would be useful in terms of both innovative and entrepreneurial impacts. Despite the complexity of the transportation sector, there are still many issues to address in terms of efficiency and sustainability. Additionally, we need to take into account topics related to trend, such as sustainable tourism and multimodal transport systems which requires further research. Moreover, effectiveness of state aids given to those air carriers, which have been awarded in an open international bidding process for impositions of PSO on scheduled air services, must be paramount for future researches in this area. Considering that transportation should be available to all commuters independent of their geographical location within the EU Single Market, PSO system is being utilized in an appropriate and optimized manner to enhance adequate transport systems, thereby contributing to an efficient and sustainable transportation. In this regard, questions have been raised regarding the limits of state aids to support PSO impositions in both chapter books and academic papers, and even thesis dissertations. For instance, an examination of all PSO impositions in the EU Single Market on both current and past air routes since 2008 may have been studied by interested researchers. Unfortunately, the monitoring of PSO impositions have not been regular and consistent by both national authorities and EU surveillance bodies. It may be of relevance in studying the evolution of PSO air routes to enhance the results of this system as an interference in the functioning of the free market. Related to this research direction, but on a broader level, some authors have presented an assessment methodology for the implementation of PSO lines in a public passenger transport system (Blaž et al., 2019), while others have wondered whether PSO system hinders the cost competitiveness of regional airlines (Santana, 2009). By contrast, recent works have aimed to study the current EU regulatory framework of PSO system regarding its impact on the air sector's competitiveness, such as (Kociubinski, 2014) or (González Sanfiel, 2010), and even some matters related to particular case studies of island territories across the EU territory, e.g. for the Azores case (Pita et al., 2013) or the Canary Island case (Campos et al., 2015).

Another interesting research perspective deals with all the issues related to sustainable development, particularly those applied to innovation. On this basis, regarding emerging trends about innovative factors on this matter, it is worth noting that the ultimate goal hereof should be to study those actions geared towards encouraging carriers to lead the battle against climate change by reducing their carbon emissions. In order to research more deeply into this field, it is important to account for disruptive innovation by using methodologies based on big data analytics processes, such as machine learning and data mining. It is also important to consider entrepreneurial initiative, and the capability of adapting itself into the new business environment. As the future of public transportation is intimately bound up with the advance of new technologies applied to sustainable alternative fuel source, it may provide further findings related to energy-efficient technologies for a better sustainable transportation. Perhaps, the main point of this research interest may actually be to determine the future viability and sustainment of PSO impositions. Given the total amount of public state aids (see Table 1) for this purpose, it is worth wondering whether imposition of PSO on schedules air services should always be considered as part of services of general economic interest, despite PSO is not a tool exclusive to the air transport. Hence, depending on from the future European initiatives for promoting air services, a variety of research direction can come out of this discussion. Moreover, regarding future research opportunities within the domain of this chapter, it will focus on issues of legal nature and relevant to keep the current PSO system under European law. This matter is especially appropriate to determinate the impact of concerned state aids through this legal practice, as well as identifying those interferences in the free market system caused by PSO impositions, both economically and legally. Hence, previous discussions on legal framework applied to European PSO system which may be a source of interest for new researches, such as how authorities can prepare appropriate legal fair market conditions in order to decide which public transport should be subsidized and conducted (Stojić et al., 2018) or how competitive pressure in the air market, due to LCC and new generation of hub carriers, may result in more protective aviation policies (Burghouwt & De Wit, 2015).

CONCLUSION

Throughout this chapter, the term value creation has been broadly discussed to shed light on the PSO issue, and how this form of state aid may help ensure transport network of remote territories and, as result, improving concerned regional economies. Whereas the EU Single Market for aviation services has already been liberalized, European airlines have whole freedom to design their route plans based on principles of market economy policy with free competition. Due to this, it is often the case that no airline in the EU internal market is interested in operating on certain routes because of various reasons, such as those based on low profitability or lack of operational capacity, and even non-adequate certifications of both crews or aircrafts required to operate on concerned airports. As already explained, the imposition of PSO may lead to public compensation, if the concerned scheduled air service is restricted to one carrier. And when this happens, the awarded airline ought to operate the imposed PSO air route under severe workload and performance requirements by public authority. Although the imposition of PSO has been an essential measure to solve a market gap, this form of public intervention would constantly need to be surveilled by both national civil aviation authorities and competent European bodies to reduce distortions in free competition in the air market. In summary, this form of state aid applies to scheduled air services and, consequently, gives rise to a potential problem of creating indirect barriers to market entry for small-sized airlines, or even new entrant carriers, and precisely for this reason, it considers that entrepreneurial carriers may be affected by their particular circumstances to tender for PSO bidding processes, thereby making practically impossible to be awarded any PSO imposition restricted to one carrier.

Another key concept to understand the issue is the innovative nature of PSO impositions. Bearing in mind the added value generated by this practice, carriers may diversify its business by opening new air routes in the non-covered market at a regional level. Although some of these issues have been broadly addressed throughout this chapter, it is worth mentioning that entrepreneurship is intrinsically linked to the concept of innovation. Strengthening both concepts is a key challenge for the public efficiency of the PSO system due to the intensive use given by certain countries on this concern (see Table 1). Although it has not expressly been discussed at this chapter, some socio-economical aspects related to the concerned territories with PSO air routes, such as relationship existing between economic growth and entrepreneurship at a European level (González-Sánchez, 2015), it should be considered to illustrate the consequences of perpetuating this particular market distortion through a system where the EU Member States are not always able to find a balance between the regional development by supporting business initiatives and the promotion of entrepreneurial spirit in the field of transportation sector.

For as long as LCC have entered the EU Single Market in aviation, they have constantly looked for ways to reduce costs, and therefore increasing competitiveness in such a demanding market. This sectorial competitiveness has obliged the legacy airlines to develop business plans which provide strategies adjusted to the new situation market. The process has been, however, not free of difficulties due in part to the implementation of strong budgetary adjustments in the air industry. Consequently, this has triggered an inevitable outcome of carriers, even some of them with high entrepreneurial spirit (see Table 2). Without any doubt, the airline sector is slowly moving towards its maturity through an irremediable process of market concentration around a few multinational enterprises[10].

As an additional and final point related to the scope of this topic, we must consider what will happen with those PSOs imposed by UK CAA (specifically 22 air routes; all of them imposed on an exclusive basis with financial compensation at a total amount of 14,476,746.30 €), once UK's withdrawal from the EU may be accomplished. As the UK routes do not belong to DG MOVE under Regulation No 1008/2008, despite the UK is still a part of the EU, it is expected to monitor the application of PSO provisions and, in extreme cases the Commission could even take a decision to stop the PSO (see Article 18(2) thereof), as Member States make a decision on their own PSO impositions, they finance the respective compensations by such operating carriers. Hence, if EU Regulation on PSO routes stops applying in UK, then it is UK's decision on how it continues with those routes. However, it is yet to be seen how Brexit affects in replicating the existing EU aviation regulations in the UK law on this regard, despite UK has been preparing secondary legislation that would come into force if UK leaves EU without any agreement.

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KEY TERMS AND DEFINITIONS

Air Operator Certificate (AOC): An official certificate provided by national CAA authorizing a carrier to operate in both national and international air services market on basis of bilateral agreements.

Ancillary Revenue: For a commercial airline, any other revenue not related to flight fares, such as baggage fees and meal service on-board.

Civil Aviation Authority (CAA): A national body that is entrusted with the function to administrate the air sector, as providing certificates or surveilling airlines to ensure aviation safety within its jurisdiction.

International Air Transport Association (IATA): A worldwide trade association of airlines that was founded in La Habana in 1947, and which represents a clear example of self-regulation on certain issues within the air transport industry.

International Civil Aviation Organization (ICAO): A transnational authority that was founded in Montreal in 1944 and acts as regulator body of United Nations on all concerns of the air transport industry.

Legacy Airline (LA): A carrier that operated in the air market as public undertaking, habitually under a monopoly regime, and later privatized, is currently operating in free regime.

Low Cost Carrier (LCC): A fully private undertaking that operates air routes in free regime under low structure costs.

Scheduled Air Service: A point-to-point air route that links periodically two specific airports.

State Aid: A monetary amount given by public authority from tendering process for a public contract to cover a public service.

ENDNOTES

1. This Directorate-General is a body of European Commission (EC) that is responsible in matter of transportation within the European Commission (EC).
2. The Lufthansa Group is the largest airline group in Europe, whose main offices, both of Lufthansa (LH) and Eurowings (EW), are in Cologne (CGN), whereas its subsidiaries, such as Austrian

Airlines (OS), Brussels Airlines (SN) and Swiss (LX), are located respectively in Vienna (VIE), Brussels (BRU) and Zurich (ZRH).

3 The International Consolidated Airlines Group, S.A., also called International Airlines Group, also known as IAG, is nowadays one of European's most important airline groups, and is headquartered in both Heathrow (LHR) and Madrid-Barajas Adolfo Suárez (MAD) airports.

4 Air France-KLM is a leading air group that was created through a merger of both legacy airlines, respectively AF and KL, whose main hubs are located at Paris-Charles de Gaulle (CDG) and Amsterdam-Schiphol (AMS).

5 Special mention must be made of the Volotea case, in spite of not having particular papers related to this airline. For that reason, this case study has been the subject of some comments in the present chapter.

6 See the Official Journal of the European Union (OJEU), C 256, 20 July 2018.

7 Norway is a non-EU Member State, but an EEA country. While Norway complies, therefore, with the acquis Communautaire, Air Services Regulation (EC) No 1008/2008 is fully enforced at national level too. However, EEA routes are in the competence of the EFTA surveillance authority, as there is no obligation in such regulation to award an airline through tender process at a community level on this particular concern.

8 According to data obtained from Eurostat (2019), population density (as people per sq. km of land area) is 92.7 and 117.7, respectively for Spain and EU-28.

9 The national aviation authority for Spain is called Agencia Estatal para la Seguridad Aérea (AESA) that works in collaboration with the Dirección General de Aviación Civil (DGAC). Both of them are part of Spanish Minister of Public Works, also called Ministerio de Fomento (FOM).

10 According to current UE laws, no undertaking abroad from the EU is allowed to own shares up to 49% of any airline registered with an AOC provided from national CAA of any EU Member State.

CHAPTER 3: THE PSO SYSTEM IN THE SPANISH DOMESTIC MARKET

Subsection 3.1.a

AN STUDY ON PROCUREMENT PROCEDURES RELATING TO PSO CONTRACTS

Tender Management Relating to Imposition of Public Service Obligations on Scheduled Air Routes: An Approach Involving Digital Transformation of Procurement Procedures in Spain

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Tender Management Relating to Imposition of Public Service Obligations on Scheduled Air Routes: An Approach Involving Digital Transformation of Procurement Procedures in Spain

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Abstract: The promotion of efficient and sustainable means of transport has been a key issue of public debate across the European Union (EU). Particularly, transport needs in peripheral and remote areas have a great importance for EU transport policies in order to ensure the mobility of goods and persons in these regions, and thus to achieve greater territorial cohesion in the member states concerned. Despite the remarkable efforts to improve the competitiveness of aviation in the EU single market, certain regional routes have traditionally suffered a lack of scheduled air routes. The internal market, once liberalized, has provided an instrument in order to ensure adequate transportation for the carriage of goods and persons in special cases. When this occurs, according to Regulation (CE) no. 1008/2008, national civil aviation authorities may impose a public service obligation (PSO) on specific air routes. In addition, this form of public intervention can lead to restriction on market access to one carrier, and even to the payment of compensation to the awarded airline through the launching of a tendering procedure for the operation of the required air service. In the case of Spain, this type of administrative concession has been shifting towards e-procurement processes by providing transparent electronic portals. This research aims, precisely, at encouraging a better understanding of how information technology may have systemic benefits to public bodies aiming to efficiently conduct a digital procurement ecosystem. To do this, the authors have analyzed the 23 PSO routes imposed so far, and the corresponding administrative procedures. The findings suggest that e-procurement has led to greater public transparency.

Keywords: EU single market; aviation; transportation; public service obligation; information technology; digital procurement ecosystem

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1. Introduction

Transportation plays an essential role in ensuring the free mobility of goods and individuals that, together with services and capital, provide the four freedoms of the European single market. The air transport market has achieved great liberalization with a high level of openness, being one of the most convincing cases of success in its internal market. However, the benefits of opening the market have not always reached all regions across the European Union (EU), such as peripheral and remote territories, and isolated areas. Given the fact that the enhancement of sustainable mobility usually has a positive social impact, the existence of adequate means of transport may also ensure regional development in terms of territorial cohesion within the EU. But the free-market regime can lead to a territorial disadvantage when there is a lack of competition on specific air routes. In such instances, several member states have strongly used the imposition of public service obligation (PSO) to ensure the availability and continuity of operation on concerned scheduled air routes. As the PSO schema creates a distortion on the EU liberalized air transport market, this form of public intervention must be duly justified, particularly when this refers to a closed PSO with compensation (the most restrictive type). In this context, this paper tries to show how information technology has helped public bodies to announce information notices, such impositions and invitations to tender, related to PSO air routes imposed in Spain, for the sake of public transparency. Furthermore, this research aims to look beyond these administrative processes to understand how public administrations have committed themselves to streamlining procurement processes through electronic public procurement and announcement platforms. To this end, this study focuses on issues related to PSO schema within the competence of public authorities regarding this type of administrative concession on scheduled air routes in Spain, in particular, those concerning the PSO restricted to one carrier with compensation. For this reason, the authors have analyzed the evolution of PSO impositions on regular air services in Spain by consulting the pertinent documentation related to these administrative proceedings at a national level. The authors also based their research on a source of community-level data in order to obtain further information on the PSO schema across the EU. In parallel with the consultation of documents through public information sources, the authors have searched other trusted sources in order to access alternative data on this matter. After requesting specific, relevant information for this investigation, the authors enriched their understanding of the procurement processes related to PSO impositions. One of the findings of this study precisely yields that tender processes related to PSO air routes have shortened the time required to award a public contract, partly as a result of public electronic procurement platforms. In this regard, a total of 17 tendering procedures related to PSO impositions were announced, as well as corresponding contracts for a total of EUR 58,178,029 awarded, within the period from 25 March 2014 to 21 August 2019 through the unified portal existing in Spain, while ten of them have exclusively been managed via an electronic tender system through public e-procurement. Bearing in mind that the PSO schema includes 176 air routes across 14 EU member states (as of 18 September 2019), the scope of this research has been limited to a case study of PSO air routes in Spain. Furthermore, because public bodies conduct administrative procedures related to the PSO system not only at national level but also at a regional level, there is a substantial heterogeneity in the management of the imposing and tendering process for PSO air services, depending on the level of information technology resources devoted to these public procedures in every EU member state. Moreover, pursuant to the Regulation of the European Commission (EC) no. 1008/2008, notices relating to the PSO system, such as impositions, modifications and abolitions thereof, and even calls for tender, must be published in the *Official Journal of the European Union* (OJEU). Nevertheless, the national administrations hold certain autonomy in the tendering and awarding process of public contracts for PSO air services. In this concern, the tender process of PSO public contracts among EU member states differs in the scope of transparency: for instance, from a fully transparent procedure such as the e-procurement system of the Spanish imposition on the air route LEI–SVQ to the Lithuanian imposition on the air route LCY–VNO, on which information regarding bids, the expected number of passengers, or the amount of compensation is considered by airport authorities to be confidential. For this reason, the main question throughout this paper investigates whether the use of electronic platforms based on information technologies results in the enhancement of the transparency and efficiency of public procurement processes. Consequently, the observed benefits associated with the establishment of e-procurement systems on PSO matters have a positive impact on public policies for e-government as part of the current fourth industrial revolution. Moreover, it has been recognized that the connectivity needs of certain regions within the EU represent such an objective, and therefore, a PSO can be imposed to meet specific well-defined public needs. In all cases, such imposition and design of a PSO route has always to meet the criteria set out in EU regulations, in addition to national laws. In the case of Spain, the civil aviation authority, named Dirección General de Aviación Civil (hereafter DGAC), on behalf of the Ministry of Public Works (currently named Ministerio de Transportes, Movilidad y Agenda Urbana, formerly Ministerio de Fomento), has the mandate to design the imposition of PSO on air routes of the domestic market, as well as to carry out the corresponding procurement procedures for awarding the public contract of regular air services.

2. Background of the Public Service Obligation Schema

Unlike the liberalization of the aviation industry in the American domestic market, the so-called "Airline Deregulation Act 49 USC 1301 of 1978", the opening of the air market in the EU has been sustained by a package of economic liberalization measures. Consequently, the national rule-making framework gave rise to common EU legislation through three packages of liberalization measures. These packages were consecutively implemented in 1987, 1990, and 1992, which has allowed for a consistent set of regulations within the European aviation area. Since the liberalization of air services, the air transport industry in the EU single market has enjoyed a high level of competitiveness and efficiency linked to the high standards of safety in its operations. Air passengers have benefited from lower fares and more routes within the internal market, whilst airlines have addressed strong cost adjustments due to a strong pressure on air travel pricing in a tough competitive environment. In recent years, the price competition in the European air transport market has been increasing. In addition, air carriers have been making extraordinary efforts in order to control and lower operational costs. As a result, airlines have significantly increased their actions in order to reformulate their business strategies by focusing on high-yield routes, which would make their operations economically highly profitable. This has led airlines to cut non-hub routes, particularly those linking to regional airports, and even to withdraw from peripheral areas. Unfortunately, some airlines were not able to adapt to new market realities, and therefore were driven to collapse. In fact, in the last few years the number of airlines going bankrupt has drastically increased compared to the amount of newer scheduled carriers in the European aviation market [1]. Despite the further expansion in supplying air routes subject to free market rules, the liberalization of the aviation market has not avoided the fact that airlines have still reduced flights and abandoned some air routes altogether, mainly those on domestic markets. Thus, the PSO schema has arisen in response to the needs of the population living in peripheral or remote territories, whose airports are not being sufficiently serviced by airlines. Although they are operating under a system of free competition, airlines might not be attracted to serve some routes in terms of public service. When this happens, a PSO may be imposed on regular air routes under certain circumstances. Nevertheless, PSO impositions in the aviation sector represent a limitation on the freedom to provide services. In line with the Treaty on the Functioning of the European Union (hereinafter called TFEU), the freedom to provide services is one of the fundamental four freedoms of its internal market. Consequently, any such limitation has to be strictly limited in scope and proportionate to the desired objective. This form of public intervention has played a fundamental role in developing regional airports, especially medium-sized airports serving narrow scheduled routes. As can be seen from Table 1, within the PSO schema, three cases can be distinguished depending on whether the route is open or closed to one carrier. Furthermore, if a carrier receives compensation from public funds at a national, regional, or local level for the provision of PSO services, it also must comply with member state aid rules.

The current legal basis for the PSO schema within the European single market in aviation has been enshrined in articles 16–18 of Regulation (EC) no. 1008/2008 of the European Parliament and of the Council of 24 September 2008 on common rules for the operation of air services in the Community (hereinafter called Air Services Regulation 1008/2008). Previously, the concept of PSO had been introduced under Council Regulation of the European Economic Community (EEC) no. 2408/92 of 23 July 1992 on access for Community air carriers to intra-Community air routes and whose article 4 established a basic regime for the PSO system. However, in both regulations, reforms are still pending to enhance this form of public intervention in the internal air market. Specifically, there are certain aspects related to the public transparency of procurement procedures for contracts for PSO services. Moreover, the question of funding has still not been fully resolved in order to consolidate a common fund at the Community level. On this aspect of the former legislation, it has been recommended that procurements for PSO contracts should be mainly carried out and funded at EU level [2]. More recently, upon the entry into enforcement of the current air services regulation, it was argued that a common model for the PSO schema, directly administrated at Community level, could become over-regulated for both political and legal reasons, and even interfere with national interests for public services [3].

Table 1. Summary of public service obligation (PSO) schema on the Single Aviation Market (as of 18 September 2019).

EU Member State	Total Number of PSO Air Routes	Annual PSO Subsidization (in Millions of EUR) [1,2]	Open PSO with Operating Requirements (Type 1)	Closed PSO without Any Compensation (Type 2)	Closed PSO with Economic Compensation (Type 3)
France	37	92.16	9	0	28
Greece	28	8.30	8	3	17
Spain	23	17.26	15	0	8
UK	22	15.05	0	0	22
Portugal	20	30.79	4	0	16
Italy	11	52.08	0	2	9
Sweden	11	16.98	0	0	11
Croatia	10	13.88	0	0	10
Estonia	3	2.67	0	0	3
Ireland	3	8.32	0	0	3
Finland	3	3.22	0	0	3
Czechia	3	0.84	0	0	3
Cyprus	1	0.00	1	0	0
Lithuania	1	4.90	0	0	1

[1] Own work based on latest data available [4]; [2] Applicable for PSOs under type 3 only.

As the European aviation sector has been fully deregulated in accordance with Article 100(2) of the Treaty on the Functioning of the European Union (TFEU), the European Commission (EC) has consistently worked towards strengthening the EU single market for air services, including advocating the extension of its scope to certain nonmember countries with geographical proximity. Since the maintenance of an adequate transportation network usually requires promotion through EU common public policies aiming at improving regional development in terms of territorial and social cohesion, the EU member states have looked for a way to meet this essential need for public service without interfering with free competition. Strictly speaking, the imposition of a PSO on a particular scheduled air route can be regarded as a public intervention on the transportation market. While it is true that the long-term implications of the PSO schema in terms of sustainability and efficiency have not widely been researched, some recent work have tried to shed more light on this matter based on certain case studies concerned, for instance, with the case of Norway with regard to social efficiency measures by determining the level of service (LOS) [5], or a welfare perspective by modelling a socially-oriented analysis for flight scheduling and fleet assignment [6] (please note that Norway, as well as Iceland and Liechtenstein, despite not being an EU state member, is part of a broad agreement with the EU to act as part of its single market with exceptions through the European Economic Area (EEA), and therefore assumes compliance with EU law). Other earlier work has sought to gain a deeper understanding of the public impact due to the existence of the PSO schema in low-populated areas. In the case of Italy, the efficiency of accessibility in remote regions served by the PSO schema has been analyzed through comparison with different transport alternatives [7]. In the case of Portugal, the research question has been raised of whether the local network's operating costs can be reduced in order to achieve greater efficiency in applying subsidies on PSO air routes [8]. All of this reflects that the maintenance of an adequate transportation network usually needs to be promoted through EU common public policies aiming at improving regional development in terms of territorial and social cohesion. In this respect, with regard to the scope of the present paper, the air passenger transportation system serving Spanish remote territories has traditionally been suffering from weaknesses in domestic demand because of high seasonality that undermines the profitability of certain regular air services. As discussed later, particular thin regular routes in Spain have been identified as an essential transport service, and thus this has forced the imposition of a PSO for ensuring affordable and accessible air transportation.

2.1. Legal Considerations

The current legal basis for the PSO schema within the European single market in aviation was enshrined in articles 16–18 of Regulation (EC) no. 1008/2008 of the European Parliament and of the Council of 24 September 2008 on common rules for the operation of air services in the Community (hereinafter called Air Services Regulation 1008/2008). Previously, the concept of PSO had been introduced under Council Regulation (EEC) No 2408/92 of 23 July 1992 on access for Community air carriers to intra-Community air routes and whose article 4 established a basic regime for the PSO system. However, in both regulations, reforms are still pending to enhance this form of public intervention in the internal air market. There are certainly some domestic legal issues concerning the public transparency of procurement procedures for contracts for PSO services that pose difficulties in aligning with the government tender system among member states. Additionally, the question of funding has still not been fully resolved in order to consolidate a single frame at Community level. Since Air Services Regulation 1008/2008 does not specify tender directives for an efficient procedure of public procurement in awarding PSO contracts, it seems that member states are free to adopt calls for tenders from an electronic platform either at national or regional level without being obligated to make public all the procurement documents and performance reports concerned. In this regard, it is to be expected that an impact assessment report can be finalized by the Commission, and then published within the shortest possible time. Once the corresponding staff working document has been revised, a legislative proposal should be drafted to modify Air Regulation No 1008/2008. These changes are likely to further affect the PSO provisions, particularly those concerning the length of the tendering period and the amount of information to be published in public notices. This will entail a significant improvement in regulatory monitoring capacity along with greater transparency that can be used for tendering and contracting from related public authorities to the air carriers concerned.

2.2. Economic Considerations

As the PSO schema is supposed to become an instrument for ensuring the existence of adequate air services serving peripheral areas or development regions, it is fundamental to have transparent and unambiguous criteria for defining when air routes are eligible to be imposed as PSO services. Nevertheless, under Air Services Regulation 1008/2008, it does not state clearly what is meant by eligible territories for PSO impositions in the context of economic development. In order to address that concern, the Commission provided a notice with further clarification of the current PSO regulation, also named 2017/C 194/01, from the *Official Journal of the European Union* (OJEU). Thus, the criteria traditionally used to determine whether a territory is a development region are based on the evaluation of gross domestic product (GDP) per capita (e.g., when purchasing power parity (PPP) is less than 75% of the EU average) or the unemployment rate [9]. However, there are still aspects that require further improvements, such as those related to common rules for subsidies, airfares, and tenders, in order to achieve a regional air transport system as a viable supporting factor for regional economic advancement [10], and therefore to avoid inconsistencies in designing social air routes [11]. From a strictly economic-related point of view, the objective of the air passenger market should be to match supply with demand for regular services in the most efficient way and so to give individuals the best possible means of transport to meet their mobility needs. The provision of public regular air services requires, therefore, a focus that goes further than the needs of the domestic market, since the imposition of a PSO on certain air route interferes in the EU's single market for transportation services. In the event that such disruption to the market does occur, the possible adverse effects on free competition should be analyzed in depth to avoid unnecessary market distortions. With remote territories and peripheral areas, there is usually no choice but to use the PSO schema, whether it is imposed as a way of regulating or subsiding, or even both, the scheduled air services needed to ensure the maintenance of adequate mobility. When such market failure is identified, the imposition of a PSO in combination with related subsidization may be required to ensure essential air transport services in the most efficient manner. Unfortunately, the previous literature relating to economic efficiency in awarding PSO contracts is very scarce and probably insufficient so far, and even non-existent when the subject concerns e-procurement procedures.

3. The PSO Schema on the Domestic Air Transport Market in Spain

With a population of 47,026,208 (as of 1 January 2019), Spain holds the second greatest surface area in the EU, leading to a low population density compared with the European average. Traditionally, the unequal distribution of economic opportunities throughout the Spanish territory, defined by an extensive coastline, as well as a rugged terrain and a scattered population, has created an imbalance among regions, particularly those related to low-demand transportation networks. For territories with peripheral or remote nature, mobility needs are inherent in promoting the use of public service transport, simply by the fact of facilitating sustainable and adequate means of transport. When alternative modes of transport such as rail, bus, or ferries, or the combination of these, cannot be considered for reasons of travel time, frequency or price, or even a lack of such services, the design of a PSO air route often represents the most reasonable choice in terms of economic and social benefits. In Spain, the most restrictive case of PSO impositions, here called type 3, has not been used widely in designing PSO air routes, as seen in Table 2. Nevertheless, Table 3 shows a trend in the past few years towards imposing PSO on regular air routes restricted to one carrier, and consequently an increase in the number of tender process related to awarded public contracts for air services (Airlines and Airports see Appendix A). Furthermore, the number of bids submitted against invitations to tender for PSO contracts announced in Spain so far has almost always been one bidder for each bidding process. The domestic transport market of PSO air routes is thus highly concentrated among a few airlines, all of them headquartered in Spain. In fact, some tender procedures of contracts for PSO air services have been declared void in the lack of any bidder, as happened in the public biddings for the cases no. 155/A14 and no. 209A19 (refer, respectively, to Tables 3 and 4. When this occurs, as in both of these cases, aviation authorities are forced to enhance the requirements contained in the bid documentation in order to make it more appealing to potential bidders by preparing a new announcement of invitation to tender. It is clear that aspects of the language and culture of bidders are not a detriment to cross-border competition for PSO air service contracts [12]. It is equally true that the specific features thereof, in addition to the complexity of operating at certain aerodromes with particular restrictions, such as those related to runway length or operational flight rules, have resulted in submitting tenders that were bid by domestic airlines only. This is precisely the case with all PSO routes tendered in Spain. Specifically, in none of the PSO air routes under type 3, for a total of 23 impositions (refer to Table 2), was there any bidder in any public competition from other EU member states.

Domestic carriers have played a fundamental role in operating PSO air routes related to low-demand regions. Without them, the mobility of people and goods would not be possible not only on routes serving remote territories, but also on thin ones. The socio-economic impact of the PSO schema on peripheral regions, including disadvantaged ones, is beyond any doubt. Prior research studies have shown how the PSO schema has proven to be very useful in serving some regional airports with a high degree of dependency on scheduled air services within the corresponding domestic markets, such as the case of the Canary Islands [13], the Azores [14], and the air routes between the Italian mainland and the island of Sardinia [15]. In contrast, concerns have been raised regarding the long-term sustainability of the regional airports, such as in the case of Ireland [16]. In the case of Spain, PSOs have been instrumental in growing the regional economy and regional development by providing communities with a fast means of transport. Such a form of public intervention on the internal air market has coexisted with price discounts not only for island residents (the Balearics and the Canaries), but also for those living in isolated areas (Melilla and Ceuta). In the case of the Canaries, this may even guarantee the profitability of PSO air routes in spite of their lower elasticity of demand [17]. Additionally, the existence of a dense airport network of nearly 47 operational facilities (as of 31 December 2019), 43 airports and two heliports managed at national level, in addition to two local airports, one of them privately managed and the other regionally managed, might explain the likely effect of expansion in the domestic flight supply from a deconcentrating pattern due to the growth of low-cost carriers at small and medium-sized airports [18]. It can be said that the main criterion of public investment in airport infrastructure has been established on the basis of enhancing territorial cohesion, and mainly from policies based more on social benefits than cost–benefit analysis. It may be wondered how air transport should be encouraged in assessing socio-economic footprint [19].

Table 2. Summary of PSO system on the Spanish domestic air transport market (as of 18 September 2019).

Route Code	Airport	IATA Code	Airport	IATA Code	Type of PSO
ES01	Almeria	LEI	Sevilla	SVQ	3
ES02	Menorca	MAH	Ibiza	IBZ	1
ES03	Menorca	MAH	Madrid	MAD	3 *
ES04	P. Mallorca	PMI	Ibiza	IBZ	1
ES05	P. Mallorca	PMI	Menorca	MAH	1
ES06	Gran Canaria	LPA	El Hierro	VDE	3
ES07	Gran Canaria	LPA	Tenerife S.	TFS	3
ES08	Gran Canaria	LPA	Fuerteventura	FUE	1
ES09	Gran Canaria	LPA	Lanzarote	ACE	1
ES10	Gran Canaria	LPA	Tenerife N.	TFN	1
ES11	Gran Canaria	LPA	La Palma	SPC	1
ES12	La Gomera	GMZ	Gran Canaria	LPA	3
ES13	La Gomera	GMZ	Tenerife N.	TFN	3
ES14	La Palma	SPC	Lanzarote	ACE	1
ES15	Tenerife N.	TFN	El Hierro	VDE	1
ES16	Tenerife N.	TFN	Fuerteventura	FUE	1
ES17	Tenerife N.	TFN	Lanzarote	ACE	1
ES18	Tenerife N.	TFN	La Palma	SPC	1
ES19	Badajoz	BJZ	Madrid	MAD	3
ES20	Badajoz	BJZ	Barcelona	BCN	3
ES21	Melilla	MLN	Almeria	LEI	3
ES22	Melilla	MLN	Granada	GRX	3
ES23	Melilla	MLN	Sevilla	SVQ	3

Source: compilation based on data from [4]; additional information provided by DGAC upon request. Explanatory note: International Air Transport Association (IATA); * in seasonal periods only.

4. Background of Procurement System for PSO Provision

Considering "Directive 2014/24/EU of the European parliament and of the Council of 26 February 2014 on public procurement and repealing Directive 2004/18/EC", the use of electronic means in designing the procurement management process should be promoted by all member states, once the provision of this EU directive has been integrated into the corresponding national legislation. Regarding tender processes concerning PSOs restricted to one carrier (type 3), there are not many rules in the regulation of the tendering process, and therefore there is no guidance on it either. While it is desirable to provide call for tender available electronically, some of them may still be paper-based. In the last few years, indeed, there has been a significant increase in the number of PSO impositions (type 3) across the EU, and not all of them follow strictly the same methodology. Procurement procedures for the provision of PSO services depend on national regulations, as Air Regulation no. 1008/2008 gives no further indication in this respect. Despite the existence of a guide to good practices for the PSO system, also named "Interpretative Guidelines on Regulation (EC) No 1008/2008", this document explicitly excludes the procurement of air services from its scope (refer to points 113 and 114 of [9]). Although Directive 2014/23/EU of the European Parliament and of the Council of 26 February 2014 describes procedural aspects related to the award of concession contracts, public procurement directives are not in the remit of Department for Mobility and Transport (DG MOVE), and therefore the PSO tender procedures may not necessarily be aligned to each other. In fact, the Air Services Regulation (refer to Article 17(9)) only obliges member states to inform DG MOVE about the results of both the tender and the selection. Unfortunately, nothing is mentioned in the regulation about PSO provision by using cross-border free open sources, such as the e-Prior. However, thanks to the promotion of e-procurement, it is foreseeable that tenders among EU countries can become fully transparent and permanently monitored without any restriction.

5. Results

This section intends to provide readers with an overview of the results obtained from the analysis and study of the features of procurements related to invitations to tender for PSO air services. As noted previously, the PSO schema comprises three modalities of air routes, depending on whether they have been imposed as an open PSO (type 1), as a closed PSO with exclusivity and without compensation (type 2), or as a closed PSO route with both exclusivity and compensation (type 3). Hence, both types 2 and 3 are necessarily linked to tendering procedures. However, for the scope of this research, the discussion will be focused on the PSO routes under type 3 that have been imposed in Spain thus far. As seen in Table 3, the Spanish PSO domestic market has traditionally been characterized by non-indiscriminate use of the tendering process for PSO contracts, instead massively setting routes restricted to one carrier as the first choice for PSO provision, except in the case of low-demand routes. In fact, PSO impositions have greater flight frequencies than those on unprotected passenger air services, particularly on low demand routes [20]. Most recently, the lack of airlines willing to operate under an open PSO has led to the design of such routes as public routes under the most restrictive type. Studying the evolution of PSO air routes in Spain, it can also be found that, in addition to a sharp increase of impositions in recent years, the provision of related procurement procedures has grown substantially over the past few years. This research highlights, therefore, the strong commitment made by public authorities with regard to considering such air routes as essential services.

Table 3. Summary of tender processes for PSO impositions (as of 31 December 2019).

Route Code	Passengers Carried (in Thous.)	Contract Duration (mos.) [a]	CAGR (%) [b]	Public Aid (in Thous. of EUR) [c]	Ratio (EUR/PAX) [d]	Level of Implementation (Ratio) [e,ii]	Air Carrier (IATA Code) [f]
ES01	331.8 [i]	144	3.7 [i]	28,349.1	85.44	2:3	YW
ES02	119.3	n/a	6.7	n/a	n/a	n/a	YW, UX
ES03	3777.1	40	1.0	9440.3	2.49	4:8	YW & IB
ES04	6252.2	n/a	0.8	n/a	n/a	n/a	YW, UX
ES05	4196.3	n/a	0.9	n/a	n/a	n/a	YW, UX
ES06	460.6	40	2.0	2932.4	6.36	1:4	NT, PM
ES07	1500.5	40	1.6	2932.4	1.95	0:3	NT
ES08	8628.7	n/a	0.3	n/a	n/a	n/a	NT, PM, UX
ES09	9348.5	n/a	0.7	n/a	n/a	n/a	NT, PM, UX
ES10	11,463.9	n/a	1.0	n/a	n/a	n/a	NT, PM, UX
ES11	1841.5	n/a	1.0	n/a	n/a	n/a	NT
ES12	133.3	88	0.0	7344.1	55.10	1:4	NT
ES13	479.5	88	4.1	7344.1	15.31	1:4	NT
ES14	122.1	n/a	−0.4	n/a	n/a	n/a	NT, PM, UX
ES15	2325.4	n/a	0.9	n/a	n/a	n/a	NT, PM
ES16	3172.1	n/a	1.1	n/a	n/a	n/a	NT, PM, UX
ES17	4456.5	n/a	0.9	n/a	n/a	n/a	NT, PM, UX
ES18	9296.2	n/a	0.6	n/a	n/a	n/a	NT, PM, UX
ES19	364.3	18	0.4	4084.5	11.21	1:1	YW
ES20	390.9	18	0.4	4084.5	10.44	1:1	YW
ES21	278.2	8	−0.7	506.1	1.81	1:1	YW
ES22	234.1	8	0.3	506.1	2.16	1:1	YW
ES23	22.2	8	−0.2	506.1	22.79	1:1	YW
Σ	69,195.2	n/a	n/a	67,662.4	n/a	n/a	n/a
Ā	3008.5	45.45	1.2	6184.5	19.55	n/a	n/a

Source: Own calculations based on data from [21,22]. Explanatory notes: [a] including existing contract, if any; [b] applicable between 2004 and 2019; [c] contracts awarded until 2019; [d] ratio between total passengers carried (PAX) and total amount of awarded contracts; [e] e-procurement with respect to total procurement procedures; [f] as of 2019. Figure notes: [i] for the period between 2010 and 2019; [ii] including existing contract.

Table 4. Summary of tenders for PSO routes without full e-procurement process (as of 31 December 2019).

Route Code	322/A09	197/A12	108/A14	108 BIS/A14	138/A14	155/14 BIS	155/A14	20/A16	46/A16
ES01	•				•				
ES02									
ES03		•				•	•		•
ES04									
ES05									
ES06			•	•				•	
ES07			•	•				•	
ES08									
ES09									
ES10									
ES11									
ES12			•	•				•	
ES13			•	•				•	
ES14									
ES15									
ES16									
ES17									
ES18									
ES19									
ES20									
ES21									
ES22									
ES23									
Budget (EUR) [a]	11,900,000	2,400,000	6,200,000	6,200,000	9,074,050	2,400,000	2,400,000	5,581,000	2,071,835
Duration (mos.) [b]	48	16	16	16	48	16	16	24	16
Execution (%) [c]	100	68.8	0	100	100	100	0	100	100

Source: Own elaboration based on [21,22]. Figure notes: [a] Maximum budget estimated to meet the funding gaps for PSO operations; [b] Duration of the service defined on the PSO contract; [c] Current degree of execution of PSO contract. Explanatory note: Black circle "•" denotes a route with procurement procedure applicable to a PSO contract, while blank space indicates "not applicable".

5.1. Overview of Tenders Related to Imposition of PSO without Full E-Procurement Procedure

At the beginning of the implementation of the PSO system in Spain, there was no obligation to post on a unified online platform documents relating to procurements for the provision of PSO air services. Hence, procurement procedures for the purpose of awarding a contract for PSO imposition under type 3 were governed by Royal Legislative Decree 3/2011, in which was approved the recast text of the Public Sector Contracts Law 09/2017 (hereinafter LCSP). Only tender announcements, as well as those related to awards of PSO contracts, were thus subject to domestic law, and therefore published in the corresponding official gazettes. Despite this, some documents submitted by carriers in order to bid in a tender procedure were not permitted to be accessed by anyone, and therefore were restricted for reasons of confidentiality. Covering the period from 2009 to 2016, as shown in Table 4, the time taken to award PSO contracts, with the exception of those with unsuccessful tenders, was approximately two years. Apparently, such public procedures were time-consuming tasks due in part to the lack of a compulsory tender system for complete electronic processing that would have facilitated the use of electronic tools, thereby eliminating the need to use physical documents.

5.2. Overview of Tenders Related to Imposition of PSO with Full E-Procurement Procedure

In Spain, upon the entry into force of Law 09/2017 of 8 November on Public Sector Contracts, the so-called Ley 09/2017 de 8 de noviembre, de Contratos del Sector Público (hereinafter new LCSP), which was the result of the transposition of directives of the European Parliament and of the Council of

21 February 2014 (2014/23/UE and 2014/24/UE), procurement management on the PSO system achieved much better performance in terms of transparency and openness thanks to the implementation of a unified procurement platform, commonly referred to as the Plataforma de Contratación del Sector Público (hereinafter PLACSP). As a result, documents relating to any tender process must be posted on PLACSP regardless of which public authority manages it. Irrespective of whether the economic compensation for a PSO air service is directly provided at national level (e.g., air route E03), or, failing this, at regional level (e.g., air route ES01), the award of the corresponding contract involves the use of the PLACSP not only by the national aviation authority, but also by bidders that expect to win a competitive tender to carry out regular air services on the PSO route. This contributes to increasing the flexibility of these procedures. In fact, Table 5 illustrates precisely how often PSO contracts have successfully been awarded under the e-procurement system.

Table 5. Summary of tenders for PSO routes with full e-procurement process (as of 31 December 2019).

Route Code	15/A18	43/A18	79/A18	123 A18	209 A19	177 A18	281 A19	328 A19	162 A2020	123 A2019
ES01		•								
ES02										
ES03					•	•	•			
ES04										
ES05										
ES06			•							•
ES07										
ES08										
ES09										
ES10										
ES11										
ES12	•									
ES13	•									
ES14										
ES15										
ES16										
ES17										
ES18										
ES19				•						
ES20				•						
ES21								•	•	
ES22								•	•	
ES23								•	•	
Budget (EUR) [a]	5,731,000	8,925,000	6,800,000	10,500,000	1,200,000	180,000	725,144	2,100,000	2,100,000	1,390,000
Duration (mos.) [b]	36	48	24	18	16	2	4	8	12	12
Execution (%) [c]	41.7	35.4	0	77.8	0	100	100	100	0	100

Source: Own elaboration based on [21,22]. Figure notes: [a] Maximum budget estimated to meet the funding gaps for PSO operations; [b] Duration of the service defined on the PSO contract; [c] Current degree of execution of PSO contract. Explanatory note: Black circle "•" denotes a route with procurement procedure applicable to a PSO contract, while blank space indicates "not applicable".

6. Discussion

As already pointed out, the promotion of public transport plays a key role in the European common policy for implementing a sustainable mobility model, and thus enforcing best practices by fighting against climate change. To this end, the European Commission (EC) has consistently advocated the establishment of an integrated transportation network by supporting the development of multimodality. In certain European peripheral regions, specifically those located far away from main transportation hubs, air transport may better meet administrative requirements with regards to frequencies and capacities. In such cases, the establishment of scheduled air services, besides being more convenient, could also become the optimal solution to ensure adequate public means of transport, particularly those serving remote territories. In that context, air transport is therefore not only the most appropriate rapid means for carrying people and goods in remote areas, but also the only possible method for island territories. Considering that the EU single market in aviation has been gradually liberalized, European airlines are already entitled to freely establish and provide air services in any place in the internal market they choose, even on domestic routes, without restrictions, on the basis of a valid air operator's certificate (AOC) from any EU member state. However, scheduled air services in a free market regime have not always adequately served due to a lack of competition or even private initiative in operating on thin air routes, in addition to those serving peripheral areas. The PSO schema has been shown to be a useful mechanism to solve such market failure. Earlier studies, in spite of not being numerous, have found evidence pointing to the importance of the PSO schema in terms of efficiency, for instance, by analyzing certain determinants from a semi-parametric approach [23] and considering the level of service in terms of social efficiency [5]. As administrative procedures for imposition of a PSO on a certain air route can involve specific technical and operational requirements, particularly those related to awarding tenders, current European legislation seeks to safeguard free competition in a single market economy while promoting adequate public transportation, and thus facilitating free mobility. In contrast, there is a risk that excess public intervention in allowing the imposition of a PSO on several routes may lead to the undermining of free competition in the internal air market. For that purpose, EU member states have been urged to avoid any obligation without due justification based on precise arguments as to proportionality to socioeconomic development needs, as well as to the inadequacy of alternative transport modes [9]. As the EU internal air market is already fully liberalized, confirmation of its public service nature has been addressed by earlier studies, such as those analyzing the social aspects of air transport [24], and also in previous studies that considered whether air transport is a necessity for social inclusion and economic development [25].

On a different point of discussion, it is also worth noting that the practices of carrying out the PSO tender process vary, since some member states do everything centrally and electronically with a national authority (as in the case of Spain, Greece, Croatia, Ireland, Lithuanian, Estonia, and Sweden), and in others procurements have been carried out at regional level (as in the case of Finland and the Czechia), or a mixture of both (as in the case of Portugal and Italy), or even at community level (as in the case of France and UK). As for the case of public contracts for PSO, it is expected that tenders should be subject to the procedures announced and awarded from the contracting electronic platform, also known as the e-procurement system. Unfortunately, Regulation no. 1008/2008 does not explicitly regulate this, but only applies the condition of universal free availability, either on paper or electronically, to those documents based on which tenders can be drafted. In fact, our research has long observed some gaps for possible future modification of EU Air Regulation in those aspects that would make it possible to achieve greater transparency of tender documents and the related explanatory reports. It might bring clarity to the issue of how the call for tenders can be managed more efficiently in order to achieve more simplified procedures. Hence, after an analysis of the 23 PSO routes imposed in Spain, as will be thoroughly seen over the following sections, it can be observed that e-procurement has been extensively used by DGAC in the whole administrative process relating to the imposition of PSO and related public contracts since. Given the fact that no previous studies have investigated the potential benefits of the information technologies used in electronic platforms for impositions of PSO on regular air services, particularly in the case of Spain, this research can serve as an avenue for future works. Herein lies the originality of this paper.

6.1. Considerations on Findings about Public Tenders Relating to PSO Services on Air Route ES01

Some characteristics of the scheduled air services on the route SVQ–LEI make it a specific case of PSO imposition in the Spanish domestic air transport market. This route was the first imposition of PSO on a regular air route to link two airports within mainland Spain. As seen both in Tables 3 and 4, it was the most significant public procurement process for the awarding of PSO services under type

3 within the Spanish domestic market, in terms of both the total volume awarded (EUR 28,349,124) and the total duration of the contracts (144 months), with up to a total of three tender procedures. In addition, the analysis of the efficiency and sustainability of this PSO route in an earlier paper showed that the imposition of a PSO on this route resulted in enhanced demand for air services, and specifically compensation from the procurement contract for regular air services [26]. As shown in Figure 1, since August 2014, scheduled air services have been guaranteed thanks to the succession of two fixed-term PSO contracts. This has enabled awarded the carrier (YW) to consolidate the supply of direct flights per the requirements of the invitation to submit a tender bid for such transport service. Based on the data from this research, the effect on the performance of such contracts in attracting passengers has been very positive. Moreover, according to our estimation, the budgetary savings compared with the award amount of the three successful tenders sum to a total of EUR 1,549,926. During the 2010–2019 period, the compound annual growth rate (CAGR) was 3.7%. Within these years, this air service has been consolidated with the domestic market and it is a clear case according to the successful figures shown.

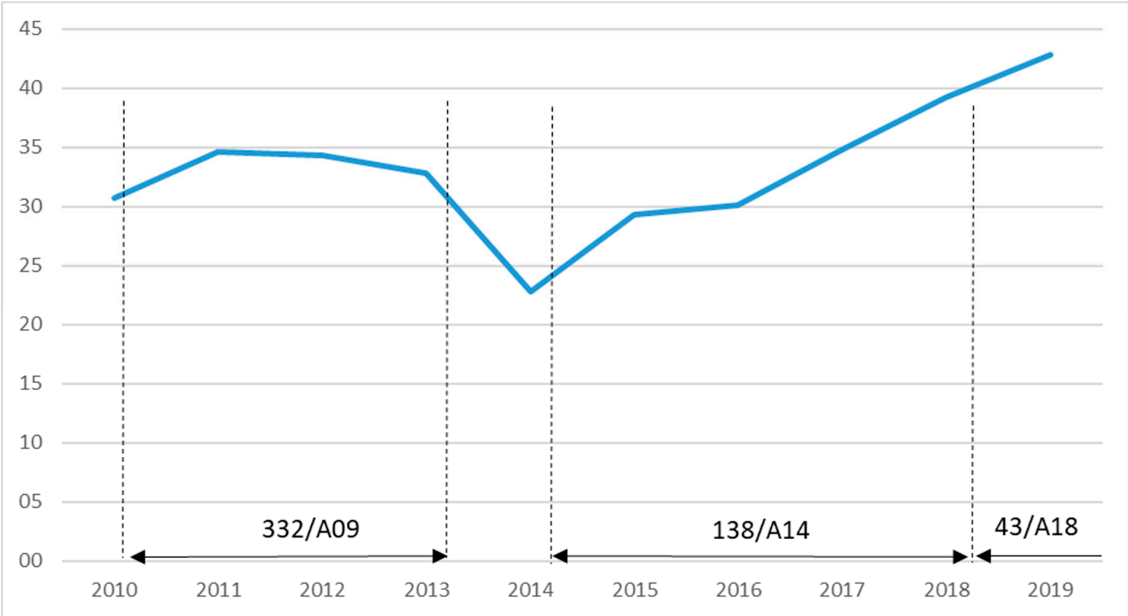

Figure 1. Thousands of passengers carried yearly on the PSO air route ES01 (as of 31 December 2019). Source: Own elaboration based on [21,22]. Explanatory notes: Each arrow denotes a contract period for a PSO type 3 with its respective case number for proper identification; where there is no arrow, this denotes a period of activity without any compensation (PSO type 1 or 2), or failing this, under free market conditions.

The continuity of PSO contracts such as 138/A14 and 43/A18 appears to have had a significantly decisive role in stimulating the demand for daily flights on this air route. The implementation of e-procurement in tendering the contract of 43/A18 has made it possible to maintain demand growth, while also ensuring efficient execution of related call for tender before ending the contract of 138/A14. In contrast, the lack of continuity in subsidization during the period between the 332/A09 and 138/A14 contracts led to a sharp drop in demand for flights on air route ES01. Clearly, the supply of air services (UX) on this route in a free market regime in such a period (from 14 January 2014 to 1 August 2014) did not have as good performance in terms of passengers as those transported under the PSO of type 3.

6.2. Considerations on Findings about Public Tenders Relating to PSO Services on Air Route ES03

This case relates to the only PSO imposed on an air route in Spain linking an airport serving an island territory and a major hub airport, these being Menorca (MAH) and Madrid (MAD), respectively.

The flux of tourism tremendously influences the activity of air traffic on this island's airport at Mahon. This not only results in offering a wide range of direct flights from many European airports to the island airport, but also in creating a high seasonality for its air operations. This situation means that slot coordination at this airport has been classed, according to European laws such as Article 3 of EEC Regulation no. 95/93, later modified by EC Regulation no. 793/2004, in addition to corresponding national laws such as Article 4 of Royal Decree 20/2014, into two main categories depending on whether flights are operating in low season or high season. This creates a dual categorization each year as a facilitated and coordinated airport, respectively. Nevertheless, the singularity of such s PSO route resides more than anything in the high number of tender processes carried out in order to maintain adequate air transportation services for people living on the island of Menorca. Given the fact that such route was sufficiently served over previous years, there was no need to impose a PSO under type 3. However, by the end of 2011 the number of passengers transported suddenly dropped. One of the causes of such a dramatic change in passenger traffic, as shown in Figure 2, could be attributed to the collapse of carriers operating in the Balearic Islands, such as Spanair (formerly JK) on 28 February 2012, and Air Berlin (formerly AB) on 28 October 2017. Then, the route suffered a reduction in regular flights, and was eventually withdrawn by Vueling (VY), Ryanair (FR), and Iberia Express (I2). In fact, the last carrier (YW) operating this route in the free market regime also considered leaving it, but only in the winter season. This suggests that PSO contracts would have to meet the needs of air transportation on this route, but only in the low season. Indeed, this is precisely the main difference from other PSO impositions in Spain, where that does not happen. In this concern, two tenders of eight total processes could have been successfully awarded, and four of them were carried out as e-procurements. Based on our findings, the settlement of such procurement procedures allowed the public authorities to save a total of EUR 880,886. In addition, since November 2012, the succession of short-term PSO contracts assured the provision of scheduled air services, in addition to continuous growth, made evident by the fact that the CAGR calculated is 5.8% between 2013 and 2019.

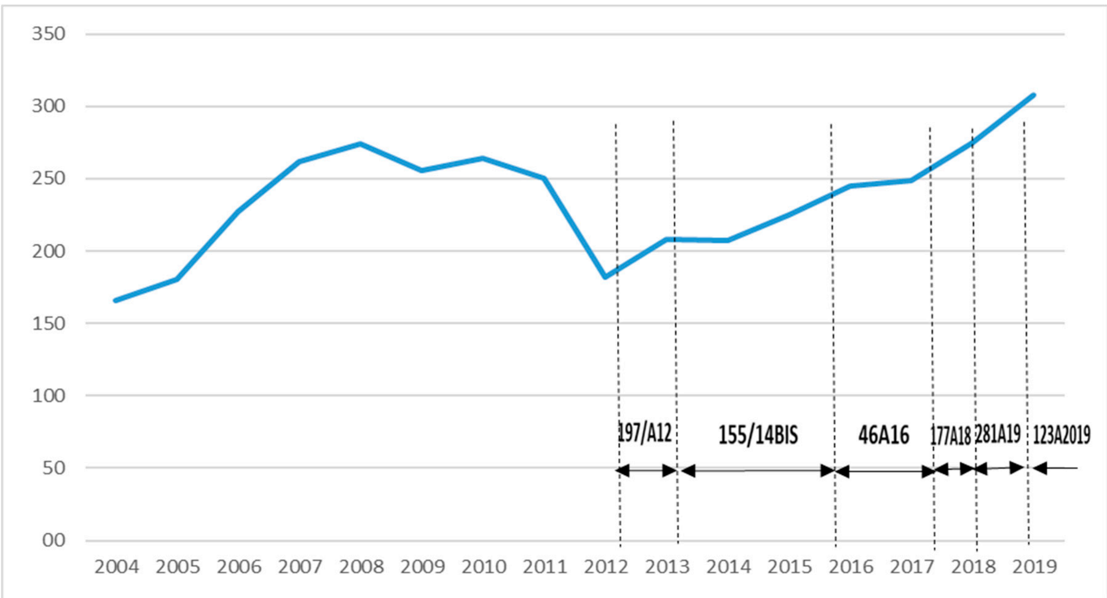

Figure 2. Thousands of passengers carried yearly on the PSO air route ES03 (as of 31 December 2019). Source: Own elaboration based on [21,22]. Explanatory notes: Each arrow denotes a contract period for PSO type 3 with its respective case number for proper identification; where there is no arrow, this denotes a period of activity without any compensation (PSO type 1 or 2), or failing this, under free market conditions.

6.3. Considerations on Findings about Public Tenders Relating to PSO Services on Air Route ES06

This is a clear case of PSO imposition relating to air services linking two islands within an archipelago, but of substantial differences in population size and territory coverage. As the fastest way to ensure the transportation of people and goods to remote areas, air routes are economic and social drivers for the development of peripheral regions, such as the Canary Islands. On occasion, if airlines incur a loss in profit, they are forced to diverge from such scheduled air services and move towards other regular routes. This was precisely the case of the route LPA–VDE, whose performance did not sufficiently guarantee the existence of adequate means of transport between both islands. This led to an increased risk of the cessation of regular air services on such a route. As can be seen in Figure 3, the evolution of the route required public authorities to design a PSO route (type 3) by launching procurement procedures for contracting air services. Such public intervention has facilitated air services on this route thanks to the corresponding procurement procedures, for a total of EUR 2,932,476, whose budgetary saving, compared with the award amount of the two successful tenders, sums to a total of EUR 12,774. Although the corresponding awarding procedures, such as 108 BIS/A14 and 20/A16, for scheduled air services on route ES06 were not conducted entirely under the digital tendering ecosystem resulting in e-procurement management, the performance on this route has been growing continuously since the beginning of 2013. Another distinctive feature is that it shows high capacity for resilience, since demand for flights on this route has been growing at a scorching pace in spite of long periods of operation without subsidization from the PSO schema. As shown below, for the period between 2013 and 2019, there have been two periods where this PSO route was operated under type 1, and the calculated value of CAGR stands at 20.2%. Although the last PSO contract (10/A16) expired on 31 July 2018, the route has since been operated without any PSO subsidization provided directly to air carriers. It is also worth pointing out that there was an unsuccessful tender procedure managed under e-procurement (79/A18). Despite that, the growth of demand for flights on the route seems not to have been disrupted. Apparently, the continued resident subsidy has led to the maintenance of good performance belonging to such scheduled air services in regard to the passengers carried.

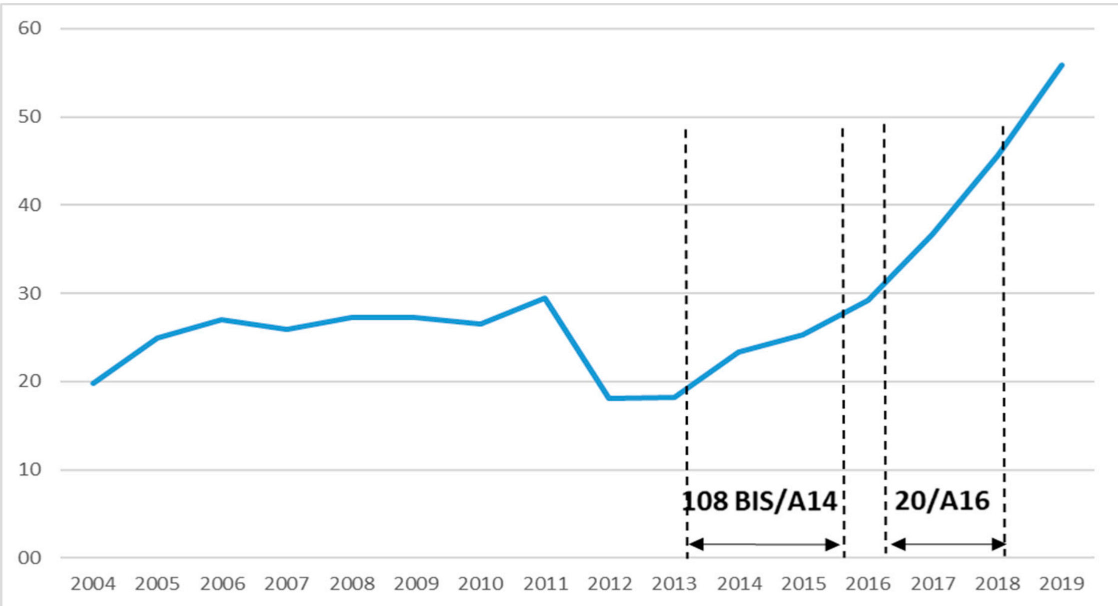

Figure 3. Thousands of passengers carried yearly on the PSO air route ES06 (as of 31 December 2019). Source: Own elaboration based on [21,22]. Explanatory notes: Each arrow denotes a contract period for PSO type 3 with its respective case number for proper identification; where there is no arrow, this denotes a period of activity without any compensation (PSO type 1 or 2), or failing this, under free market conditions.

6.4. Considerations on Findings about Public Tenders Relating to PSO Services on Air Route ES07

The air route LPA-TFN belongs to the air transport network in the Canary Islands, in addition to directly serving the local populations of the largest islands within the archipelago. Unlike the previous case, the so-named ES06, the air route linking Gran Canaria to Tenerife is a fundamental route for socio-economic development in the region. Such an air route is indispensable to maintaining adequate transport services in this peripheral area. Both the national government and regional authorities have ascribed paramount importance to the evolution of the domestic transportation market in connection with the route performance. As this air route was initially operated in a free market regime and then with a PSO imposition, it is interesting to observe the evolutionary demand for these direct air services in order to compare the different operating periods depending on whether they were subsidized by a PSO contract. In this regard, Figure 4 clearly shows how the curve of passenger traffic was impacted by the Great Recession of 2008, and the effect that PSO imposition had on the route performance. For the period 2004–2019, it appears that public tenders for public contracts on the route led to a tremendous increase in demand for these regular air services, achieving thus a GADR of 1.6%.

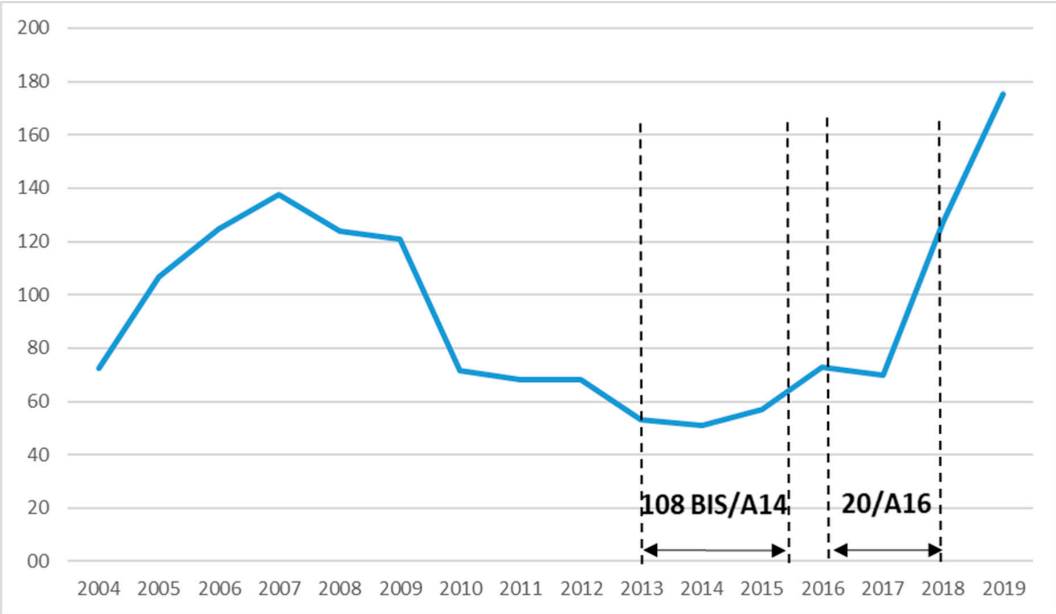

Figure 4. Thousands of passengers carried yearly on the PSO air route ES07 (as of 31 December 2019). Source: Own elaboration based on [21,22]. Explanatory notes: Each arrow denotes a contract period for PSO type 3 with its respective case number for proper identification; where there is no arrow, this denotes a period of activity without any compensation (PSO type 1 or 2), or failing this, under free market conditions.

Although the last contract (20/A16) was not awarded under a full e-procurement system, it also seems that demand has been growing consistently due to resident subsidy. Therefore, there is no need for state aid for the airline operating the route in order to maintain its economic equilibrium. Similarly, this effect has been seen in certain air routes within the Canary archipelago as well, such as route ES06. Consequently, it appears that the termination of a PSO contract for scheduled air services linking both islands does not necessarily entail a sudden drop in demand. Furthermore, direct flights on the route were operated for 40 months and covered two public contracts not linked with each other (respectively, 108 BIS/A14 and 20/16). The resident subsidy seems to be the main cause of the steady growth of this regional route, as such government incentives are exclusively for residents living in the Canary Islands and do not include other Spanish citizens. In view of the results of the research concerning air route ES07, so far, a strong domestic demand for regular air services and the permanent resident subsidy have been sufficient to promote a stimulating leverage.

6.5. Considerations on Findings about Public Tenders Relating to PSO Services on Air Route ES12

Along with the case below, the air route GMZ–LPA belongs to the public transport network of the Canary Islands, whose main purpose is to serve the resident population of La Gomera and thus aims to strengthen the mobility of the local population by imposing a PSO. With the advent of the last world economic crisis (the so-called Great Recession), direct flights on this route suffered from a dramatic loss of passenger traffic to the point at which they were abandoned in early 2009. Since then, this route has remained without continuous direct flights. While the possibility of resuming direct flights between both islands has been broadly discussed both at a local and a regional level, no interested party has submitted any information that would suggest the possibility of operating on air route ES12 again under free market conditions. As soon as direct flights were resumed, the number of passengers carried on the route has been rising at the same level as in 2014. In fact, the CAGR calculated for the period 2004–2019 is 0%. Hence, in that case, it seems that a resident subsidy is not sufficient in itself to stimulate sufficient demand for making direct flights commercially sustainable, but it needs to be supported by tendering PSO contracts if it is applied in supporting direct air services linking both islands.

As seen in Figure 5, the tender process for public air service contracts on both PSO routes serving La Gomera with mainly non-direct flights has led to a slight recovery of passenger traffic for the scheduled air services GMZ-LPA, however on regular air services operated via TFN. Moreover, the budgetary saving from the three procurement procedures (in chronological order, 108 BIS/A14, 20/A16, and 15/A18) has accomplished thus far a total of EUR 288,674 for this route, the third being through an e-procurement procedure (15/A18). Whilst direct flights between both islands have been mainly operated in the summertime, a favorable tendency is observed precisely in the evolution of air passengers carried from July to September 2019. The imposition of a PSO on air route ES12 is a clear example of a public intervention mechanism to ensure an adequate transport mode on ultraperipheral routes, particularly when adequate alternatives are not available. This effect has been seen in other air services as well, such as those related to PSO routes ES21, ES22, and ES23, and seems to explain how the PSO schema, especially under type 3, can help in reactivating scheduled air services in EU developing regions.

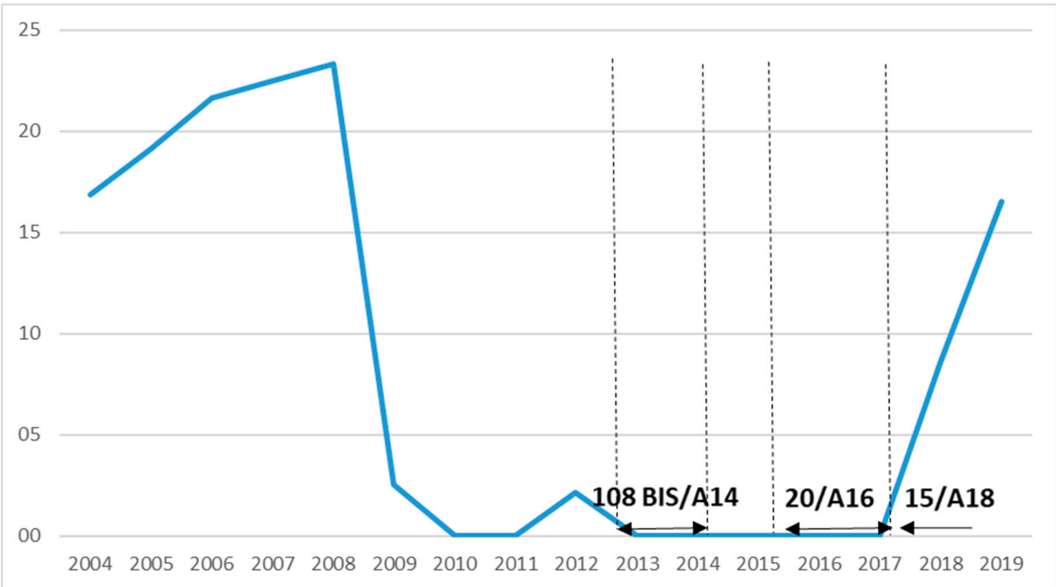

Figure 5. Thousands of passengers carried yearly on the PSO air route ES12 (as of 31 December 2019). Source: Own elaboration based on [21,22]. Explanatory notes: Each arrow denotes a contract period for PSO type 3 with its respective case number for proper identification; where there is no arrow, this denotes a period of activity without any compensation (PSO type 1 or 2), or failing this, under free market conditions.

6.6. Considerations on Findings about Public Tenders Relating to PSO Services on Air Route ES13

Together with the previous case, the route GMZ–TFN is a part of the PSO schema serving the island population living in La Gomera. Unlike the case of ES12, this route has traditionally seen a strong demand even throughout the last worldwide economic downturn, and has recently been awarding public contracts due to the PSO imposition on regular flights. In this regard, the public tenders have aimed to ensure the mobility of people by providing proper monetary compensation to the route operating carrier. The total cost of state aid directly paid to the awarded airline from the three tender processes, one of them carried out as a full e-procurement procedure (15/A18, currently in force) in order to meet the PSO (type 3) requirements, has amounted to EUR 5,522,076. Furthermore, it has recently experienced notable growth due to the demand for these air services on this air route, particularly from the enforced entry of the first PSO contract on 1st August 2014, as seen in Figure 6. Thus, it is interesting to note that demand growth came to a halt within the period between 1 January and 31 July 2016, precisely when there was no PSO contract enforced. Nevertheless, the evolutionary demand for this route seems to be on a path towards sustainable growth. In this context, the GADR calculated over the period analyzed (2004–2019) was 4.1%. This shows a mutual dependency between the subsidization of scheduled transport services from the imposition of PSO on the air route ES13 and its continuous traffic growth in carrying air passengers. This is further strengthened by the fact that such an administrative imposition has been applied in two steps, one between 2006 and 2011 under a PSO of type 1, and the second since 2011 under a PSO of type 3. Evidence from Figure 6 sheds further light on the significant effects of efficient public tendering procedures on the preservation of scheduled air services, particularly those relating to e-procurement management from the corresponding PSO imposition, such as public contract 15/A18. This has also made public bodies able to open a call for tenders more expeditiously, and therefore allows the concatenation of the new contract (15/A18) with the previous one (20/A16). The number of air passengers on the route has been increasing every year since 2012, and it has been clearly motivated by the fact that public authorities have been supporting possible losses of operating expenses of regular flights through PSO contracts, in addition to a resident subsidy. Indeed, as shown below, growth abruptly stalled in the short timeframe between 108 BIS/A14 and 20/A16 in which there was no PSO contract.

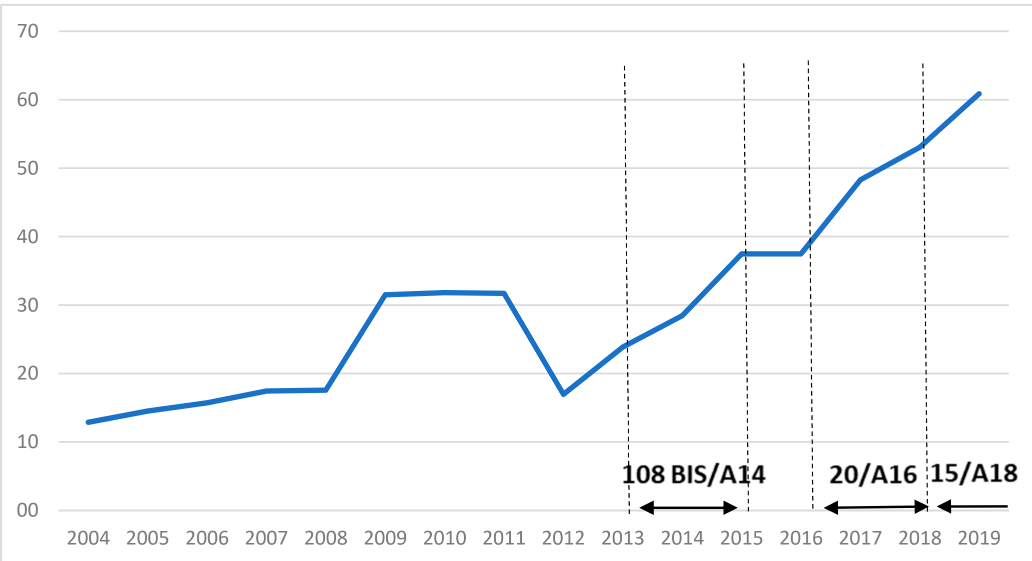

Figure 6. Thousands of passengers carried yearly on the PSO air route ES13 (as of 31 December 2019). Source: Own elaboration based on [21,22]. Explanatory notes: Each arrow denotes a contract period for PSO type 3 with its respective case number for proper identification; where there is no arrow, this denotes a period of activity without any compensation (PSO type 1 or 2), or failing this, under free market conditions.

6.7. Considerations on Findings about Public Tenders Relating to PSO Services on Air Route ES19

The imposition of PSO on scheduled air services serving the region of Extremadura has led to an increased demand for fights from Badajoz airport since the corresponding public contract was awarded by the national government's Ministry of Public Works. Traditionally, such regional airport infrastructure has been underused in operating regular air services for the carriage of passengers, particularly in the case of international flights. However, the existence of the Spanish air force base, located near the civil airport terminal, appears to have had a considerable impact on keeping the entire infrastructure lively and active, despite a significant drop in the number of passengers carried until the summer of 2012. Currently the public air transport network from this airport comprises two routes linking Badajoz to the two largest Spanish cities, Barcelona and Madrid. Although the route BJZ–MAD was operated under free market conditions, none of the airlines operating this route were able to make these air services profitable or reliable, which resulted in both UX and YW ceasing their operations at Badajoz. In view of the sudden lack of supply of these flights, the route was converted into a PSO route under type 3, and therefore an e-procurement procedure was carried out for the tendering of a service contract (123/A18), which remains currently in force since 28 October 2018. Thanks to diligence and flexibility in the resolution of an e-procurement procedure related to awarding the tender for this PSO case, as seen in Figure 7, there has been a significant increase in the number of passengers carried on this route. All of this has led to the CAGR of 0.14% within the period between 2004 and 2019, in addition to a budgetary saving of EUR 1,750,000 from the e-procurement process for the contract 123/A18.

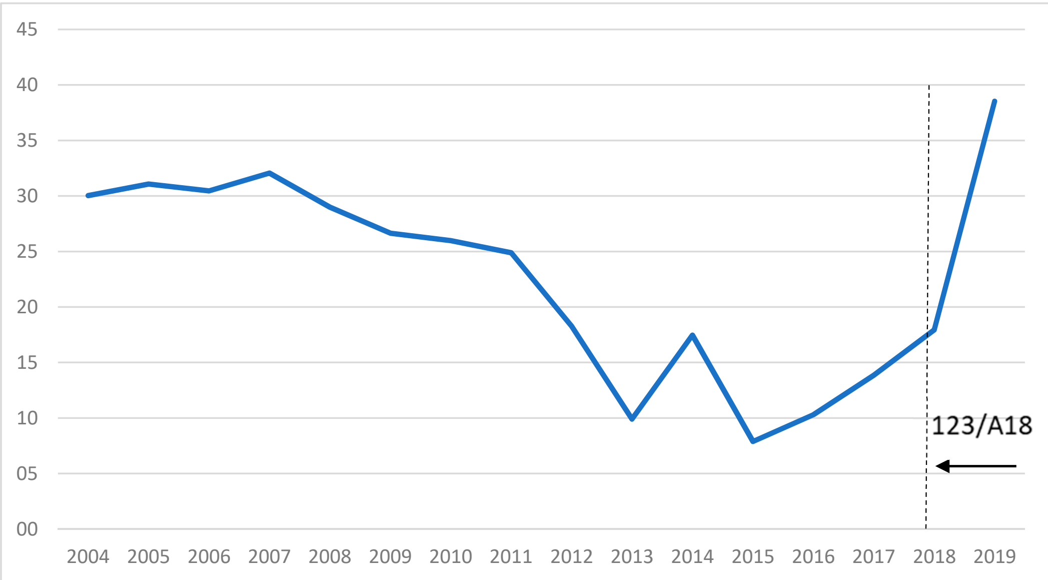

Figure 7. Thousands of passengers carried yearly on the PSO air route ES19 (as of 31 December 2019). Source: Own elaboration based on [21,22]. Explanatory notes: Each arrow denotes a contract period for PSO type 3 with its respective case number for proper identification; where there is no arrow, this denotes a period of activity without any compensation (PSO type 1 or 2), or failing this, under free market conditions.

Other findings indicate that the subsidies from PSO imposition appear to have increased the demand for regular flights to and from Badajoz than marketed tourism promotions. This explains the slight upturn in demand between mid-2012 and mid-2017 due to two public marketing contracts, which initially encompassed two periods (from July 2012 to July 2014, and then from August 2015 to March 2017), and were budgeted at EUR 1,800,000 and EUR 1,480,000, respectively. Nevertheless, as seen in the graph below, the growth performance of demand has been much better from subsidization under PSO contracts. It is clear that the imposition of a PSO on such route supported by a public contract causes a stimulating effect on the demand for flights.

6.8. Considerations on Findings about Public Tenders Relating to PSO Services on Air Route ES20

The route ES20, together with the previous one, is a part of the regular air services imposed by the Spanish authorities on peripheral areas, such as Extremadura. The route linking Badajoz to Barcelona, the second largest city in Spain, has traditionally been the subject of special interest from the regional government (Junta de Extremadura), since adequate public transport services can contribute to the further development of the regional economy. The imposition of a PSO on regular air services from Badajoz has thus given an opportunity to contribute to the strengthening of this airport in operating domestic flights. Being the only commercial airport in the region, its catchment area extends far beyond the regional territory of Extremadura, including the neighboring areas of Portugal. Due to the existence of large number of family ties among the population living in Catalonia and Extremadura, the need for transportation to link both Spanish regions has traditionally been constant over time. However, over the last few years, the route has undergone marked changes in respect to the demand for air services, which seems to be a response to the specific conditions of the region, which is an addition to previous marketing contracts promoting regional tourism.

As previously mentioned, related marketing contracts were awarded by the regional government in order to stimulate the establishment of new flights to and from Badajoz airport, thus promoting tourism in the region. As soon as these marketing contracts were terminated in June 2014 and March 2017, respectively, the route's activity dropped significantly. As is evident from Figure 8, the intensity of demand is represented as an erratic path due to its heavy reliance on economic support from public contracts. Since air routes operating within Spanish mainland are not subject to a resident subsidy, the only way to promote adequate scheduled air services is to impose a PSO on such routes, specifically under type 3, and then to award a public contract for establishing regular flights. In sum, this is a typical example of an air route in the public interest that needs to be encouraged and supported, if there exists no rapid alternative to road and train transport for passengers. Nevertheless, the PSO contract (123/A18) currently in force was carried out as a result of an e-procurement procedure, which has led to a 25% increase in savings with respect to the amount initially budgeted for awarding these air services.

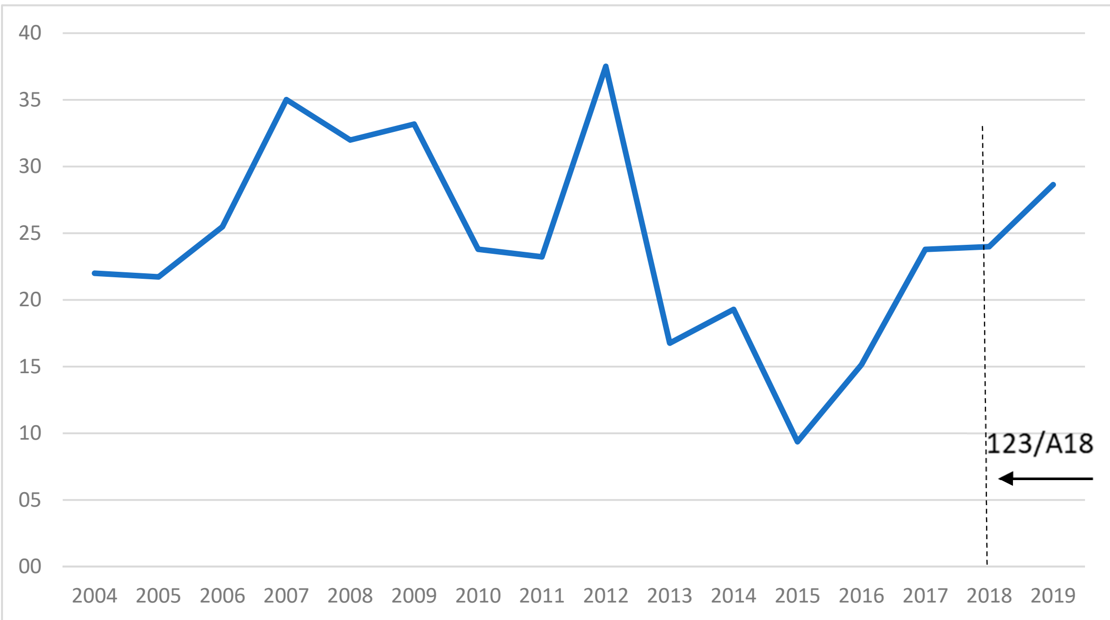

Figure 8. Thousands of passengers carried yearly on the PSO air route ES20 (as of 31 December 2019). Source: Own elaboration based on [21,22]. Explanatory notes: Each arrow denotes a contract period for PSO type 3 with its respective case number for proper identification; where there is no arrow, this denotes a period of activity without any compensation (PSO type 1 or 2), or failing this, under free market conditions.

6.9. Considerations on Findings about Public Tenders Relating to PSO Services on Air Route ES21

This air route MLN–LEI is a part of the PSO network broadly based in the city of Melilla, an autonomous city under Spanish sovereignty, whose objective is to serve the local population in addition to those living within a large catchment area located in the northeastern region of Morocco. Historically, this air corridor has had a greater economic component, being strongly linked with trade relations between Melilla and mainland Spain. Moreover, Almeria being the nearest gateway from Africa to trans-European road networks, scheduled air services on the route have played a vital role in enhancing connectivity among people living on both sides of the Mediterranean Sea, particularly for those visiting their relatives in the summertime. Although this route has reaped the benefit of the Spanish resident subsidy (formerly 50%, currently 75%) for those living in Melilla, the number of air passengers has been dropping steadily since 2004. Nevertheless, upon the 328A19 public contract award, the imposition of a PSO has led to a revival of flight demand. As can be seen in Figure 9, this seems to be growing substantially again.

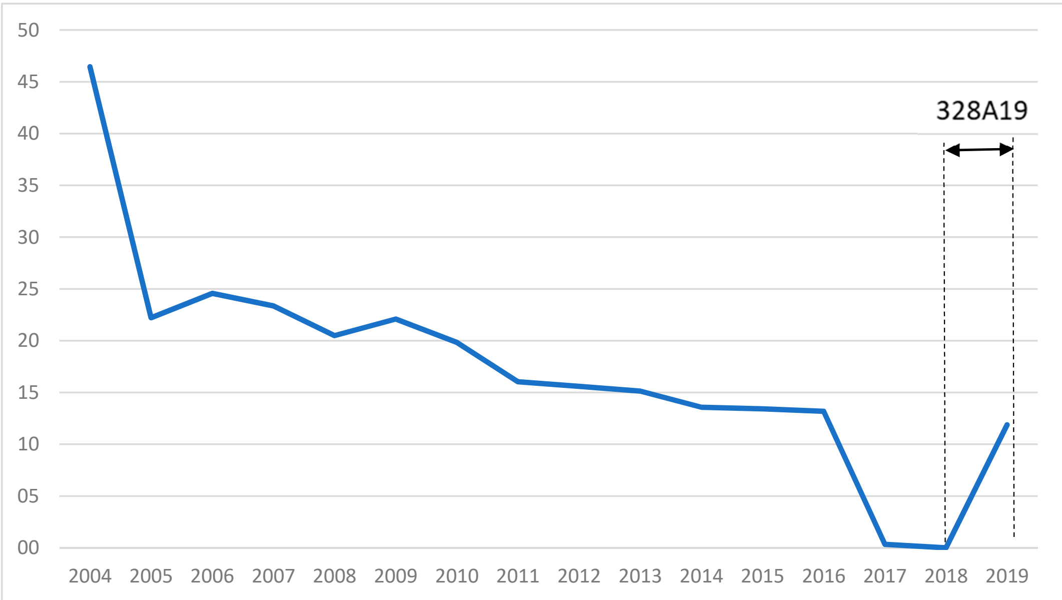

Figure 9. Thousands of passengers carried yearly on the PSO air route ES21 (as of 31 December 2019). Source: Own elaboration based on [21,22]. Explanatory notes: Each arrow denotes a contract period for PSO type 3 with case number concerned; the area without an arrow denotes a period of activity without any economic compensation (type 1 or 2), or failing this, under free market conditions; the case 162A2020 has not been mentioned on the graph because this is an ongoing contract since 1 January 2020.

In designing public air services for such an isolated city, along with understanding the transportation needs of the beneficiaries, it has also been important to take into consideration certain restrictions associated with the airport, such as aeronautical limitation surfaces, as well as take-off and approach paths, and runway length. Therefore, this fact has limited air operation, and thus forced airlines to use turboprop aircraft in operating any regular air services from this airport. These technicalities constitute a constraint for the aviation market, thus reducing the number of potential air carriers interested in serving this route. Consequently, a specific aircraft type, specifically a turboprop (e.g., ATR 72-600 or the DASH 8-400 series) capable of operating in Melilla airport (MLN), had to be clearly specified in the documents relating to competitive tendering for PSO contracts, including the imposition of operating requirements, in addition to other requirements such as daily flights or maximum fares. All this has led to the existence of an air carrier interested in bidding for the corresponding PSO contract (328A19). Additionally, thanks to an e-procurement procedure for tendering this public contract, there was a saving of 27.7 % in respect of the initial budget.

6.10. Considerations on Findings about Public Tenders Relating to PSO Services on Air Route ES22

As in the previous case, the evolution of passenger numbers carried on the route MLN–GRX shows certain noteworthy aspects relating to its performance with regard to the annual passenger volume. After the eruption of the Great Recession in 2008, particularly after its acceleration in 2010 within the Eurozone, air passenger traffic on this air route dropped massively by over 50% between the years 2007 and 2014, as can be seen from Figure 10. The airline (YW) operating this regular air service was forced to leave this route in early 2017 due to its low occupancy. In view of the need to keep operating such a vital link for both cities, the Spanish Ministry of Public Works had no other option but to impose a PSO under type 3 on this route, and then to set an e-procurement procedure to efficiently award the contract, named 328A19, for the required air services. Thanks to the public contract, regular flights on the route were reactivated, and thus have been operating successfully since May 2019. On the basis of the information revealed in Figure 10, it is clear that the combined effect of the compensation to the awarding airline (YW) resulting from the existence of a resident subsidy (see Annex I of Royal Decree 1316/2001 of 30 November) has led to an increased number of passengers carried on this route, in addition to a budgetary saving of EUR 893,866 from the PSO contract awarded for the period between 1 May 2019 and 31 December 2019. Clearly, the imposition of a PSO for such air services has not only revived air traffic on this route, which had been cut by the airline (YW) formerly operating regular flights, but has also led recently to a fast rise in the number of passengers carried. In fact, the calculated value of CAGR is 0.6% for the period 2013–2019, whereas for the period 2004–2019 it was 0.3%. Furthermore, as usual for air routes revitalized by imposing PSOs, in addition to being subsidized, there was only one bidder so far, precisely the sole airline operating formerly the route in the free market regime. This seems to indicate that previous experience in operating regular air services on certain regional routes may be a competitive factor in bidding for PSO contracts, particularly if the airline uses an efficient fleet that can be easily adapted to meet PSO requirements. In the particular case of air route ES22, as previously mentioned, air services have been operated with a turboprop aircraft as the only viable option in flying efficiently to and from Melilla airport.

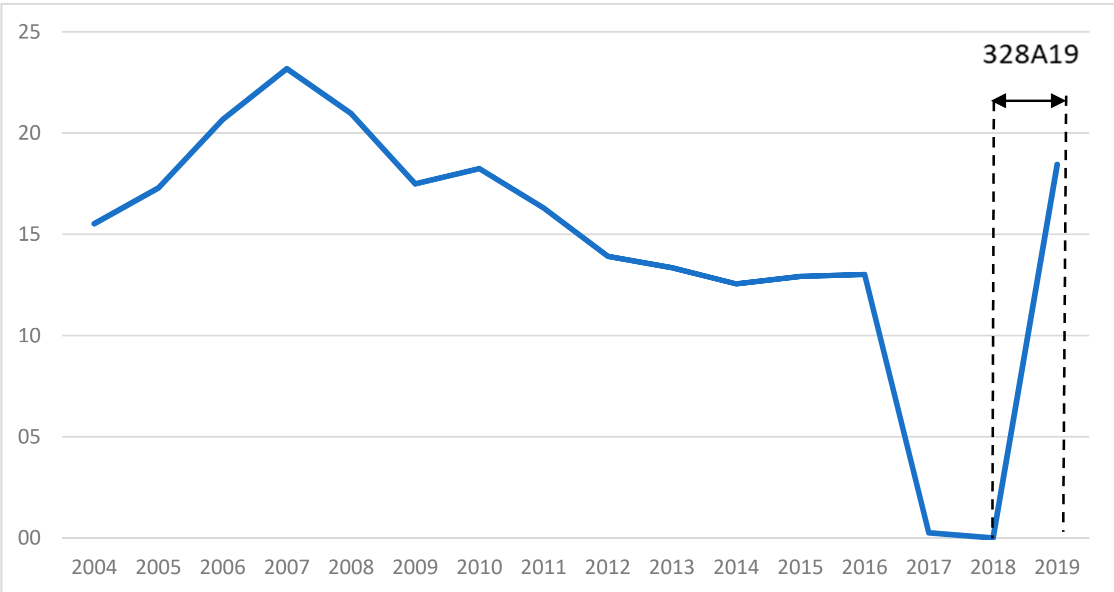

Figure 10. Thousands of passengers carried yearly on the PSO air route ES22 (as of 31 December 2019). Source: Own elaboration based on [21,22]. Explanatory notes: Each arrow denotes a contract period for PSO type 3 with case number concerned; the area without an arrow denotes a period of activity without any economic compensation (type 1 or 2), or failing this, under free market conditions; the case 162A2020 has not been mentioned on the graph because this is an ongoing contract since 1 January 2020.

6.11. Considerations on Findings about Public Tenders Relating to PSO Services on Air Route ES23

Although being part of the imposition of a PSO on routes serving Melilla (MLN), the route linking to Sevilla (SVQ) differs significantly from those linking to Almeria and Granada. Whilst being a form of public transportation with no possible direct alternatives, the PSO imposed on air route MLN–SVQ appears to be a low-demand service, as can be noted from Figure 11. In contrast to the two previous cases, route ES23 had not been previously operated in a regular and continuous manner. It has not been shown that there was latent demand for the scheduled air transport of either passengers or goods in previous years. Nonetheless, local authorities saw the opportunity to strengthen the supply of direct flights to and from Melilla airport, mainly those linking to the regions with the most extensive economic ties to the area within Spain, in particular, Andalusia. Hence, this PSO route was established, together with two other routes (ES21 and ES22), under a single tender (A328/A19), in order to be more appealing to bidders so that it could be awarded promptly, and thus preventing the declaration of an unsuccessful procedure. In order to avoid a lack of bidders on public tenders for PSO air services, as was the case with air route ES13 in regard to procedure 209A19, the procurement of scheduled flights operating in Melilla opened the invitation to tender for three routes under a single awarded air carrier. As e-procurement procedures usually enable synergies at many levels, this tender procedure made possible a saving on the initial budget for air route MLN–SVQ of up to EUR 893,866. However, the current active demand for this air transport service is still relatively weak. According to our calculations, in the period from 2004 to 2019, this route had one of the poorest performances (CAGR of −0.2%) across the PSO schema of air routes in Spain, in addition to the lowest volume of passengers carried (22.2k). Nevertheless, the tender process (328A19) for the first PSO contract on this route was carried out based on an e-procurement procedure that led to significant stimulation of the demand for these regular air transport services. Significantly, as in the cases of other PSO air routes operating to and from Melilla airport, the stimulation of any public subsidization from both the PSO contract and a resident subsidy, in addition to former agreements for tourism promotion at a local level, seem to be key factors in this growing demand.

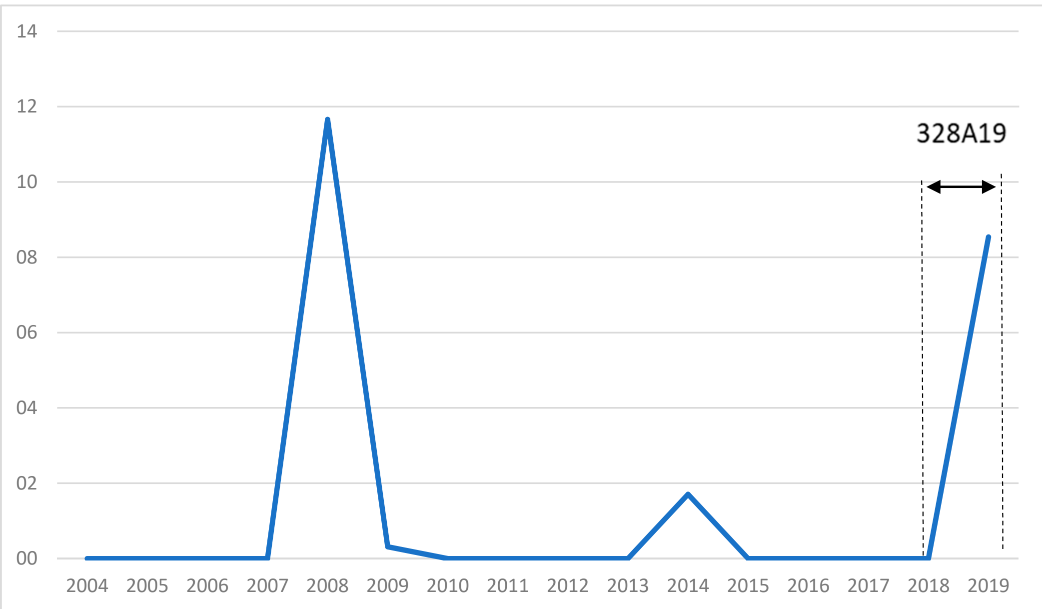

Figure 11. Thousands of passengers carried yearly on the PSO air route ES23 (as of 31 December 2019). Source: Own elaboration based on [21,22]. Explanatory notes: Each arrow denotes a contract period for PSO type 3 with case number concerned; the area without an arrow denotes a period of activity without any economic compensation (type 1 or 2), or failing this, under free market conditions; the case 162A2020 has not been mentioned on the graph because this is an ongoing contract since 1 January 2020.

7. Conclusions

Throughout this paper, a whole new outlook has been given on the PSO schema applied to the Spanish case, especially issues related to procurement procedures with regards to inviting tenders and awarding the concession of public air services. Thus, the main objective of this research was to examine not only how impositions of PSO on routes can ensure adequate air services, but also whether the use of e-procurement procedures leads to increased efficiency on the public tender side. These challenges have been reflected in the considerations selected for this study, in particular those analyzed for each PSO route under type 3. Hence, a total of eleven PSO routes imposed in Spain so far have been subsidized under the Air Services Regulation 1008/2008 by awarding concessions for scheduled air services on routes restricted to one carrier. As this form of public intervention on the aviation market generates a strong distortion of free competition in the EU internal market, the competent civil aviation authorities should be extremely careful in imposing PSO routes, particularly those under type 3. Thus, in the case of Spain, the national government has avoided the indiscriminate use of this public intervention, paying particular attention to setting a restriction to one carrier, and therefore to launching a procurement procedure to award the corresponding compensation. However, the reality of the current air transport market points towards a concentration of air carriers, and therefore a reduction in the number of market players. This will lead to a small number of airlines interested in participating in tendering procedures from PSO impositions. Consequently, there will be an increase in the amount of economic compensations as more bidders can meet the requirements for air services concerned. The present paper has revealed PSO impositions whose tender process was declared null or void (108/A14, 155/A14, 79/A18, 209A19), and even whose awarded carrier terminated the public service earlier than the date signed on the contract (197/A12). Unfortunately, while the implementation of e-procurement seems to lead to more efficient and agile procedures, the ratio of unsuccessful tender processes remains quite high with respect to total procurement procedures carried out so far. In fact, our findings suggest the necessity of encouraging improvement opportunities in order to avoid distortions of the EU transportation market when unnecessary public services are imposed on regular air routes with compensation. This is precisely the most restrictive type of the current PSO schema. Further related questions dealing with air market issues have also been widely discussed in this paper. For instance, from a cost perspective, e-procurement can lead to a risk relating to maximizing the range of realized performance on the bidder's side [27]; from an innovation perspective, public procurements can contribute to the creation of markets for new transport services [28]; and from a competitiveness perspective, the PSO schema can affect the economic performance of air carriers, particularly in the case of regional airlines [29].

As seen previously, the PSO schema has been imposed on twenty-three Spanish air routes to date, and of these, eleven were involved in awarding public contracts to provide scheduled passenger air transport services. Since May 2018, related calls for tenders have been conducted under a full e-procurement process from the unified platform at national level, the so-called PLACSP, the earliest being the case numbered 15/A18 concerning routes ES12 and ES13. Having carefully examined the corresponding administrative procedures for tendering scheduled air services on these eleven routes, a common characteristic of the PSO system results from the analysis of passenger traffic for the period 2004–2019. Clearly, the imposition of a PSO under type 3 has a stimulating effect on the demand for regular air services. Equally clear is the fact that such a positive effect can be amplified when there is a resident subsidy on those PSO routes serving peripheral areas and remote territories. A similar effect can be observed on certain PSO air services operated under type 1 or 2, where the passengers concerned can be eligible for a resident discount. This seems to suggest that in very specific cases, such as route ES07, the resident subsidy would be enough to ensure the continuity of air transportation. However, airlines operating such routes may be tempted to raise air fares, while knowing that the reduction of standard air fares has recently improved by up to 75%. In this regard, it is highly desirable that future modifications of Air Services Regulation 1008/2008 strengthen the oversight function necessary for the residency subsidy in order to avoid distortions of the EU transportation market when an unnecessary PSO is imposed on a regular route with compensation.

8. Future Research Directions and Limitations

This section intends to provide interested readers with a few ideas on how to gain a source of inspiration for their future research on issues related to transportation in terms of efficiency and sustainability. As previously pointed out, this paper aims to thoroughly study the effect of PSO impositions on the air transport market in Spain by shedding some light on the details of what should be further done by the public authorities in order to achieve better results than those that have been obtained in procurement procedures, to be specific. As mentioned before, a new research direction can emerge from studies of other domestic air transport markets across the EU where air routes have been declared to be public services (see Table 1). Moreover, the analysis of the market and institutional barriers that hinder open competition in the air transport market can lead to other research topics where more studies might be needed. In this context, further issues can be addressed by examining whether the liberalization of air transport has led to increased competition [30]. Economic issues surrounding air market challenges can also be addressed in future work, such as those related to entrepreneurship in operating PSO air routes [1], in addition to the implications for tourism of promoting private initiatives [31]. Another aspect to take into consideration in future studies on the air market impact of PSO routes is the relationship between connectivity and scheduled air services through hub centrality metrics, as earlier studies suggested [32]. Similarly, the sociopolitical framework of the criteria for justifying the necessary imposition of a PSO on the air routes concerned can be considered as a priority research topic in order to deepen the analysis of the challenges faced by the public transportation system. It may be convenient to gather and analyze evidence on the need for updating the EU legislation applicable to the air market with a special focus on the efficiency and effectiveness of the PSO schema. In this context, earlier works may also be helpful in identifying key aspects for future research involving the review of policies concerned, such as those relating to air connectivity in remote regions worldwide [33] and to multi-level governance from various scales of jurisdiction [34].

The coronavirus disease 2019, also named COVID-19, is causing awful effects on the air market in the passenger transport sector worldwide and is particularly intense for those air carriers operating mostly on long-haul flights due to travel restrictions for public health reasons. Since the most dramatic fall in air activity is occurring principally in both Asia and Europe, many airlines have massively withdrawn international routes, and have then been forced to reduce their fleets. Among other mobility problems arising from preventive health measures against the current pandemic, European airlines have been suffering a severe loss of liquidity because of the strong drop in income, primarily that from ticket sales and ancillary revenues, but also due to ticket refunds for flight cancellations during the pandemic, according to EU law on air passenger rights. Since Regulation (EC) no. 261/2004 is highly beneficial for individuals using air transport services, such an unprecedented situation is leading airlines into different survival scenarios in order to safeguard their liquid assets. As a follow-up to this paper, the related effects on airlines serving PSO routes can be discussed.

On the limitations of this study, it must be pointed out that there are few reliable data on air route performance, such as passenger load factor (PLF) or available seat kilometers (ASK), which can be consulted through free public access. As it is crucial to have reliable data available before carrying out a research project, it took a lot of work to obtain the proper data and then to calculate the results that have been revealed in this paper. Unfortunately, with the exception of the airline headquartered at Gran Canaria airport (LPA), named Binter (NT), it was not possible to find domestic airlines that were willing to collaborate on this research. Most airlines were not able to provide the authors with the required information, and therefore this led to problems investigating the research topic. Nevertheless, the in-depth knowledge that the researchers have of the transportation sector has led us to acquire valuable information for this study, in addition to the invaluable collaboration of competent staff members at both national and regional level. As reflected in the comments above, the results revealed by the present study can serve as fundamental information, allowing other researchers to learn about what the transportation market expects of the PSO schema and what challenges relate to this form of public intervention.

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Conflicts of Interest: The authors declare no conflict of interest

Appendix A

Airlines named in the paper: Air Berlin (formerly AB), Air Europa (UX), Air Nostrum (YW), Binter (NT), Canaryfly (PM), Iberia (IB), Iberia Express (I2), Ryanair (FR), Spanair (formerly JK), Vueling (VY).

Airports named in the paper: Adolfo Suárez Madrid–Barajas (MAD), Almería (LEI), Badajoz (BJZ), El Hierro (VDE), Fuerteventura (FUE), Gran Canaria (LPA), F.G.L. Granada-Jaén (GRX), Ibiza (IBZ), Josep Tarradellas Barcelona-El Prat (BCN), La Gomera (GMZ), La Palma (SPC), Lanzarote (ACE), London City (LCY), Málaga-Costa del Sol (AGP), Melilla (MLN), Menorca (MAH), Palma de Mallorca (PMI), Sevilla (SVQ), Tenerife Norte (TFN), Tenerife Sur (TFS), Vilnius (VNO).

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Subsection 3.1.b

The existing PSO system in Spain:

An overall Outlook

A graphical summary of PSO system in Spain

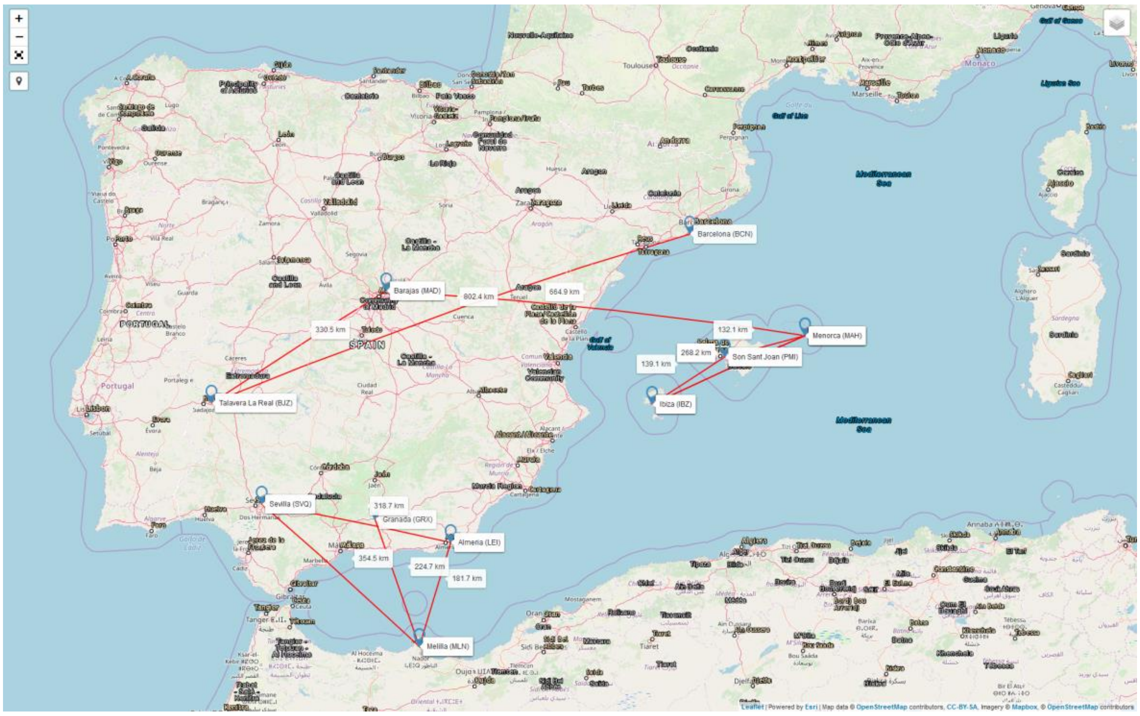

Figure 1. PSO air routes imposed so far across the Spanish territory, particularly in mainland Spain, as well the Balearic Islands and Melilla (as of 31 December 2019). Source: Own work prepared with FreeMapTools.com

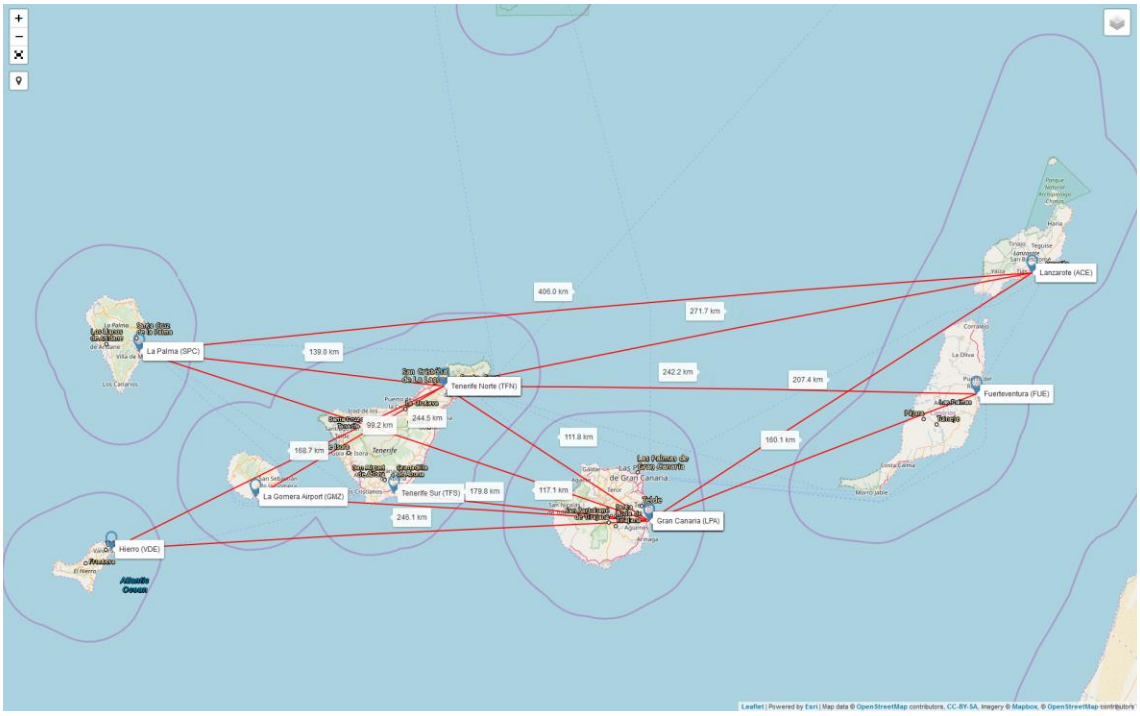

Figure 2. PSO air routes imposed so far across the Spanish territory, particularly in the Canary Islands (as of 31 December 2019). Source: Own work prepared with FreeMapTools.com

Table 1. Existing PSO air routes in the Spanish domestic air transport market (as of 14 March 2020).

Route code	Airport (from/to)	IATA [b] code	Airport (to/from)	IATA [b] code	PSO justification	PSO type
ES01	Almeria	LEI	Sevilla	SVQ	P, D	3
ES02	Menorca	MAH	Ibiza	IBZ	P, D	1
ES03	Menorca	MAH	Madrid	MAD	P, D	3 [a]
ES04	P. Mallorca	PMI	Ibiza	IBZ	P, D	1
ES05	P. Mallorca	PMI	Menorca	MAH	P, D	1
ES06	G. Canaria	LPA	El Hierro	VDE	P, D	1
ES07	G. Canaria	LPA	Tenerife S.	TFS	P, D	1
ES08	G. Canaria	LPA	Fuerteventura	FUE	P, D	1
ES09	G. Canaria	LPA	Lanzarote	ACE	P, D	1
ES10	G. Canaria	LPA	Tenerife N.	TFN	P, D	1
ES11	G. Canaria	LPA	S. C. Palma	SPC	P, D	1
ES12	La Gomera	GMZ	La Palma	LPA	P, D	3
ES13	La Gomera	GMZ	Tenerife N.	TFN	P, D	3
ES14	S. C. Palma	SPC	Lanzarote	ACE	P, D	1
ES15	Tenerife N.	TFN	El Hierro	VDE	P, D	1
ES16	Tenerife N.	TFN	Fuerteventura	FUE	P, D	1
ES17	Tenerife N.	TFN	Lanzarote	ACE	P, D	1
ES18	Tenerife N.	TFN	S. C. Palma	SPC	P, D	1
ES19	Badajoz	BJZ	Madrid	MAD	T, D	3
ES20	Badajoz	BJZ	Barcelona	BCN	T, D	3
ES21	Melilla	MLN	Almeria	LEI	T, D	3
ES22	Melilla	MLN	Granada	GRX	T, D	3
ES23	Melilla	MLN	Sevilla	SVQ	T, D	3

Source: Compilation based on data provided both by DG MOVE and by MITMA. Explanatory note: a) Economic compensation applicable in seasonal period only; b) International Air Transport Association (IATA).

Table 2. Key facts of air passenger traffic at airports considered from the PSO schema in Spain (2004-2019).

IATA Code	ICAO Code	Airport Group [a]	Airport Typology [b]	Airport Category [c]	Average Annual Passenger Traffic [d]	CAGR (%) [e]
LPA	GCLP	Canary	Touristic	Level 3	10,747,000	0.5
VDE	GCHI	Canary	Regional	Level 2	185,000	1.0
TFS	GCTS	Canary	Touristic	Level 3	9,099,000	0.4
TFN	GCXO	Canary	Regional	Level 2	4,178,000	0.9
FUE	GCFV	Canary	Touristic	Level 3	4,689,000	0.5
SPC	GCLA	Canary	Touristic	Level 2	1,108,000	0.6
GMZ	GCGM	Canary	Regional	Level 2	185,000	1.0
ACE	GCRR	Canary	Touristic	Level 3	5,910,000	0.4
LEI	LEAM	II	Touristic	Level 2	896,000	0.3
SVQ	LEZL	I	Regional	Level 2	4,502,000	2.0
MAD	LEMD	Major	Madrid-Hub	Level 3	48,414,000	0.7
BCN	LEBL	Major	Barcelona-Hub	Level 3	36,116,000	1.3
BJZ	LEBZ	III	Regional	Level 1	61,000	0.0
GRX	LEGR	II	Regional	Level 2	952,000	1.3
MLN	GEML	III	Regional	Level 1	315,000	0.9
MAH	LEMH	I	Touristic	Level 2 [i]/ 3 [ii]	2,811,000	0.4
IBZ	LEIB	I	Touristic	Level 2 [i]/ 3 [ii]	5,789,000	1.1
PMI	LEPA	Major	P. Mallorca-Hub	Level 3	23,781,000	0.6

Source: Own calculation based on information from Aena database [27]; additional information provided by the Spanish Directorate-General for Civil Aviation (DGAC) upon request. Explanatory notes: a), b) According to the classification provided by Aena; c) According to the categorization under Article 3 of [13] and Article 4 of [28], Spanish air facilities are classified as non-coordinated airports (Level 1), airports with schedules facilitated (Level 2), or coordinated airports (Level 3); d) Total amount including both arrivals and departures at each airport; e) Compound annual growth rate. Additional note: i) During the winter season; ii) During the summer season.

Table 3. Some operational facts of PSO air routes serving the Canary Islands (as of 31 December 2019)

Route Code	Distance (km) [a]	Travel time (h)	Heading Direction	Block Fuel (kg) [b, c]	CO2 Emissions (kg) [b, c]	Standard Aircraft	Emissions CO2/PAX (kg) [b, c]
ES01	319	0:42	283° (WNW)	560.9	1,766.9	ATR72	24.5
ES02	269	0:52	247° (WSW)	436	1,373	ATR72	19
ES03	667	1:05	279° (W)	2,522.9	11,455.8	CRJ1000	114.5
ES04	140	0:36	238° (WSW)	228	718	ATR72	10
ES05	132	0:35	74° (ENE)	213	671	ATR72	9
ES06	247	0:49	268° (W)	434.3	1,368.1	ATR72	19.0
ES07	117	0:34	276°(W)	205.7	648.1	ATR72	9.0
ES08	160	0:39	68° (ENE)	281.3	886.2	ATR72	12.3
ES09	208	0:44	57° (ENE)	356.7	1,152.1	ATR72	16.0
ES10	112	0:33	303° (WNW)	196.9	620.4	ATR72	8.6
ES11	245	0:49	289° (WNW)	430.8	1,357	ATR72	18.8
ES12	180	0:41	93° (E)	316.5	997	ATR72	13.8
ES13	99	0:32	59° (ENE)	174.1	548.4	ATR72	7.6
ES14	407	1:08	84° (E)	639.8	2,015.2	ATR72	28.0
ES15	169	0:40	244° (WSW)	297.2	936.1	ATR72	13.0
ES16	243	0:49	90° (E)	427.3	1,346	ATR72	18.7
ES17	272	0:52	78° (ENE)	478.3	1,506.6	ATR72	20.9
ES18	139	0:36	277° (W)	244.4	769.9	ATR72	10.7
ES19	331	0:43	56° (ENE)	1,600.39	4,650	CRJ200	93.0
ES20	804	1:16	68° (ENE)	3,873.78	9,810.73	CRJ200	196.21
ES21	181.7	0:41	17° (NNE)	319.4	1,006.2	ATR72	13.9
ES22	224.7	0:46	341° (NNW)	395.1	1,244.3	ATR72	17.2
ES23	354.5	1:02	313° (NW)	623.3	1,963.2	ATR72	27.2

Source: Own calculation partially based on a performance study provided by ATR upon specific request. Explanatory note: a) Orthodromic distance; b) Standard assumptions: Jet A1 density as of 0.804 kg/l, CO2 emissions as of 3.15 kg of CO2 per kg of Jet A1; c) En-route assumptions: Max. payload, no wind, 1 aircraft per leg under technical specifications by International Standard Atmosphere (ISA), Joint Aviation Requirements (JAR), European Union Aviation Safety (EASA).

Subchapter 3.2

CASE STUDIES

Subsection 3.2.a

THE PSO ROUTE BETWEEN ALMERIA AND SEVILLE (ES01)

Economic Research-Ekonomska Istraživanja

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Efficiency and sustainability of public service obligations on scheduled air services between Almeria and Seville*

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ABSTRACT

The objective of this paper is to examine how the imposition of Public Service Obligations (PSO) on certain routes may affect the transportation sector, with a focus on aviation in the European Single Market. Thus, this research investigates how this form of public intervention can be useful to access adequeate transport system in remote and peripherical regions. Subsequently, this paper intends to display that the imposition of PSO on aviation routes should be considered as a unique mean of market intervention on behalf of territorial cohesion. To accomplish this, an analysis of the economic impact in terms of efficiency and sustainability in the case of the scheduled air route between Almeria and Melilla in addition to other transportation alternatives such the bus or train was conducted. Additionally, this research attempts to shift the research focus away from PSO routes in order to determine the convenience of administrative concession as a way to foster the creation of specific routes, which furthermore cannot be covered by the entrepreneurship of private initiative in a free market regime. Consequently, this approach recognises that this form of public intervention is a way of correcting particular market failures, such as the lack of the adequate transportation.

Glossary (IATA airport codes): BCN: Barcelona; BJZ: Badajoz; LEI: Almeria; MAD: Madrid; MAH: Menorca; SVQ: Seville; SXF: Strasbourg

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Public service obligations; aviation; European Single Market; transportation; efficiency; sustainability; entrepreneurship; market failure

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L93; L91; Q56; L51

1. Introduction

In the past, the transport sector has attracted the interest of national governments due to the business dimention of its entreprenuerial activity and the economic impact on territorial cohesions. For this reason, public administrations seek to promote efficient public transport systems that will consider the scale of generated transportation is ultimately linked to the size of economies of the countries involved, but also transport efficiency.[1] In this context, the air transport industry takes a leading role in

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terms of efficient and effective aviation, and also its relationship with other public transport services. Indeed, numerous studies have noted that economic growth and air service expansion are closely interrelated.[2] This solely indicates the importance of air transport in the economy. It is precisely the high level of openness that makes the air transport[3] so unique, as reflected in the deregulation of air services in the EU since the late 1980s.[4] In fact, it is said that airline industry has been moving from a planned economy to a market economy. Compared to the other public transportation means, such as bus and rail transport, the European aviation system is glad to have high levels of competition through the formation of a real internal EU market.

Traditionally, the civil aviation has been considered an effective mean of transport to connect the population, as well as transported goods, especially where cities are not well-communicated with each other. Nowadays, air market services are highly open to competition due to the intense liberalization process carried out by European Commission since 2009.[5] However, the private air sector is not always able to cover all possible regional routes among peripherical airports due to the existence of alternative means of transport, such bus or train, or even the lack of profitability on routes in question. It may therefore be necessary to either stimulate the air market by promoting competition from new entrants or to cover the operating losses incurred by air carries on fundamental routes through State aids, respectively. Hence, in order to promote private initiative in this concern, entrepreneurship may need to be stimulated to encourage investments on air routes. There is an undeniable socioeconomic element of air transport, often it needs to be done through support provided by public administrations. However, public subsidies regarding European aviation are subject to specific rules and regulations[6] in view of ensuring fair competition among airlines, thus avoiding distortions of its internal market which are likely to have an impact on the air transport industry and hence its cost structure.[7]

The consideration of PSO relevant to transport within a precise framework both legal and economic sides have had its difficulities, particularly determining a well-defined concept from both points of view. This raises a key issue about whether the implementation of PSO may have consequences on the free market.[8] Given the fact that commercial air operation is in many cases the most suitable solution for population mobility on both peripherical territories and remote areas, this regard leads to the question how air transport should be implemented into regional economic and social system in favor of the collective interest.[9] According to free market principles, it is nonetheless true that some EU regions, but not limited to island territories, do not have full and equal access to the transportation system and mobility services like the rest of the country. It is crucial to carry out certain actions from public administration competencies that, among other things, can stimulate the private initiative, so that airlines can operate a given air route or series of routes under the scope of the PSO regulation. The European Comission has therefore defined such a long-term framework in regulating the regime for impositions of PSO in order to avoid undue distortions of market competition.[10] However, it is also necessary to ensure competitive rules through control and evaluation policies focusing on efficient legal and regulatory compliance within the EU single market in aviation. In this regard, it is also important to highlight the role of public administrations and their related bodies as a key player behind how transport market functions.[11]

2. Background

2.1. Legal framework

Those air routes declared as PSO on the territory of the European Union must be established and operated in accordance to the above mentioned Regulation (EC) No 1008/2008, especially in regards to Articles 16 and 18 thereof. Hence the difficulty of finding air carries, either entrepreneurial companies or established enterprises, that can be interested in operating routes of doubtful profitability. For this reason the current EU legislation provides for the possibility to award financial compensation in the form of subsidy to an airline operating with PSO services. Furthermore, the Article 16(9) of Regulation (EC) No 1008/2008 makes provision for restriction to a single airline through public tender procedures. A PSO contest may be declared void once corresponding invitation to tender has been carried out with no companies being interested in participating in the tender procedure. However, in order to avoid this type of contest there could be advantages towards certain companies, such as local airlines or former national flag carriers, which risks creating distortions of competition in the single market. A prior authorization must be approved by the home competent authority before being published by both corresponding national gazette and the Official Journal of the EU (OJEU). Nevertheless, once a particular obligation has been imposed, provided that no Community airline has submitted a flight plan to the corresponding national civil aeronautical authority with an intention of operating scheduled flight on PSO route, an individual invitation to tender is published in both respective public journals for administrative contract award to the exclusive exploitation of the air route. It is interesting to note here that a PSO contract does not necessarily lead to subsidy for the operation. Authors such as Williams and Pagliari (2004), argue that "the regulation does not deal with the payment of subsidies for proposed service levels that are an improvement on or are in addition to the minimum levels stipulated in the tender". In the specific case of air routes in Spain declared as public obligation, air carriers are subject to certain limitations and exceptions to meet their business goals,[12] in addition to their own operational limits such as fleet availability and aircraft type, as well as other matters relating to crew certifications and aircraft registration. Obviously, AOC holders certified by an EU Member State can participate in tender procedures. However, there are certain restrictions to gain access into the air market in terms of aviation safety, airworthiness, infrastructure capacity, environmental requirements and other public policy issues (Gómez Puente, 2007). Hence the need for a consistent legal framework to reconcile an open market economy with protection of the rights of the European citizens to individual mobility without discrimination on the basis of their place of residence. In this regard, some years back, two changes have been identified in regards to this matter, distinguishing between pro-competitive and restrictive changes (Williams & Pagliari, 2004).

Whilst it is true that the Regulation (EC) No 1008/2008 imposes common rules for the operation of air services in the EU single market, its Member States reserve the right to restrict the freedom of access to the market in certain cases covered by the above-mentioned regulation. Sure enough, amongst other relevant facts, PSO services are included (Guerrero Lebrón, 2012). In this respect, it is worth noting that

PSO routes are imposed by governmental authorities at the request of regional governments,[13] and obviously with corresponding notification to the EC. It is interesting to note here that all tender procedures have been conducted by Spanish Department of Public Works regarding PSO contracts at issue in the present case. In addition, if applicable, any subsidy should be financed using their own regional funds by agreement with the autonomous Andalusian Administration.

2.2. Market framework

According the list of PSOs published by EU Commission for Transports, there are 176 air routes (as of 27.9.2018). As the Table 1 shows, both numbers of PSO air routes per million inhabitants and per square kilometer appear higher than respective average values in those Member States with peripheral regions and islands. There, you can see countries with a lengthy coastline such as Greece and United Kingdom, but also some without neither high population nor large geographical area or vast number of inhabited islands such as Estonia and Portugal, and even Croatia. This is particularly apparent in the case of the Greece on very fragmented territory, scattered by islands and skerries, and whose mobility needs for its widely scattered population have to be met. In the case of the Spain, despite having a vast territory with sizeable population, it does not seem to have an extensive use of PSO impositions.

It is interesting to highlight the fact that an imposition of PSO does not necessarily lead to public subsidy for operation on the route, but it may favor the opportunity to establish airline routes by granting an exploitation monopoly in exchange for air operation under the terms of the imposition. Additionally, it may be subject to an invitation to tender allowing airlines to operate on an exclusive regime within applicable legislation. Moreover, even its corresponding call for tenders might be accompanied with substantial amount of funds for the required air transport service. This is precisely the case of the PSO route on which this paper is focusing.

Table 1. PSO domestic market by EU Member State (2018).

EU Member States with at least one PSO route	Number of PSO air routes	Total population	Total area (km^2)	Number of PSO air routes per million inhabitants	Number of PSO air routes per total area (Mm^2)
France	40	67,221,943	549,060	0.5950	72.8518
Greece	28	10,738,868	131,912	2.6074	212.2627
United Kingdom	22	66,238,007	247,763	0.3321	88.7945
Portugal	20	10,291,027	88,847	1.9434	225.1061
Spain	20	46,659,302	498,504	0.4286	40.1200
Italy	14	60,483,973	301,291	0.2315	46.4667
Sweden	11	10,120,242	449,896	1.0869	24.4501
Croatia	10	4,105,493	56,539	2.4358	176.8691
Estonia	3	1,319,133	45,347	2.2742	66.1565
Ireland	3	4,838,259	70,601	0.6201	42.4923
Finland	2	5,513,130	337,547	0.3628	5.9251
Cyprus	1	864,236	9,249	1.1571	108.1198
Czech Republic	1	10,610,055	78,874	0.0943	12.6784
Lithuania	1	2,808,901	65,412	0.3560	15.2877
Average values:				1.0375	8.1256

Source: Compiled by authors based on figures from EC (2018) and Eurostat (2018).

In the particular case of Spain, there are currently twenty PSO air routes (as of 19.03.2018),[14] thirteen of which have been imposed on scheduled air routes within the Canary Islands, and another three routes within Balearic Islands, as well as three routes on the Spanish mainland (BJZ-MAD-BJZ, BJZ-BCN-BJZ and, in particular, LEI-SVQ-LEI)[15] and one route from the island of Menorca linking it with mainland (MAH-MAD-MAH) but only during IATA Northern Winter Season.[16] Furthermore, there is a particular case of PSO air route established in Spain, but imposed by French Government from *Direction de la Sécurité de l'Aviation civile Nord-Est*, which is currently being operated by AIR NOSTRUM under exclusive exploitation rights on the route SXF-MAD-SXF from 9 April 2019 to 8 April 2022.[17]

3. Case study

The present paper aims to take a clearer view of one of the most interesting air routes declared as Public Service Obligations (PSO) on the territory of one EU Member State. In Spain, PSO air routes must be authorized by national civil authority, here called *Dirección General de Aviación Civil* (DGAC), which is responsible for defining of national aeronautical strategy, determining policies for the use of its airspace, and acts as a regulator in the aviation sector, under the mandate of Department of Public Works, here called *Ministerio de Fomento*, of the Kingdom of Spain (officially called *Reino de España*).[18]

In this context, the decision is to focus on the need for research in the economic aspects of PSO which led us to choose the air route between Almeria and Sevilla, respect hereinafter referred to as the "LEI" and "SVQ", as a subject for study.[19] It should be noted that both airports are managed by the largest airport operator in the world called AENA, S.M.E., S.A.[20] (or simply AENA[21]), and furthermore are holding 11th and 27th position respectively per passenger carried during the past year (SVQ: 6,380,465 PAX; LEI: 992,043 PAX).[22] Regarding slot coordination,[23] in accordance with Regulation (EEC) No 95/93,[24] SVQ is categorized as airport with schedules facilitated (level 2), whereas LEI is classified as airport with schedules facilitated (level 2), but also as coordinated airport (level 3), depending both levels upon the season planning (IATA Northern Summer and Winter seasons respectively).

Much of the present paper revolves around the main subject of the case study which is the PSO route between both airports. Nevertheless, it is important to bear in mind considerations to properly address this matter. It should firstly be noted that the selected PSO route has been the first imposed within mainland Spain. It is also the only PSO route that links two cities within a single Spanish region, that is to say, the autonomous Community of Andalusia. Given the fact that the city of Almeria, and consequently its province, is the one furthest away from Seville, the capital of Andalusian, the entire transport system did not seem to be responding to the demands of civil society and the private sector since long. It was aggravated by the local feeling of abandonment by public administrations to meet investments needed in rail and road infrastructures for many years. Both provinces indeed present the greatest gross domestic product per capita of the eight Andalusian provinces.[25] As a result of this concern the Andalusian regional administration saw the need to reflect[26] that metropolitan areas and cities over medium and long distances should be connected by air transport as its second function in the region (Pazos Casado, 2006). However, following the guidelines from the "Plan de Infraestructuras para la Sostenibilidad del Transporte en Andalucía", also know as PISTA (Junta de Andalucía, 2016), pursuit of substantial transportation improvement ocurred before the first imposition of PSO between the two cities that was undertaken in the autumn of 2009. More recently, the regional administration has firmly committed to a sustainability transport system by combating climate change.

So far airlines had not traditionally shown any commercial interest in operating LEI-SVQ-LEI in a free market regime largely for reasons of profitability, and corresponding bidding processes which have been endowing with the necessary public funding to cover potential economic losses caused by operating the PSO route, and this is precisely provided by the *Junta de Andalucía* in this subject. When considering transport system as a key factor in securing successful socio-economic development of regions, public administrations have been forced to take all possible measures in meeting citizens' mobility needs.[27] As the regional governments within national market economies are based on free competition, they do not have sufficient means to operate air routes with their own resources. Consequently, this is well beyond the scope of public competencies when it comes to this matter, a declaration of PSO obliges them to put the transport service out to tender. It is worth noting that governments alone do not have a wide range of resources to stimulate the aviation market under the legislation currently in effect. Even though there should be no state aids for any air routes (excluding PSO, of course) in the highly liberalized air transport sector in the EU single market, concealed subsidies in the form of advertising or promotion from local and regional administrations are usually difficult to prove. This is why, the most effective solution is to open an invitation to tender, once the corresponding imposition of PSO is published, for operation of the route under a concession regime on exclusive exploitation.

In the present case, given that there were no offerors set to join this route operating in a system of free competition, the statement of tender documents has thus introduced the need to establish the air service while also ensuring a proper budget allocation in order to cover possible operating losses. The Table 2 summarizes those tender procedures of this case carried out to date, whose data will be discussed in the context of the following chapter.

4. Data and analysis

The present study has focused on aquring data from primary sources, such as those figures provided from the Table 2. Under these criteria, priority has been given to those players involved in the matter of the case study. For this purpose, information used by authors are resulted from statistical passenger data,[28] as well as those provided by regional government.[29] In any case, other resources of reference for research interests involved with EU single market in aviation have also been consulted such as papers and book chapters. However it should be noted that certain considerations, such as rough orography and scattered population with regards to regional transport

Table 2. Tender procedures for awards of PSO route (as of 31.12.2018).

Case reference	1st case: 332/A09[i]	2nd case: 138/A14	3rd case: 43/A18
Short description of the contract	Air transport services subject to PSO on the route LEI-SVQ-LEI, pursuant to the contents of ACM of 13 March 2009.	Air transport services subject to PSO on the route LEI-SVQ-LEI, pursuant to the contents of ACM of 13 March 2009, amended by FOM/2457/2013 Order of 27 December 2013.	Air transport services subject to PSO on the route LEI-SVQ-LEI, pursuant to the contents of ACM of 13 March 2009, amended by FOM/2457/2013 Order of 27 December 2013.
Duration of the contract [months]	48	48	48
Scheduled start date	15.10.2010	01.08.2014	01.08.2018
Scheduled finish date	14.01.2014	01.08.2018	01.10.2022
Announcements on the Official State Gazette (BOE)	BOE-A-2013-13800	BOE-B-2014-10733 BOE-B-2014-28797	BOE-B-2018-22408 BOE-B-2018-40380
Announcements on the Journal of the Community (OJEU)	Internal (unpublished) documents	2014-OJS060-101398-en	Docs. 52018XC0328(05) 52017XC1011(02)
Estimated value of the contract (€)	11,900,000	9,074,050	8,925,000
Awarding authority	Dirección General de Aviación Civil (DGAC)	Dirección General de Aviación Civil (DGAC)	Dirección General de Aviación Civil (DGAC)
Applicant airline (call sign) (IATA code)	Operador Aéreo Ándalus, S.A. (ANDALUS) [formerly EA]ii Air Nostrum Líneas Aéreas del Mediterráneo, S.A. (AIR NOSTRUM) [YW]	Air Nostrum Líneas Aéreas del Mediterráneo, S.A. (AIR NOSTRUM) [YW]	Air Nostrum Líneas Aéreas del Mediterráneo, S.A. (AIR NOSTRUM) [YW]
Awarded airline	YW	YW	YW
Allotment amount [€]	10,525,898	8,925,000	8,898,226
Bid selection criteria according to the tender specifications published by DGAC (listed in descending order)	• Contract price. • Responsiveness. • Economic study • Fares and conditions of price schemes. • Improvements in the service rendered.	• Contract price. • Responsiveness. • Proper fleet availability. • Fares and conditions of price schemes. • Improvements in the service rendered. • Enhancement of connectivity.	• Price of compensation (70%). • Responsiveness of service (6%). • Connectivity (3%). • Service continuity (9%). • Flight frequencies (7.5%). • Fares and conditions of price schemes (4.5%).
Maximum basic one-way fare [€] (in start of the contract year)	117 each way	130 each way	LEI-SVQ: 139.27 SVQ-LEI: 140.89
Possibility of undercutting fixed maximum fees	yes	yes	yes
Minimum capacity available each way	30,000	30,000	25,500
Selected aircraft modeliii [IATA code]	CRJ-200ER [CR2]	CRJ-200ER [CR2]	CRJ-200ER [CR2]
Available seats with standard configuration	50	50	50
Aircraft and crew based on airport	LEI	LEI	LEI

Please note that ACM means Acuerdo del Consejo de Ministros (Agreement of the Council of Ministers), while FOM means Fomento (Department of Public Works).

[i]On December 3, 2018, upon our request, the authors were told by the Subdirectorate General for Air Transport that first invitation to tender for first imposition of PSO in 2009 is not available, and therefore has not yet been published on the corresponding public repository from the DGAC. A few months later of this fact, the Spanish Minister of Public Works subsequently sent further documents on this matter. As a result, missing figures therefore were updated in the Table 2.

[ii]ANDALUS was a regional airline headquartered at Malaga Airport (AGP) that operated only two aircrafts, ERJ-145EU and ATR42-300, from 27 February 2009 to 13 August 2010.

[iii]Occasionally, the PSO route may be operated due to reasons of force majeure with other aircraft models of YW fleet such as ATR72-600 [AT7] (74 standard seats), as well as CRJ-900 [CR9] (90 standard seats) and CRJ-1000 [CRK] (100 standard seats). Indeed, this matter is expressly mentioned in attachments related to bidding documents of case reference No. 43/A18 for the purpose of ensuring those levels of service required from tender specifications.

Source: Compiled by authors based on information provided from tender documents related to bidding process of concerned imposition of PSO on scheduled air service LEI-SVQ-LEI.

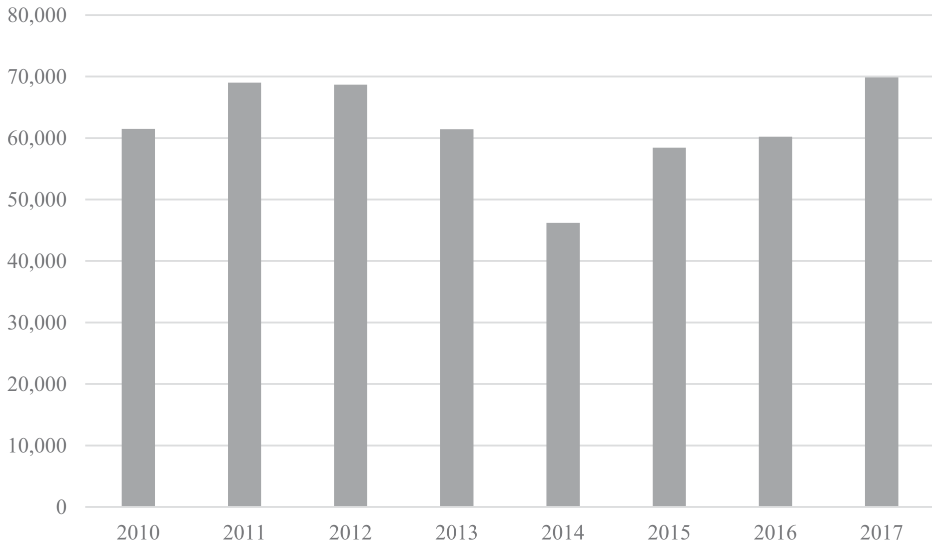

Figure 1. PAX per year on the route LEI-SVQ-LEI.
Source: Elaborated by the authors from air traffic data provided by AENA (2018).

may not have been discussed in previous articles. Thus, a solution to addressing the issue may be through studying routes in similar cases concerning imposition of PSO across Europe.

Lack of insufficient transport connectivity has historically been one of the causes of depopulation in the most rural areas inland. Added to this, in the case of Andalusian, is the low capillarity of its conventional rail network, such as commuter trains, which leds to its need for additional measures. Other causes are most often due to dimensions and territorial disposition of areas to be covered by transport system[30] such as geography and demography of Andalusian.[31] In fact, it is precisely the main reason why the authors decided to research the matter of public service on air routes, focusing on the only existing PSO within Andalusian, and indeed the oldest PSO route that still exists in mainland Spain. As a first step in this direction, below is the evolution of passenger traffic on the route of this study. It has been grouped per year by summing monthly figures that were collected from transported passengers.

One important fact to point out is that the route was performed in a free market regime from January 15th until 31th July of 2014 because of the expected termination of the PSO contract agreed with AIR NOSTRUM (see 1st case from Table 2). For this reason, since the contract expired on January 14th, this airline ceased operation on the route. Futher as expected, the Figure 1 shows a significant drop in number of passengers handled by the new entrant carrier between both airports[32] continued to be provided in operating on the route with similar services to those of the previous airline. Indeed, it may appear from the below chart that no subsidies from the general regional budget had been included while the non-PSO route was performed along free-market principles for almost seven months.[33] However, it is surprising to note that AIR EUROPA did not submit a bid to the invitation to tender. As a result of

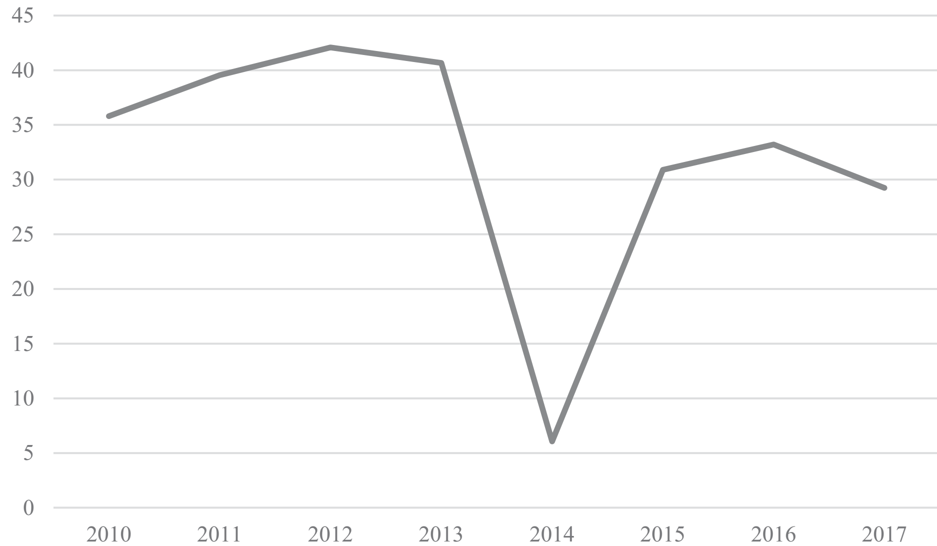

Figure 2. Effective subsidy per passenger carried (€/PAX).
Source: Compiled by authors based on air traffic data provided by AENA (2018), and by the Junta de Andalucía through the corresponding request No. EXP-2018/00001153-PID@.

this fact, AIR NOSTRUM was awarded the contract once again (see 2nd case from Table 2).

In the 2010–2017 period, the sum of all cash transfers executed within the PSO contracts to date (see Table 2) sums up to a total of €16,311,762.01 for a total of 473,063 PAX.[34] Hence, the effective subsidy per transported passenger amounting to about 32.93 €/PAX (see Figure 2), and whose funding is directly provided by the regional government through an agreement with General State Administration for this purpose. It should be emphasized that such document reflects the agreed conditions between both administrations allowing for the sharing of responsibilities and costs. This is actually the case on this research matter, so that whenever tender record is approved, it is also associated with corresponding public expenditure record for the payment of remittances to operating company. In light of the previous reading of those documents related to tendering proceedings of this PSO (see Table 1), it has been verified that the regional government is precisely in charge of payments on what is stipulated on the contract (Table 3).

As seen above, the public transport system between Almeria y Sevilla demonstrate noteworthy differences in its network depending on each means of transport. To this effect, this panel summarizes some key findings of public transport system in order to provide a way for studying the matter in terms of efficiency and sustainability (Table 4).

The above figures seem to suggest that when the route was operated in a free market regime, but without any subsidy, there was not a steep climbing of users on alternative means such as train[35] or bus. But those users of aircraft under PSO regime preferred not to use other public means of transport, even inclining towards private car, from what can be gathered.

Table 3. Overview table of public means of transport on the route (as of 31.12.2018)

Key figures	Airplane[a]	Train[b]	Bus[c]
Daily frequencies/leg	2	4	4
Travel distance	319 km.[i]	456.70 km.	429 km.
Intermediate stops	0	1 - 5	1 - 19
Travel time	0:55 h	6:48 h - 07:10 h	5:30 h - 8:30h
Base price (2018)	130 € (max. price)	42.2 €	37.76 €
Standard equipment (most used on route)	Bombardier CRJ-200ER	CAF RENFE599	Setra S 417 HDH
Number of seats	50	189	50
Engines[d]	2 x General Electric CF34-3B1 turbofans	Diesel, 4 x MAN D2876 LUE623	MB OM 457 LA, Euro V, BlueTec®
Fuel Burn/journey	1540.05 liters[ii] (Jet A1)	908.83 liters (Diesel)	119.56 liters (Diesel)
Emissions CO_2/journey	4,475 kg.	1,175.09 kg.	301.30 kg.
Emissions CO_2/journey per passenger[f]	89.5 kg. / PAX[iv]	6.22 kg. /PAX	6.03 kg. / PAX
Alternative equipment	CRJ-900 CRJ-1000 ATR72-600 ATR42-500[iii]	CAF RENFE598	Setra S 419 GT-HD Mercedes-Benz 16RHD
Is there more than one carrier on the route?	No	No	No
Exploitation regime on the route	PSO contract for non-renewable period of four years (see Table 2). Tender procedures for awards of PSO route (as of 31.12.2018)	Facto monopoly	Permanent public transport on scheduled road service through both coordinated services from administrative concessions No. VJA-160 and VJA-167.[e]

[i]The distance covered with CR2 is 172 nm, 319 km, according to great circle route per leg at heading of 100° (E) from LEI to SVQ and of 283° (WNW) from LEI to SVQ.
[ii]At ISA (15° C), the Jet A1 density is 0.804 kg/l, when the aircraft fuel burn is 1,238.20 kg.
[iii]When flights on this route were supplied by UX and performed by WT from January 15th until 31th July of 2014.
[iv]Carbon Emissions declared in the ICAO's Carbon Offsetting Scheme.
Sources:.
[a]Calculated from AENA data by authors considering a standard operation performing two daily flights per leg in each calendar year.
[b]Provided and calculated by RENFE.
[c]Provided and calculated by ALSA.
[d]Datasheets from respective equipment manufactures.
[e]Information provided by Junta de Andalucía from request No EXP-2018/00002154-PID@.
[f]Whereas the equipment capacity is fully occupied (100% of seats).

Table 4. Public transport system between Almeria and Seville (as of 31.12.2018).

	Passenger load factor (PLF) [%]		
Year of operation	Airplane[i] [a]	Train[ii] [b]	Bus[iii] [c]
2010	84.22	33.02[d]	32.00
2011	94.53	34.89[e]	30.25
2012	94.09	34.00[e]	30.10
2013	84.17	35.66	29.80
2014	63.29	35.96	32.00
2015	80.04	35.77	31.50
2016	82.49	33.35	30.90
2017	95.68	33.90	31.20

[i]Figures have been calculated taking into account the transport service is performed by the standard equipment, that is, the CR2 with 50 standard seats/leg.
[ii]Figures have been calculated taking into account the transport service is performed by the standard equipment, that is, the RENFE CAF 599/598 with 189/185 standard seats/leg.
[iii]Figures have been calculated taking into account the transport service is performed by the standard equipment, that is, the Mercedes-16RHD/Setra 419GTHD/Setra 417 HDH with standard 50 seats/leg.
Sources:.
[a]Calculated from AENA data by authors considering a standard operation performing two daily flights per leg in each calendar year.
[b]Provided and calculated by RENFE.
[c]Provided and calculated by ALSA.
[d]Corresponds to the total LF on Middle Distance Train (MD) throughout Spain.
[e]Corresponds to the total LF on Middle Distance Train (MD) throughout Andalusia.

5. Conclusion

It has been emphasized that impositions of PSO are habitually focused on responding to population needs in terms of transportation. Moreover, certain countries in the EU single market are approaching this issue by providing the territory with a huge infrastructure investment that aims at offering a full range of transportation for their citizens, including the awarding of exclusive rights to operate scheduled services, with or without compensation. However, it is not always oriented towards economic efficiency in the transportation system. Other countries have already gone further than the current requirements of EU policies in this matter, where the market has already been broadly liberalized, thus allowing new players in the transport system. In this case, Spain has placed an important emphasis on promotion towards heavy investment in implementing high-speed railway infrastructures as a way to promote a very fast way of transport. This fact is part of negative externalities, since there is not enough capillarity of the transport network to cover a very large range of populated areas.

In describing the case of PSO on scheduled air service between Almeria and Seville, it has already been seen that there are no faster public transport alternatives to the air route. In fact, as already seen, both train and bus journeys take at least five times longer than air link in terms of travel time. However, it must be understood that public transport services both by train and bus present a differential fact in comparison with air services. Here it is referring to the ability to provide a transport service to other areas of population through intermediate stops in the route. Therefore, the issue addressed here has been territorial cohesion in providing, to some extent, the access to mobility of the population and thus go beyond recognizing the access to public transportation as a fundamental right granted by treaty to EU citizens. In fact, this is a prime topic related to free movement of persons on the basis of EU fundamental rights. Additionally, compared with related schemes, such as both American

EAS and Australian RASS, the scope of PSO system also includes developing regions (Hromádka, 2017).

After all, the authors consider that it would be premature to affirm that PSO is the most efficient formula under a law-based regime in meeting essential transport needs, because of the scarcity of historical traffic data on PSO routes at the European level accessible to researchers. Nevertheless, that does not change the undoubted social dimension of establishment of a PSO air route. On one hand, it has acted as a generator of demand for flights in the study case at issue, but it is also necessary to bear in mind that it could lead to artificial pricing structures that might hinder free competition within the EU single market in aviation. According to data analyzed in this paper, there seems to have stimulated a latent demand of air scheduled services between Almeria and Seville, which seems to nor arise from the other means of public transport such train or bus, but rather from private car. In any case, it must be remembered that Almeria is the one provincial capital furthest away from the capital of Andalusian (i.e. Seville). On the other hand, fares are benefited from the stimulating effect of the PSO routes. Similarly, according to data analyzed, there seems to have been little significant actions to favor a sort of multimodal sustainable public transport system. Rather, it seems instead that the need for a fast and punctual transport has been met by this PSO air service.

Based on the analysis of data obtained in this research, this suggests that the practical impact on the imposition of PSO, when the scheduled air service is subsidized through corresponding tender procedure, is decisive for maintaining cost-reflective prices on the path to addressing efficiency of public transport. Otherwise, even this public service compensation could be declared incompatible (Guillard, 2015). Additionally, transport networks are usually interconnected with a strong component of intermodalism. In this area, earlier research (Merrina, Sparavigna, & Wolf, 2007) had discussed to consider “intermodal systems as a whole”. In fact, throughout the paper, reference has already been made in this regard to the intermodal transportation concept. In the light of findings above, it seems that the imposition of PSO on this scheduled air route has not had any impact on intermodality of regional transport system.

6. Research limitations and future directions

Due to the interdependency of different public transport sectors, common transport policies should be harmonized with the objectives and goals for “unique coherent” transport system while its liberalization process advances. However, “the free provision of services does not necessarily mean free market, since this should be compatible with controlled access to the market” (Salafranca Sánchez-Neyra, Summers Rivero, & González-Blanch Roca, 1986). It is exactly in such conditions, both in bus and air transportation, depending on the distance to be covered, to take their role as key players in resolving such weaknesses of the transport market. In this connection, there would be two solutions to address the mobility issue in remote and peripherical regions, which are not sufficiently served in terms of air services: resident subsidy and PSO imposition. Particulary, the second form of public intervention necessarily leads to a distortion in the transport market that should not be overlooked by other researchers.

Concerning the legal aspect of the PSO system, analysis of tender documents related to the particular impositions on regular air route between Almeria and Seville shows that this form of public intervention on the air market has been disposed according to both domestic and community laws. Moreover, for the period between 2009 and 2018, the relevant EU legislation has not experienced any variation as amended by Articles 16-18 of Regulation (EC) No. 1008/2008. However, at national level, the concerned law has been modified through two reforms. The 2006 reform had relevant effects in increasing flight frequencies on PSO imposed air routes by loosening the price setting scheme. Whereas the 2011 reform did not have a similar traffic impact as achieved by the previous reform on the regional air transport. (Abreu, Fageda, & Jiménez, 2018). With regard to future research on this matter, it would be interesting to study how this fact has contributed to enhance the PSO tender procedures in terms of transport efficiency. Additionally, it is worth analyzing whether these legal changes could be implemented in other EU Member States and what its likely local market impact will be.

The PSO system not only creates point-to-point routes by liking two concerned airports but also may lead to additional benefit in the air connectivity through transfer flights. Indeed, a distinction can be drawn between the PSO impositions that provide onward connections and those that do not (Wittman, Allroggen, & Malina, 2016). In turn, it is linked to the flight distribution traditional paradigm, that is, both point-to-point and hub-and-spoke route network. This is precisely a direction of special concern on what future research may be focused. Unfortunately, in this research, it has not been possible to take into account the effect on passenger traffic that connecting flights have caused on this route. Despite repeated requests for further figures made by the authors, it has been impossible to obtain any proper information by the airline that has been awarded the PSO route between Seville and Almeria from 2009 to present. Therefore, future research should be aware that certain limitations may occur because of a lack of cooperation from carriers in this matter.

The data analysed and represented in this paper appears to confirm the fact that both airfare cost and travel time play decisive role in air travel choice. However, the effect of the reliability on this PSO air route has not been analyzed due to lack of proper information sources, such as customer satisfaction survey provided by airlines. Therefore, it is suggested for further studies to focus on how reliability has influence on customer choice, similar to the case of US market (Stone, 2016). Finally, it is important to emphasize the importance of examining relationship between airline size and entrepreneurial ability in terms of an efficient and reliable manner. Earlier studies (Lazzarotti & Pellegrini, 2015) showed that non-family managers can have a powerful influence on how firms are more likely to do in terms of innovation and thus on entrepreneurship. Similarly, the carrier on this PSO air route is a clear example of that.[36]

Notes

1. Indeed, as transportation industry designs its business plans based on operations more efficiently and effectively, capita national income will be increased (Rus Mendoza, 2006).

2. In fact, this is always within the context that there is an almost direct relationship between air transport demand and economic growth. There are indeed some interesting approaches on the matter. For instance, in USA case you have (Chi & Baek, 2013), while in Brazil case (Marazzo, Scherre, & Fernandes, 2010) and in South Asia case (Hakim & Merker, 2016).
3. Air transport system is often studied separately in type of services (passenger transport, cargo transport, a combination thereof, or even other). However, this paper will focus only on passenger transportation services.
4. The EU single market in aviation has been shaped by a sort of regulated liberalization at the request of the European Commission. Initially, the first liberalization package that was based on the Council Regulation (EEC) No 3975/87 of 14 December 1987 laying down the procedure for the application of the rules on competition to undertakings in the air transport sector, and the Council Regulation (EEC) No 3976/87 of 14 December 1987 on the application of Article 85 (3) of the Treaty to certain categories of agreements and concerted practices in the air transport sector, as well as the Council Directive 87/601/EEC of 14 December 1987 on fares for scheduled air services between Member States, and the Council Decision 87/602/EEC of 14 December 1987 on the sharing of passenger capacity between air carriers on scheduled air services between Member States and on access for air carriers to scheduled air-service routes between Member States. Then, the second liberalization package was based on the Council Regulation (EEC) No 2342/90 of 24 July 1990 on fares for scheduled air services, the Council Regulation (EEC) No 2343/90 of 24 July 1990 on access for air carriers to scheduled intra-Community air service routes and on the sharing of passenger capacity between air carriers on scheduled air services between Member States, and the Council Regulation (EEC) No 2344/90 of 24 July 1990 amending Regulation (EEC) No 3976/87 on the application of article 85 (3) of the treaty to certain categories of agreements and concerted practices in the air transport sector. Finally, the third liberalization package was based on the Council Regulation (EEC) No 2407/92 of 23 July 1992 on licensing of air carriers, the Council Regulation (EEC) No 2408/92 of 23 July 1992 on access for Community air carriers to intra-Community air routes, the Council Regulation (EEC) No 2409/92 of 23 July 1992 on fares and rates for air services, the Council Regulation (EEC) No 2410/92 of 23 July 1992 amending Regulation (EEC) No 3975/87 laying down the procedure for the application of the rules on competition to undertakings in the air transport sector, and Council Regulation (EEC) No 2411/92 of 23 July 1992 amending Regulation (EEC) No 3976/87 on the application of Article 85 (3) of the Treaty to certain categories of agreements and concerted practices in the air transport sector.
5. Martínez Sanz and Petit Lavall, (2009) focuses, precisely, on the question of whether privatization and liberalization necessarily lead to competitive air transport for further deepening of the EU internal market.
6. See the Communication of the Commission named "Guidelines on State aid to airports and airlines (2014/C 99/03)".
7. Rus Mendoza, (2006) describes the productive structure used to explain how airlines operates in the air transport market by estimating short-term costs.
8. Alejandro Nieto notes that the classic concept of PSO has been distorted by finding of three current facts. That is, administrative bodies are not directly focused on public interests, but purely political issues; public interests may be serviced from private sector; and the administrative law is no longer appropriate to the public services (Ministerio de Transportes & Turismo y Comunicaciones, 1986).
9. Some authors have precisely expressed themselves so clearly on this point. For instance, Smyth, Christodoulou, Dennis, Al-Azzawi, and Campbell, (2012) had wondered whether the air transport should always be considered as an absolute necessity for both social inclusion and economic development.
10. Regulation (EC) No 1008/2008 of the European Parliament and of the Council of 24 September 2008 on common rules for the operation of air services in the Community

11. An explanation of this role can be given through a set of the independent variables that, in turn, could explain certain dependent variables such as "traffic congestion, infrastructure investment, operating procedures, intervention policy or fail to intervention (for instance, pricing or privatization)" (Martín Hernández, Reggiani, & Rietveld, 2007).
12. Here a distinction has been made by between normal limits inherent in air transport and those directly not related to air traffic but limited through specific circumstances (Gómez Puente, 2007).
13. The Spanish State, formally named "Kingdom of Spain", is a decentralized country that comprises seventeen autonomous communities as well as two autonomous cities such as Ceuta and Melilla, both located in North Africa.
14. Source: Justifying Memoir for the imposition of PSO on scheduled air services between LEI and SVQ (case number No. 43/A18 of DGAC).
15. For many years, both airports, although with significant differences among them regarding passengers, cargo and aircraft operations. For further information about LEI and SVQ on this matter, see respectively Pazos Casado, (2006), p. 263-270 and p. 296-311, have suffered from certain lack of domestic flights, excepting whose connecting flights mainly via MAD, or occasionally even with BCN. Likewise, both of them do not have their own public transport station, which might be used by train and bus routes linking other nearby great urban centers in each area of influence of both airports, so that this type of infrastructure has not been planned to promote the intermodal transportation in neither of those airport facilities. Regarding public transport connections, it should also be noted that the only one choice to reach the main railway station, in both cases, goes by city bus, the estimated journey time being about 35 minutes.
16. For instance, at present time the IATA Northern Winter Season expires 30MAR2019, while IATA Northern Summer Season is scheduled from 31MAR2019 to 26OCT2019.
17. Announcements on the Journal of the Community (OJEU) published in the both documents 52015XC1008(01) and 52018XC1003(02).
18. Article 6 of the Royal Decree 953/2018, of 27 July 2018, which develops the basic organic structure of the Department of Public Works. «BOE» No. 183, of 30/07/2018.
19. For both airport codes assigned by International Air Transport Association (IATA).
20. http://www.bolsamadrid.es/esp/aspx/Empresas/FichaValor.aspx?ISIN=ES0105046009
21. Also known as *Aeropuertos Españoles y Navegación Aérea*, the undertaking is a state- and private-owned company whose shareholding is controlled by state company ENAIRE with 51 per cent of the shares. In Spain, AENA is in charge of managing 46 airports y 2 heliports (as of 2018).
22. According to provisional yearly data from AENA at 2018 year-end.
23. The air transport industry differentiates among airport categories whose levels (from 1 to 3) depend on key figures between operational demand and airport capacity. In the particular case of Spain, the slot coordination is carried out by the *Asociación Española para la Coordinación y Facilitación de Franjas Horarias* (AECFA) that has been appointed by Minister of Public Works as "Slot Coordinator and Schedules Facilitator" under Order FOM/1050/2014 of 17 June.
24. Council Regulation (EEC) No 95/93 of 18 January 1993 on common rules for the allocation of slots at Community airports.
25. Gross domestic product (euro/capita): 1st Almeria (19,097), 2nd Sevilla (19,011). Last data published corresponding to 2016 (IECA, 2018).
26. Decree No. 108/1999 of 11 May, approving the "Plan Director de Infraestructuras de Andalucía 1997–2007". (BOJA No.141 of 4 December). This was followed by the development of a new agenda trough the Decree No. 140/2006, of 11 July, in agreeing on the formulation of the "Plan Director de Infraestructuras de Andalucía 2007-2013" (BOJA No. 153 of 8 August), and then releasing in interests of the sustainability of the transport system the Agreement, of the 19 February 2013, of the Governing Council, stating a revision of the "Plan de Infraestructuras para la Sostenibilidad del Transporte en Andalucía 2007–2013".

27. Transport system can present practical problems as to inadequate modality, deficient transfers among the various means of transport, or even mobility insufficiently developed. This is in fact the matter of technical transport efficiency, and it is a key part of issues related to its economic efficiency (Thomson, 1976).
28. Provided from statistical site of AENA.
29. Provided by *Dirección General de Movilidad* from *Consejería de Fomento y Vivienda*.
30. It is essential not to lose sight of macroeconomics effects on this research topic, as well as their social impacts and externalities. Hence, it is worth pointing out that the public transport can create "distortion of the single market, from neo-classical perspective, social costs function does not always coincide with those of private costs" (Coto Millán & Inglada López de Sabando, 2007).
31. Andalusia is the most populated region in Spain with 8,384,408 inhabitants (source: INE, 2018), though the demography is highly concentrated on its coastline and provincial capitals. Likewise, its abrupt orography does not exactly help us to build a dense network of public transport, due to the high technical and financial efforts involved for investment in infrastructures.
32. The new operator, AIR EUROPA (UX), entered this domestic air route by using a turboprop aircraft model ATR42-500 (AT5) with 50 standard seats leased to SWIFTAIR (WT).
33. Consequently, this fact has been considered in the calculation of effective subsidy per passenger transported for the calendar year 2014.
34. Those transported passengers on both legs LEI-SVQ-LEI in a free market regime have been excluded from the calculation of these figures.
35. It is important to note that the train service between Granada and Antequera is out of service since 7 April 2015 due to the construction of the high-speed railway line. An alternative bus service has been provided to link up the two station, but it causes a lot of inconvenience for those affected at least until June 2019 (information updated as of November 30, 2018).
36. While familiar enterprises until recently, after 25 years of operation, AIR NOSTRUM [YW] became Europe's largest regional airline. Significant achievements included profit-enhancing, thanks to strong process of renovating its fleet by operating aircrafts with seating capacity of up to 100 passengers (CRJ-1000), have accomplished from a non-familiar control in making business decisions. This trend has been accompanied by the implementation of financial adjustments to address operations adequately.

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No potential conflict of interest was reported by the authors.

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Subsection 3.2.b

THE PSO INTERISLAND ROUTES IN THE BALEARIC (ES02-04-05)

Efficiency and Sustainability of Regional Aviation on Insular Territories of the European Union: A Case Study of Public Service Obligations on Scheduled Air Routes Among the Balearic Island

Tentative Article

Efficiency and Sustainability of Regional Aviation on Insular Territories of the European Union: A Case Study of Public Service Obligations on Scheduled Air Routes Among the Balearic Islands

Part of Doctoral Thesis "The European Single Air Transport Market: An Empirical Approach on the Efficiency and Sustainability of Public Service Obligations in the Spanish Domestic Routes".

Abstract: Mediterranean islands of the European Union (EU) have traditionally suffered from a lack of regularity in supplying public transportation due to the high seasonality of the demand for scheduled transport services. The insular fact forces people and goods to be carried either by sea or air and therefore needs to actively stimulate interest in operating specific routes by proper carriers. As regional economies on insular territories also have a tight dependence on tourism, it is vital to achieving an appropriate balance between the need for effective public transportation and sustainable means of transport. This paper aims to provide an approach to the Public Service Obligation (PSO) system imposed on air routes serving the regional transport needs of the Balearic Islands. This study has analyzed data relating to freight and passenger traffic in the period between 2004 and 2019 from scheduled air services linking Palma de Mallorca with Ibiza and Menorca, as well as those between Menorca and Ibiza, and to their respective short-sea links. Results obtained in the research suggest that PSO impositions, together with significant improvement in the resident subsidy schema (from 50% to 75%), have recently led to a sharp increase in the demand for passenger air services on these routes; thus, avoiding the tender for the award of a public contract. However, it has led to a dramatic fall of freight transport on air routes concerned, as such public intervention on the air market has only sought to ensure the mobility of passengers.

Keywords: European Union (EU); public transportation; Public Service Obligation (PSO); regional transport; passenger traffic; scheduled air services; freight transport; public intervention; mobility.

1. Introduction

Sustainable transportation is a key element to running more efficient mobility according to the EU common transport policy, thus stimulating a competitive transport industry within the European internal market. Market deregulation in the aviation sector was carried out based on an orderly legislative process through three liberalization packages, which were successively implemented in December 1987, June 1990, and July 1992. With the entry of the third package on 1 January 1993, thanks to the provision of a legal framework from the European Economic Community (EEC) regulations no. 2407/92, 2408/92, and 2409/92, with an ambitious market-opening process that ended, giving way to the formation of a genuine single market for air transport services. Amongst other changes, the common legislative framework has introduced the concept of 'community air carrier' by which any airline with a valid Air Operator Certificate (AOC) granted by a member state, can enjoy the same market access opportunities as other national carriers in the operating regular air services, even domestic routes. However, this has not always led to an increasing number of direct flights on air routes with low demand, otherwise known as “thin routes”. In the case of island territories, the need for regular air transportation with other surrounding communities is essential in connecting scattered populations living amongst them, as mobility plays a vital role in territorial cohesion. Situated far from European capitals and thus far from main transport hubs, most peripheral areas do not have adequate transport services in terms of availability and fares. EU island regions, thought to be populated by around 15 million people, have traditionally suffered from a lack of affordable transportation connecting regular passenger services to hub airports, especially during periods of slack demand. Since low seasons usually coincide with those where tourist activity decreases, airlines tend to adjust the offer of passenger transport services to the real demand by adapting flight schedules that, moreover, are released up to six months before starting operations. Considering that airport capacity is a limited resource within the Single European Sky (hereafter SES), airlines have habitually been cautious in applying for the slot allocation where a route could not be profitable, and operating problems may arise due to inadequate fleet. Typically, many peripheral airports have high seasonality due to heavily dependent on tourism. Furthermore, airlines operating domestic routes are also scarce, combined with few air links with a good performance and high yield. Despite the existence of thin routes, some of them even unprofitable, both local authorities and those of state members concerned have often advocated for maintenance of direct flights for socioeconomic reasons and also as a contribution to territorial cohesion, as they may be indispensable for the development of regional economies within the EU single market. According to the current EU legal framework based on article 10.2 of [1], eligible airlines have been provided with operating authorization at airports from slot coordination. Since they have to demonstrate that a minimum of 80 percent of their slots has been fully used to avoid the loss of their rights over them in the next slot conference of the International Air Transport Association (IATA), requests for slot allocation on particular routes are often very tight to fleet capacity and above all with a reasonable expectation of profitability. In the case of Spanish island territories, low demand periods do not necessarily correspond to the IATA winter season, as the seasonal demand may be more prevalent in the summer period (from June to September), which often also depends on how important tourism outbound markets are for their territories to generate economic activity and how air carriers can cover the demand from an attractive flight schedule. Since they have a greater reliance on people mobility due to insularity reasons, it has not always been possible to ensure an adequate transport network from free-market rules in terms of continuity, regularity, capacity, and pricing. Unlike the special member state territories (for instance, those located on the Atlantic sea, such as the Spanish Canary islands or the Portuguese Azores and Madeira islands), the islands on the Mediterranean Sea do not often enjoy a specific tax regime that is different from that applied in the EU mainland territory. While the challenge to the economic and social cohesion of the less favored regions, mainly peripheral areas, and remote areas, was shortly reflected in Article 174 of the Lisbon Treaty, there has been no attempt at unifying a special fiscal framework for island territories so far. This is precisely the case of the Balearic Islands, where, although it was recognized the condition of insularity at the national level, no special tax regime has been introduced [2]. Only specific measures, such as resident subsidies or public benefits, have been applied for island residents so far. Instead, for those legally living in the Canary Islands, there is an economic and fiscal regime from the Economic and Fiscal Regime (REF) and the Special Economic Zone (ZEC). Similar to this Spanish overseas territory, and protected by EU legislation for special territories, Melilla and Ceuta enjoy a special tax regime due to their specific geographical situation. Regardless of whether passengers are residents or visitors, the proper legal instrument to ensure regular and affordable air transport services at remote or peripheral airports, such as those serving the Balearic archipelago, therefore, is the imposition of a PSO on air routes concerned from the Articles 16-18 of the Air Services Regulation 1008/2008 (hereafter [8]). Once a route has been selected as an essential service in accordance with Article 95 [4], a PSO imposition could be addressed.

2. Some considerations about the PSO schema and its context in the EU Single Market

The imposition of PSO on certain air routes is a form of public intervention in the EU single aviation market, which enjoys a high level of competition from free regime rules. The introduction of the third package of market liberalization measures, (1993) and subsequent completion of the internal market (1997), enabled the provision of PSOs. The market liberalization has led to a great expansion of the regular transport services on many air routes. In contrast, certain air links serving small-community airports, and often thin routes, have been promoted from the PSO schema to avoid the lack of affordable transportation. However, this is neither administrated nor funded at the EU level, but by individual states, as already pointed out on one of the first papers studying the issue [5]. A model of multilevel governance for the PSO schema, similar to that existing in certain domestic public transportation systems, should also be useful to coordinate the EU transport policies on this matter [6]. Theoretically, a centralized system for administration and funding at the EU level could result in a more efficient and equitable distribution of such public subsidies from PSO impositions, thus achieving common social and regional development goals [7]. As the lack of affordable transportation is usually vital for socio-economic development in peripheral communities, regional administrations have often urged their national governments to submit a request for imposition to the Commission, with the expectation that related transport services may be ensured from a public contract due to social interest and public service of the air route concerned.

In the last few years, there have been many state members that have used the PSO to remedy the lack of scheduled transport services mostly on marginal routes (176 as of 2019). As shown in Table 1, PSO imposition notices have always been published in the Official Journal of the European Union (EUOJ). This also applies to tender notices if the procurement procedure is organized by the state member, apart from those impositions whose expected number of passengers is less than 10,000 per year according to articles 16(5) and 17(2) of [3]. Nevertheless, any imposition of a PSO on an air route must be duly substantiated by the civil aviation authority concerned, as it forces to make an exception to the rules of the free market. This implies that competent national authorities have to provide the European Commission (hereafter the Commission) with evidence that a PSO imposition is both necessary and adequate and that it also meets the eligibility criteria for the provision of regular transport services according to EU regulation (Article 16(3) of [3].

Table 1. Key features of PSO schema for scheduled air services under the regular procedure.

	Type 1 (Open PSO)	**Type 2 (Closed PSO)**	**Type 3 (Closed PSO)**
PSO Justification	■	■	■
PSO Imposition	■	■	■
PSO Limitation [a]	●	●	●
Call for tender			■
Information notice in the EUOJ	■	■	■
Restricted access to one carrier		■	■
Maximum fares	●	■	■
Frequencies	●	■	■
Seating capacity	●	■	■
Economic compensation			■
Contract duration [b]			■
Equipment [c]	●	●	●

[1] Source: Own work based on an analysis of current EU legislation, [3] and [8]. Caption: Black square "■" denotes a mandatory requirement from a PSO imposition while blank space indicates "not applicable" under the imposition of a PSO on regular air routes concerned. Black circle "●" denotes a specification not strictly necessary. Explanatory notes: a) If air services have not been operated in 12 months on the air route concerned, the imposition shall be expired and then moved on to operate in the free regime (Type 0); b) Up to 4 years (5 years for overseas routes); c) Type of aircraft.

3. Basic aspects of the PSO impositions applying in Spanish air domestic market

The implementation of the PSO schema in the Spanish domestic market has been traditionally focused on scheduled air transport services serving island territories (the Balearics and the Canaries), some areas with difficulties in rail transportation (Almeria and Badajoz), and even an isolated community (Melilla). Despite the wide decentralization of public administration existing in Spain, its national state administration has exclusive jurisdiction in matters of air transportation according to Article 149(1)(20) of the Spanish constitution. Hence, PSO impositions have been managed by the civil aviation authority (DGAC) on behalf of the former Ministry of Public Works, currently named Ministry of Transport, Mobility and Urban Agenda (hereafter MITMA) [4]. In Spain, moreover, the PSO schema co-exists with a subsidy regime in public transport for residents only, which is applicable under Article 107(1) of the Treaty of the Functioning of the European Union (TFUE). While these two instruments have a very different regulatory basis from each other within the existing legal framework on a European and state member level, both are managed by the MITMA in Spain. The resident subsidy has led to an increase in the demand for regular transport services in island territories, such as in the Canary, albeit with some questions about adverse effects on airfares for non-residents [9]. Nevertheless, the procurement for tendering PSO contracts (type 3) has been carried out by MITMA and afterward conducted under e-procurement procedures [10]. As shown in Table 2, so far, a total of 23 routes have been imposed with a PSO in Spain, nine of which have been operated by one carrier from a PSO contract. It is noted that, except on ES12 and ES13, inter-island services neither in the Canary nor the Balearic have been tendered.

Table 2. Existing PSO air routes in the Spanish domestic air transport market (as of 14 March 2020).

Route code	Airport (from/to)	IATA [b] code	Airport (to/from)	IATA [b] code	PSO contract	Contract duration	Resident subsidy
ES01	Almeria	LEI	Sevilla	SVQ	43/A18	12	No
ES02	Menorca	MAH	Ibiza	IBZ	-	-	Yes
ES03	Menorca	MAH	Madrid	MAD	123A2019 [a]	48 [b]	Yes
ES04	P. Mallorca	PMI	Ibiza	IBZ	-	-	Yes
ES05	P. Mallorca	PMI	Menorca	MAH	-	-	Yes
ES06	G. Canaria	LPA	El Hierro	VDE	-	-	Yes
ES07	G. Canaria	LPA	Tenerife S.	TFS	-	-	Yes
ES08	G. Canaria	LPA	Fuerteventura	FUE	-	-	Yes
ES09	G. Canaria	LPA	Lanzarote	ACE	-	-	Yes
ES10	G. Canaria	LPA	Tenerife N.	TFN	-	-	Yes
ES11	G. Canaria	LPA	S. C. Palma	SPC	-	-	Yes
ES12	La Gomera	GMZ	La Palma	LPA	15/A18	36	Yes
ES13	La Gomera	GMZ	Tenerife N.	TFN	15/A18	36	Yes
ES14	S. C. Palma	SPC	Lanzarote	ACE	-	-	Yes
ES15	Tenerife N.	TFN	El Hierro	VDE	-	-	Yes
ES16	Tenerife N.	TFN	Fuerteventura	FUE	-	-	Yes
ES17	Tenerife N.	TFN	Lanzarote	ACE	-	-	Yes
ES18	Tenerife N.	TFN	S. C. Palma	SPC	-	-	Yes
ES19	Badajoz	BJZ	Madrid	MAD	123A18	18	No
ES20	Badajoz	BJZ	Barcelona	BCN	123A18	18	No
ES21	Melilla	MLN	Almeria	LEI	162A2020	12	Yes
ES22	Melilla	MLN	Granada	GRX	162A2020	12	Yes
ES23	Melilla	MLN	Sevilla	SVQ	162A2020	12	Yes

Source: Compilation based on information collected from both [11] and [12]. Explanatory note: a) That obligation is not applicable during the period between May and October; b) Economic compensation applicable in seasonal period only; b) International Air Transport Association (IATA).

4. Addressing the issue of interconnecting the Balearic Islands from PSO schema

In the study of air routes linking with island destinations, airline yields are often higher during peak seasons, as the demand for air travel is usually very seasonal. As discussed later in chapter 6, this issue doesn't always occur with interisland flights for which regular air transport services are considered essential for socio-economic development in the Balearic Islands. In this regard, after having reviewed the related passenger traffic from the primary database [13] for each of the three routes considered, there is no evidence of a strong seasonal component. Nevertheless, the interisland air services considered in the present study involve three airports whose importance in the national airport network (managed by a state-owned company hereafter referred to as Aena) is very high in the Spanish domestic market. As can be seen in Table 3, these airports have led to a steady growth in passenger traffic in recent years, which is fundamentally due to tourism activities. Considering induced effects, indeed, the weight of tourism in the Balearic economy has been estimated at 75% [14]. Moreover, tourism in the Balearic Islands is not only very sensitive to prices but also sensitive to the costs of travel [15]. All of this reinforces the idea that the existence of accessible and affordable transportation is vital for the tourism sector of the Balearic, and therefore for the regional economy. Furthermore, since air transportation is a fundamental part of the regional mobility ecosystem in the Balearic, the three airports from Table 3 have been traditionally considered an essential infrastructure of the archipelago. However, beyond the economic effect of tourism itself, the interisland traffic has a social component that cannot be overlooked in the analysis of whether the regional passenger air transport is efficient, but also environmentally sustainable. To achieve this, public efforts have focused on the enhancement of regular air transport services over past years by imposing a PSO on the air routes considered, in addition to introducing a special subsidy for residents (recently increased from 50% to 75%) [16]. Hence, these routes have been operating since 2003 under a PSO imposition, which thus has been successful in ensuring passenger air transport services in terms of availability and continuity.

Although no paper has been published so far for analyzing the PSO schema applied on interisland routes in the Balearic, similar cases relating to EU island territories have analyzed the PSO system from some earlier studies. In the case of interisland air transport in the other Spanish archipelago, the market liberalization has also resulted in certain market dysfunctions concerning its local network that cannot be left entirely to airlines' business criteria, as it affects territorial cohesion [17]. This often causes higher fares, especially on mainland routes with a demand seasonality, such as in those serving Sardinia [18]. The first PSO impositions were introduced in 1998 from the first package of 13 interisland routes in the Canary Islands. Similar considerations in this regard apply to the Azores case, whose regional network has been fully operated under a PSO system with varying degrees of success, but should be approached at aiming at maximizing social welfare instead of minimizing total social costs as the main objective [19], or even towards an approach combining cost and level-of-service objectives without crisis scenario [20].

Table 3. Key facts of air passenger traffic at airports considered (2004-2019).

IATA Code	Airport Group [a]	Airport Typology [b]	Airport Category [c]	Average Annual Passenger Traffic [d]	CAGR (%) [e]
PMI	Major	Touristic	Level 3	23,781,000	0.6
IBZ	I	Touristic	Level 2 [i]/ 3 [ii]	5,789,000	1.1
MAH	I	Touristic	Level 2 [i]/ 3 [ii]	2,811,000	0.4

Source: Own calculation based on information from Aena database [20]; additional information provided by the Spanish Directorate-General for Civil Aviation (DGAC) upon request. Explanatory notes: a), b) According to the classification provided by Aena; c) According to the categorization under Article 3 of [14] and Article 4 of [15], Spanish air facilities are classified as non-coordinated airports (Level 1), airports with schedules facilitated (Level 2), or coordinated airports (Level 3); d) Total amount including both arrivals and departures at each airport; e) Compound annual growth rate. Additional note: i) During the winter season; ii) During the summer season.

The regional air transport network serving the Balearic Islands is comprised of three air routes forming a triangle over the archipelago, as can be seen in Figure 1. Although these inter-island connections operated from a single PSO imposition, they are regarded as point-to-point air transport services. However, for operational purposes and in accordance with the provision of PSOs, scheduled passenger services on the air route ES02 have not always operated by a direct flight, but with an intermediate stop at Palma de Mallorca airport (PMI). In the cases examined for this research, passenger traffic records have revealed that these regular services had operated on a non-stop flight throughout each year in the period from 2008 to 2011. For all other years considered, the route ES02 has been operating as the sum of two legs (i.e. ES04 and ES05) for operational efficiency reasons. The exception is mainly during summer seasons and special periods. With regard to sustainability of concerned air operations, air carriers operating such short-haul flights are practically compelled to have a competitive fleet that includes regional airliners designed to carry up to 100 passengers. Concerning the travel distances considered in this case study (less than 500 kilometers), besides the route performance, a turboprop plane is highly the most general adequate option, such as the ATR family (ATR-42/72 series) or the DHC-8 family (Q100/200/300/400 series). In the case of high demand time during certain summer seasons, a regional twin-engined turbofan aircraft from the CRJ700/900/1000 series. Since the DHC-8 has traditionally not been present in Spanish skies, the figures from Table 4 were calculated in terms of fuel consumption for the ATR72, which has been operating by the regional airlines based in Spain (UX, YW, and NT).

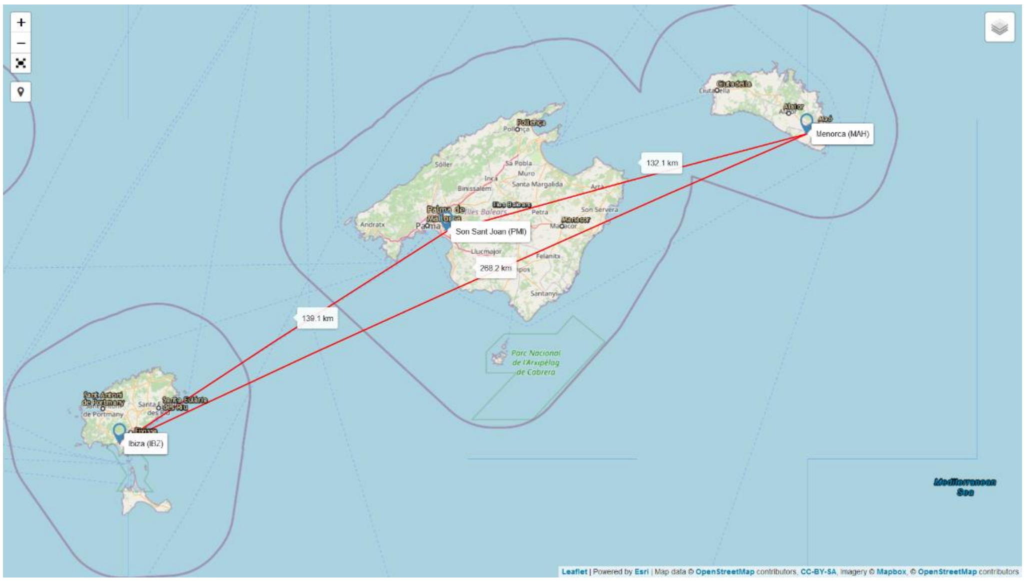

Figure 1. PSO air routes among the Balearic Islands (as of 31 December 2019). Source: Prepared with FreeMapTools.com

Table 4. Operational facts of PSO air routes among the Balearic Islands (as of 14 March 2020)

PSO Route Code	Travel Distance (km) [a]	Travel Time (h)	Heading Vector Navigation	Block Fuel (kg) [b, c]	CO2 Emissions (kg) [b, c]	Standard Aircraft Equipment	Emissions CO2/PAX (kg) [b, c]	Standard Cabin Config.
ES02	269	0:52	247° (WSW)	436	1373	ATR72-600	19	72Y
ES04	140	0:36	238° (WSW)	228	718	ATR72-600	10	72Y
ES05	132	0:35	74° (ENE)	213	671	ATR72-600	9	72Y

Source: Own figures partially based on a performance study provided by ATR upon specific request. Explanatory note: a) Orthodromic distance; b) Standard assumptions: Jet A1 density as of 0.804 kg/l, CO_2 emissions as of 3.15 kg of CO_2 per kg of Jet A1; c) En-route assumptions: Max. payload, no wind, one aircraft per leg under technical specifications by International Standard Atmosphere (ISA), Joint Aviation Requirements (JAR), European Union Aviation Safety (EASA); Passengers (PAX).

5. Overall Findings and Key Results from the Study

Beyond shaping an important part of the EU's external borders, the Mediterranean islands have been put at a competitive disadvantage as most of them have faced specific public measures that facilitate a more inclusive Europe in terms of territorial cohesion. Thus, the lack of adequate air transport services is precisely a challenge due to the condition of insularity, particularly those concerning interisland routes. In the case of the Balearic Islands, as already pointed out, the provision of scheduled flights for passengers has been operated continuously from a PSO imposition since 2003. Moreover, the provision of the related public services on these air routes (ES02, ES04, and ES05) had been ensured without the need for a PSO contract until the entry into force of the state of emergency from entire territory in Spain due to the coronavirus disease 2019 (hereafter COVID-19) [22]. As shall be seen later, this situation has obliged central administration to ensure minimum air transport services for those persons entitled to move within the national territory (i.e. essential workers) through the PSO contracts and to fly up on interisland routes.

In the period considered for the case study, two major features have been observed in how the imposition of a PSO on these interisland routes is applied, which are closely linked to the two legislative reforms carried out. The first being procompetitive and the second being restrictive, in 2006 and 2011 respectively [23]. Firstly, the imposition was introduced in 2003 to provide a stable operational framework for those airlines interested in scheduling flights under certain conditions from a PSO of type 1 [24]. These routes have therefore been designed on the premise that certain segments of the population with fewer resources may have more difficulty in accessing transportation. For the protection of such vulnerable groups as old and young people, as can be seen in Table 5, the related PSO imposition was initially set out to provide them with social tariffs, in addition to the establishment of general maximum fares. It was also designed for carrying essential goods including those considered fundamental for the regional economy, such as footwear and jewelry industries. Since the three routes were mainly imposed with a PSO on passenger grounds, the related air transport services were provisioned from a yearly minimum capacity, specifically on those connecting Palma de Mallorca with Menorca and Ibiza. Secondly, there has been a marked shift in operating conditions from the revision of the imposition in 2008. While these air routes have been operated under a sole PSO since late 2003, the requirements for the provision of regular transport services have undergone a remarkable change concerning airfares and social tariffs [25]. Comparing the findings from Table 6 with Table 5, it can be observed that a change of prices regime from a maximum fares-based system to a reference-based system. This change was aimed at introducing a flexible fare system to encourage airlines in operating the routes which should have resulted in more competition.

Table 5. Summary of conditions from the imposition of a PSO on interisland air routes in the Balearic (2003).

Resolution of 28.11.2003	ES02	ES04	ES05
Social tariffs (discount rate)	Up to 22 years: 10% off Older than 65 years: 10% off Athletes/patients: 10% off	Up to 22 years: 10% off Older than 65 years: 10% off Athletes/patients: 10% off	Up to 22 years: 10% off Older than 65 years: 10% off Athletes/patients: 10% off
Yearly minimum capacity (per leg) [b]	NWS: Unspecified NSS: Unspecified	NWS: 63,000 seats NSS: 107,000 seats	NWS: 71,000 seats NSS: 110,000 seats
Daily minimum frequency (per leg) [b]	NWS: 1 [a] NSS: 1 [a]	NWS: 4 NSS: 5	NWS: 4 NSS: 5
Priority freight	Essential goods, drugs, and daily press	Essential goods, drugs, and daily press	Essential goods, drugs, and daily press
Maximum fare	€101	€72	€72

Source: Own work based on data collected from imposition documents [24]. Explanatory notes: a) When there are no direct flights on ES02, regular services shall be operated as a stopover route (ES04 + ES05); b) Explicitly referred to each Northern Summer and Winter Season (NSS and NWS, respectively), and currently starting on 28 March 2021 and 31 October 2021, respectively).

Since the changes introduced by the revised PSO imposition, as summarized in Table 6, only have affected social tariffs and reference fares, maximum prices were removed. As a result, this revision has led to the establishment of flexible fares, which generally must not exceed 25% of the reference ones. As can be seen in Figure 2, the evolution of the maximum fares within the period between April 2008 and January 2019 indicates that the introduction of a flexible price system has allowed the related air transport services to contain any abrupt air fare movement. All this without renouncing the application of a generous resident subsidy system designed to facilitate certain mobility problems in the Balearic Islands arising as a result of its insularity. Under these circumstances, related short-haul operations would be viable for regional airlines and these regular air services may be profitable. Indeed, as noted in Table 6, it becomes clear that there is a slight increased maximum fare since 2013. And all this exactly coincides with a significant change of demand trend for regular transport services on ES04 and ES05, as shown in Figure 3.

Table 6. Summary of conditions from the imposition of a PSO on interisland air routes in the Balearic (2008).

Order FOM/1085/2008	ES02	ES04	ES05
Social tariffs (discount rate)	Up to 24 years: 20% Older than 65 years: 20% Athletes/patients: 10%	Up to 24 years: 20% Older than 65 years: 20% Athletes/patients: 10%	Up to 24 years: 20% Older than 65 years: 20% Athletes/patients: 10%
Yearly minimum capacity (per leg) [b]	NWS: Unchanged NSS: Unchanged	NWS: Unchanged NSS: Unchanged	NWS: Unchanged NSS: Unchanged
Daily minimum frequency (per leg) [b]	NWS: Unchanged NSS: Unchanged	NWS: Unchanged NSS: Unchanged	NWS: Unchanged NSS: Unchanged
Priority freight	Unchanged	Unchanged	Unchanged
Reference fare	€114	€82	€82

Source: Own work based on data collected from imposition documents [25]. Explanatory note: a) When there are no direct flights on ES02, regular services shall be operated as a stopover route (ES04 + ES05); b) Explicitly referred to each Northern Summer and Winter Season (NSS and NWS, respectively), and currently starting on 28 March 2021 and 31 October 2021, respectively).

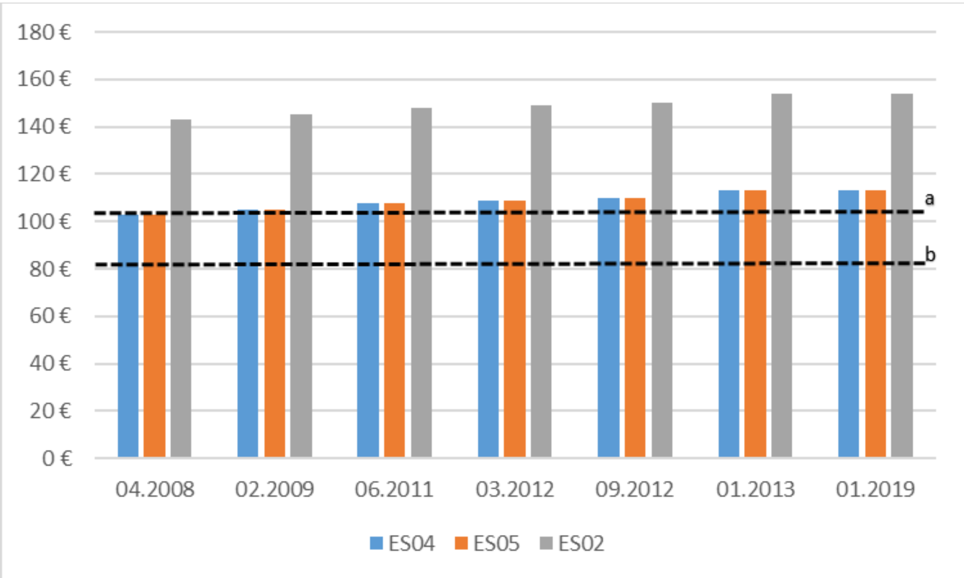

Figure 2. Maximum airfares for interisland routes serving the Balearic from the entry into force of updated PSO imposition (2008). Source: Own work based on data collected from PSO documents in the public domain through [27], and other figures with specific access rights submitted to MITMA under special request. Explanatory notes: a) Reference fare for air routes ES02; b) Reference fare for air routes ES04 y ES05.

As shown in Figure 3, two of the three air routes (ES04 and ES05) considered in the study are not thin routes according to criteria from paragraph 20(b) of [8], as much more than 100,000 passengers have been carried on them. Moreover, both routes have become increasingly similar behavior with significant growth since 2014. Similarly, this fact can be seen in Figure 4 regarding the Passenger Load Factor (PLF) of both routes since 2017.

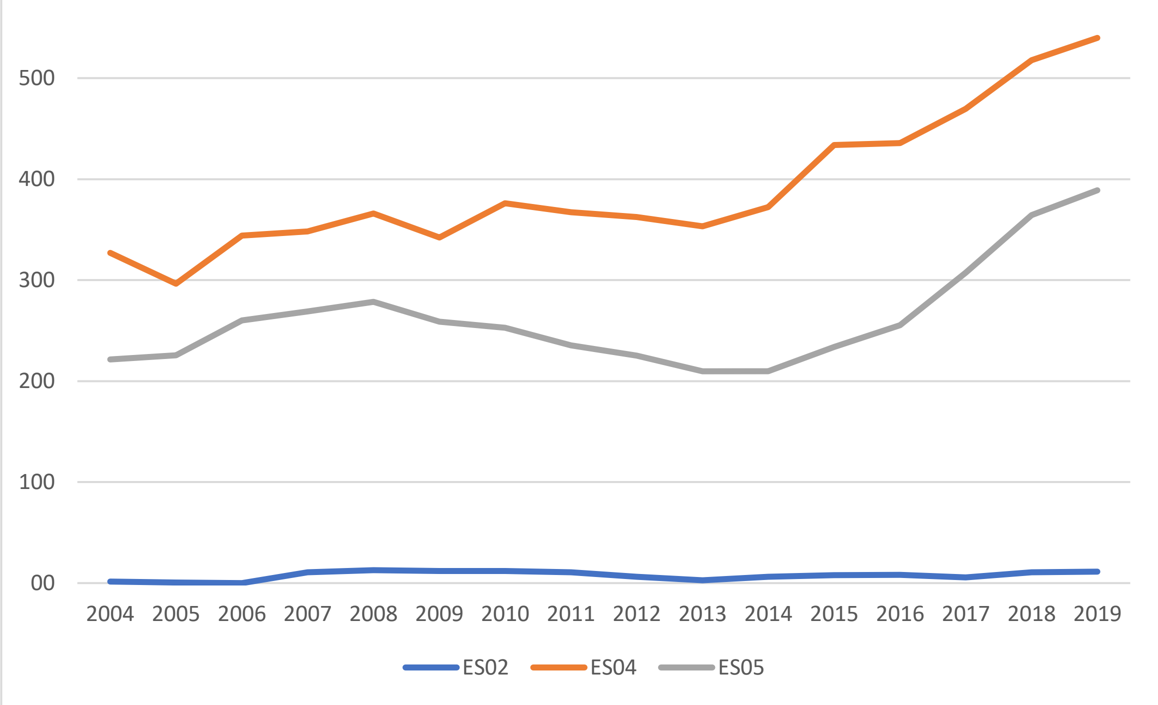

Figure 3. Annual air route performance on regular air services among the Balearic Islands as thousands of passengers carried (2004-2019). Own Source: Own work based on data collected from air traffic statistics [20].

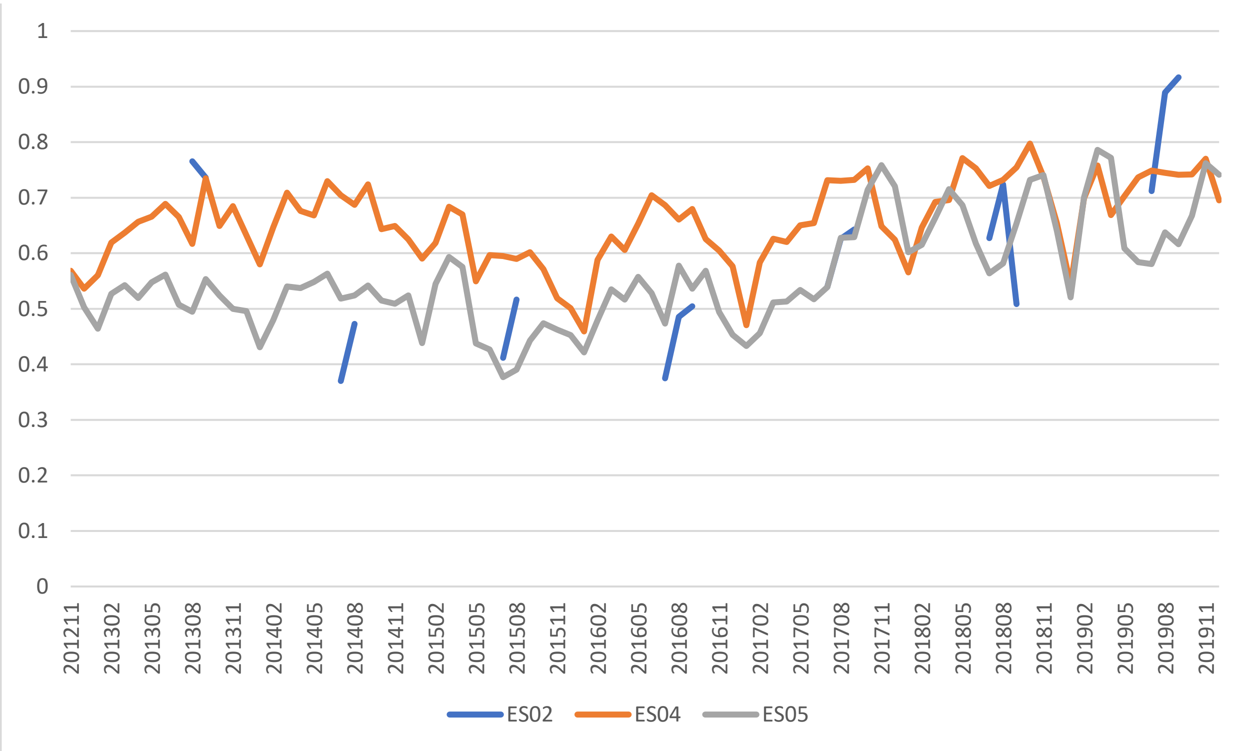

Figure 4. Annual performance as PLF (%) of PSO air routes among the Balearic Islands in the period between November 2011 and December 2019. Source: Own work based on data collected from PSO documents in the public domain through [27], and other figures with specific access rights submitted to MITMA under special request.

As already pointed out, commercial passenger air transportation is far more sensitive to worldwide economic crises and global events, since the geographical scope of the airline sector is broader than other means of public transport, such as the train or the bus. Nowadays, the transversality of aviation activity is closely linked with the globalization phenomenon since both business and leisure travels play an important role in air transportation. In the event of an outbreak of a pandemic disease such as the present one, thus, certain passenger transport services can be disrupted by mobility constraints in avoiding the spread of the pathogen. This is especially noticeable in a public health crisis of a global nature such as the COVID-19, as it has forced several countries to seal their borders. Presumably, the pandemic will have a long-term implication on worldwide aviation, as the whole industry has been plunged into a deep crisis from which it is currently being difficult to emerge due to, among other reasons, the scarce capacity of vaccination campaigns across the world. In this context, the Balearic air route network has needed public intervention as a result of the state of alarm declared in 2020. For this purpose, as shown in Table 7, a public contract had to be tendered for ensuring essential transport services on the routes ES04 and ES05 (see Figure 5) with a minimum of weekly operations and to avoid full isolation by air of the two satellite islands (MAH and IBZ) with the regional capital (PMI). Only the two air carriers (UX, YW) operating interisland routes in the Balearic decided to submit a bid under the tender procedure concerned (118V2020). The contract was awarded to a tender (UX) which had submitted the lowest price, and then it was furthermore renewed for one week until four times for a total of €74,536 per week.

Table 7. Summary of public contracts applied during the COVID19 (2020).

Symbol Caption	Contract Reference	Public Founds	Contract type	Total Award Amount [b]	Starting Date	Ending Date
α	118V2020	National	PSO	€106,480	20.03.2020	29.03.2020
β	118V2020	National	PSO	€138,424	30.03.2020	12.04.2020
γ	118V2020	National	PSO	€149,072	12.04.2020	26.04.2020
δ	118V2020	National	PSO	€149,072	26.04.2020	10.05.2020
ε	118V2020	National	PSO	€149,072	10.05.2020	24.05.2020

Source: Own work based on data collected from tender dossiers [12]. Explanatory note: a) Applicable on PSO air routes ES04 and ES05 only; b) Including taxes.

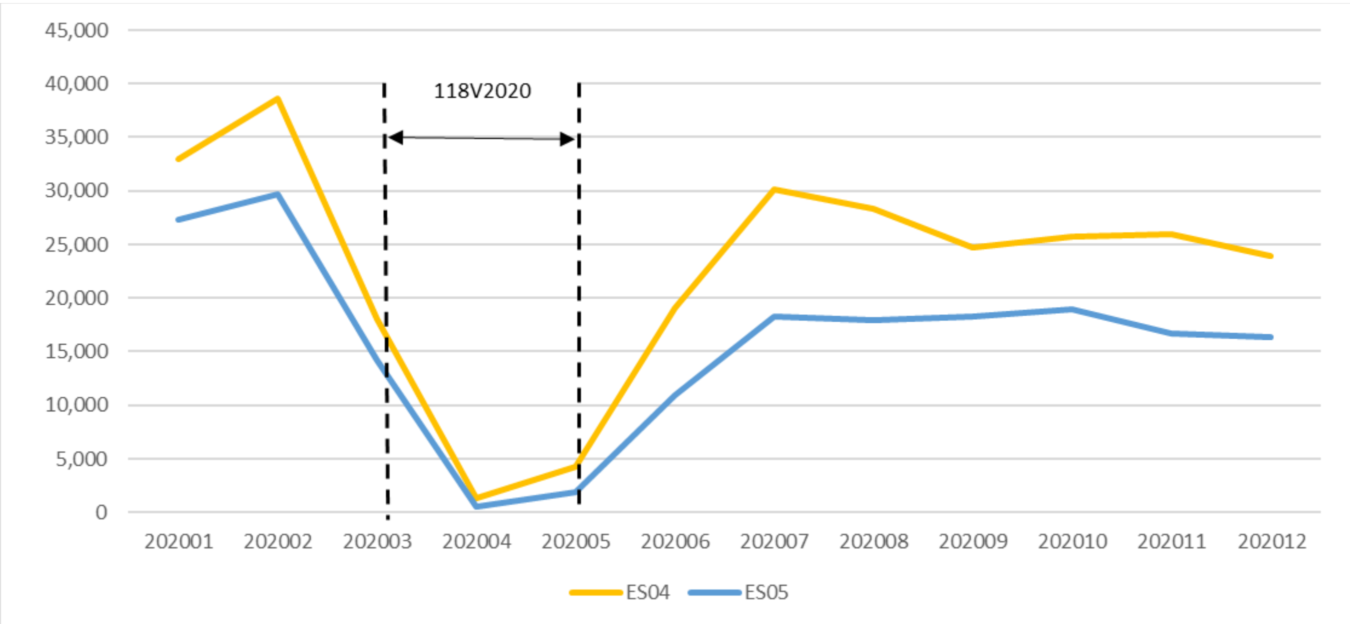

Figure 5. Passengers carried monthly on PSO air routes ES04 and ES05 in 2020 during the period from January (202001) to December (202012). Source: Own work based on data collected from air traffic statistics [20].

While a PSO air route can be designed exclusively for freights based on EU regulation [3], there has been so far no PSO imposition on cargo air route within EU Single Market, with the exception of the tentative provision for air cargo and mail only between the Portugal mainland and the Azores islands through two impositions of a PSO on routes concerned, one imposed in 2015, and another in 2017. However, the related tender procedures have remained unsuccessful, since the Portuguese Civil Aviation Authority (hereafter PCAA) did not find any airline in a position to fulfill the requirements of the concerned PSO; thus, the imposition expired at the end of 2017. Although the PSO schema so far applied in Spain has not been aimed at providing freight transportation services, certain routes were designed with some special considerations for the transport of specific goods. In the case study of interisland air routes in the Balearic islands, even though no cargo transport requirements have been fixed, the related PSO merely determines the priority for the transportation of some goods among the islands, such as essential goods, drugs, and daily press. However, since the provision of public transport services on such routes does not oblige airlines to provide a minimum payload capacity for freights on each flight, as can be seen from Table 5 and Table 6, scheduled passenger services are operated by using the optimal type of aircraft in terms of operational efficiency according to demand. This is one of the reasons why such regular services have been traditionally served with narrow-body aircrafts suitable for short-haul flights, either by operating turbofan or turbojet airplanes, such as from ATR72 and CRJ series, respectively. Nowadays, the extensive use of regional airliners on air routes as those considered in this study is also the most suitable solution for providing regular passenger transport services in terms of efficiency and sustainability. This allows airlines to make better profits by turning their airplanes round more quickly, scheduling more flights per day with the minimum number of cabin crew required (one or two workers), as well as burning less aviation fuel per full operation than commercial jetliners. However, the use of regional airliners is not suitable for cargo movements due to low payloads. For instance, 7,550 and 10,247 kg at typical in-service Operating Empty Weight (OEW) for ATR72-600 and CRJ900, respectively. As shown in Figure 6, although air route ES05 had significantly increased the goods carried until 2008, the number of goods carried on these PSO routes is practically insignificant since 2014.

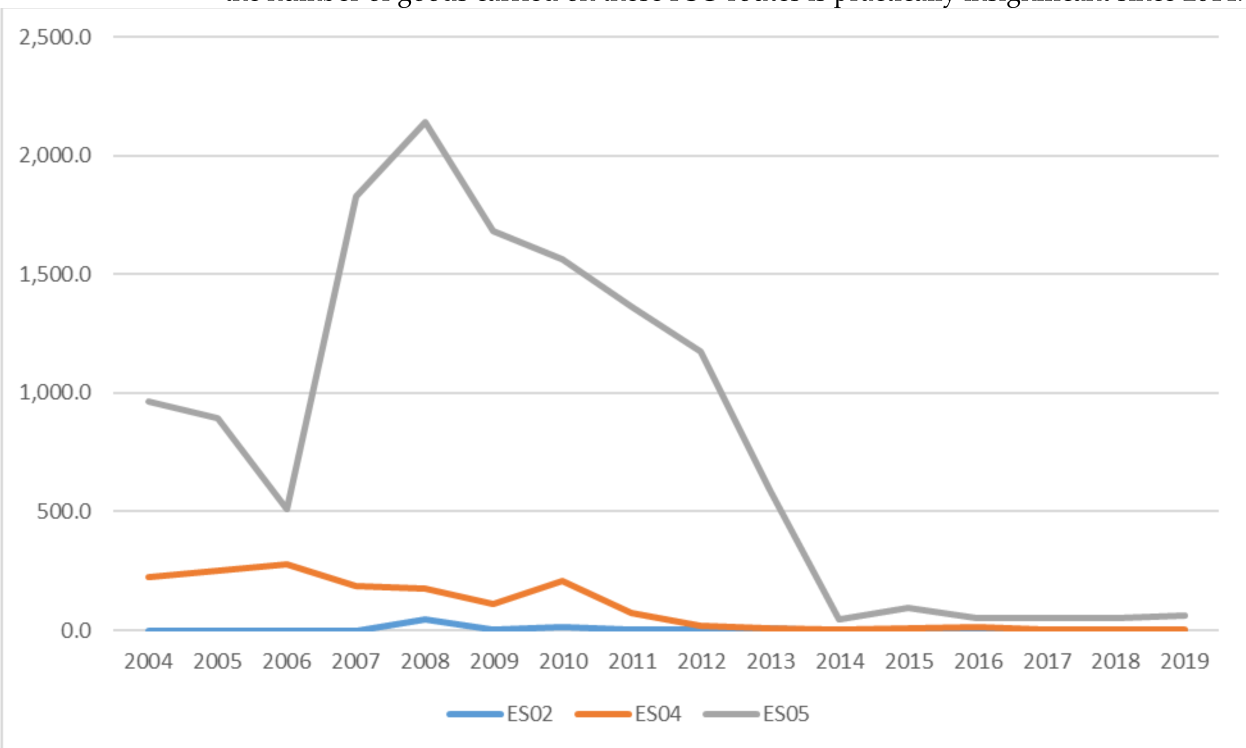

Figure 6. Freights carried (in metric tons) on regular air transport services among the Balearic Islands. Source: Own work based on data collected from air traffic statistics [20].

6. Further Considerations and Related Discussion

The above findings show that the discussion on how the efficiency of the PSO system imposed on the air routes considered should be interpreted from the perspective of earlier studies is not easy to approach in only one article. Firstly, no previous paper has specifically addressed the issue of the Balearic air transport network in terms of public efficiency and socioeconomic sustainability from the PSO schema. Secondly, though here briefly analyzed with regard to either reference fares or maximum prices, the lack of complete cost and pricing data from open-access databases has made impossible the use of statistical regression techniques to predict a wide range of phenomena relating to price elasticity of demand and price-sensitivity in the intermodal market considered base on the two modes of transport possible considered in the research (air and sea traffic). Nevertheless, the findings and their implications are discussed below in the broadest context possible concerning the 176 PSO air routes so far imposed in the EU single market of air transportation.

In the case study at issue, the provision of regular air transport services among the Balearic Islands has only sought to enhance an adequate provision of passenger transportation in terms of continuity, regularity, and prices. From the air routes considered, two of them (ES04 and ES05) had enjoyed a good level of competition. Having been operated habitually by three airlines, especially in the summer season, both routes have suffered a loss of capacity for regular services due to the cessation of activity of the third player, Air Belin (formerly AB). This has not, however, resulted in a decrease neither in the number of passengers carried nor PLF on both routes, as can be seen, both in Figure 3 and Figure 4, respectively. Regarding the route ES02, as already pointed out, scheduled passenger transport services have been operated infrequently, mostly in summer seasons and for four whole years (from 2008 to 2011). As shown in Table 8, one of Europe's largest regional airline, Air Nostrum (YW), has become a clear leader in the Balearic market of interisland routes which, together with the third-largest Spanish airline, Air Europa (UX), have been operating regularly the routes ES04 and ES05. Passenger transport services on route ES02, when operated directly, have always been carried out by YW. After carefully analyzing the traffic data on the three routes, it can be stated that YW has become the dominant market player in the Balearic air routes. Moreover, this regional airline will likely become the only carrier operating within the Balearic Islands, once the purchase agreement to buy UX by Iberia (IB) becomes effective. The entry of new players also seems difficult, once the global passenger traffic can return to pre-COVID-19 levels, as the second-largest Spanish regional airline, Binter (NT), is based in the Canary Islands. Therefore, it can be assumed that the provision of regular passenger services on these routes shall be provided from an updated PSO imposition and presumably also with public contrast at least until 2024 in avoiding the Balearic island can be under-connected among them. Considering that the increase of 25% in resident subsidy occurred in 2018 (a total of 75% as of 2019) may have been certain undesired effects on airfares for those passengers visiting the Balearic Islands, findings suggest that the future challenge will be faced in stimulating the concurrence in the local transport market, even enhancing the intramodality between air and sea transport (for instance, through a combined ticket).

Table 8. Market share of main airlines on each inter-island route in the Balearic between January 2004 and October 2019.

PSO route	Air Nostrum	Air Europa	Air Berlin [a]
ES02	98.4% ■	-	-
ES04	64.4% ■	13.4% ●	21.0% ■
ES05	85.6% ■	8.7% ●	4.7% ■

Source: Own calculation based on data collected from air traffic statistics [20], and other figures with specific access rights submitted to Aena under special request. Caption: Black square "■" denotes a turbofan aircraft mostly operating the air route considered while black circle "●" denotes a turboprop aircraft mostly operating the air route considered. Explanatory note: a) This airline definitively ceased operations on 28 October 2017.

6.1. Considerations on Findings about Performance of PSO Imposition on Air Route ES02

The route linking Menorca with Ibiza has been traditionally considered a secondary route within the transport network of regional air service in the Balearic Islands. Because of its high seasonal demand (see Figure 8), the route has been operated in the winter season (between 2005 and 2007, and later since 2012) as a connecting flight via PMI with YW.

6.1.1. Specific assessment on considerations related to passenger traffic

Although both destinations have a high dependence on the tourism sector, and thus a strong seasonal impact on the activity at their airports, the territorial component of the air transport in island territories should not be ignored. Figure 7 shows, in fact, a growing demand in passenger services, when the route is operated point-to-point.

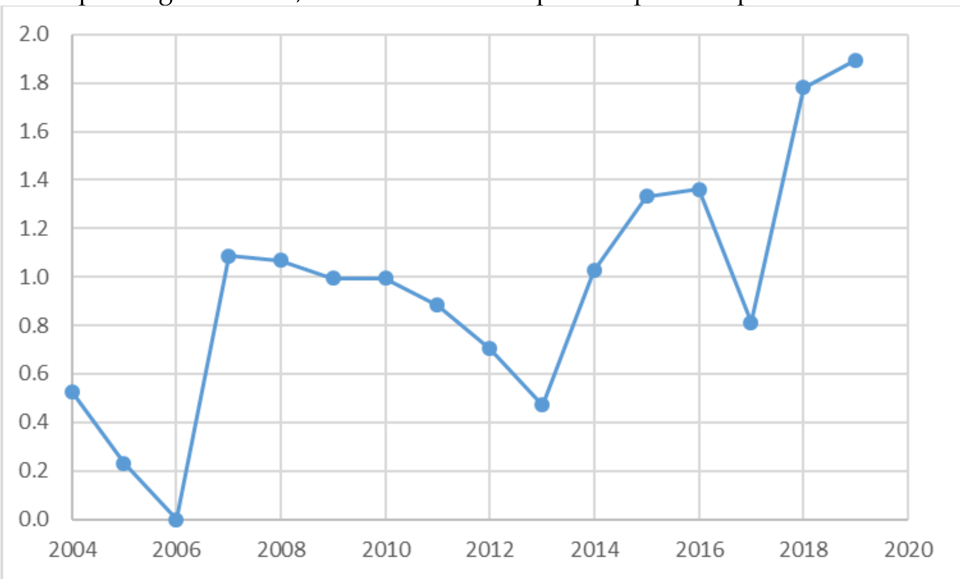

Figure 7. Yearly average of passengers carried in air route ES02 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [20].

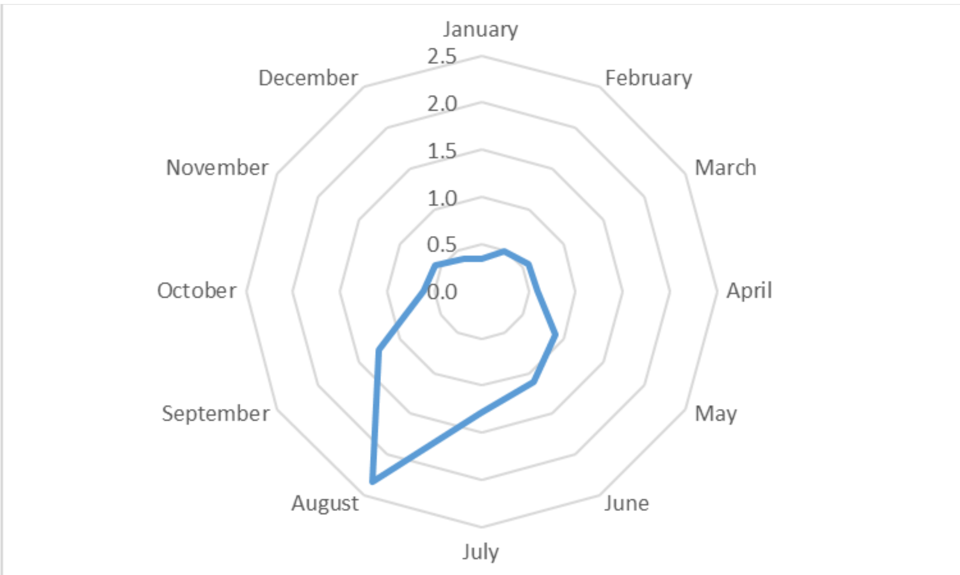

Figure 8. Monthly average of passengers carried in air route ES02 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [20].

Annual traffic data have also been analyzed to determine whether the demand for passenger transport services depends on each semester. Figure 9 shows a slight increase in demand during the second half over past years. Apparently, this may be due to the fact that there are more people traveling for visiting relatives and folks during Christmas time. However, Figure 10 seems to indicate otherwise, as the evolution of passenger demand during low seasons is much more accentuated in the first period than in the second one.

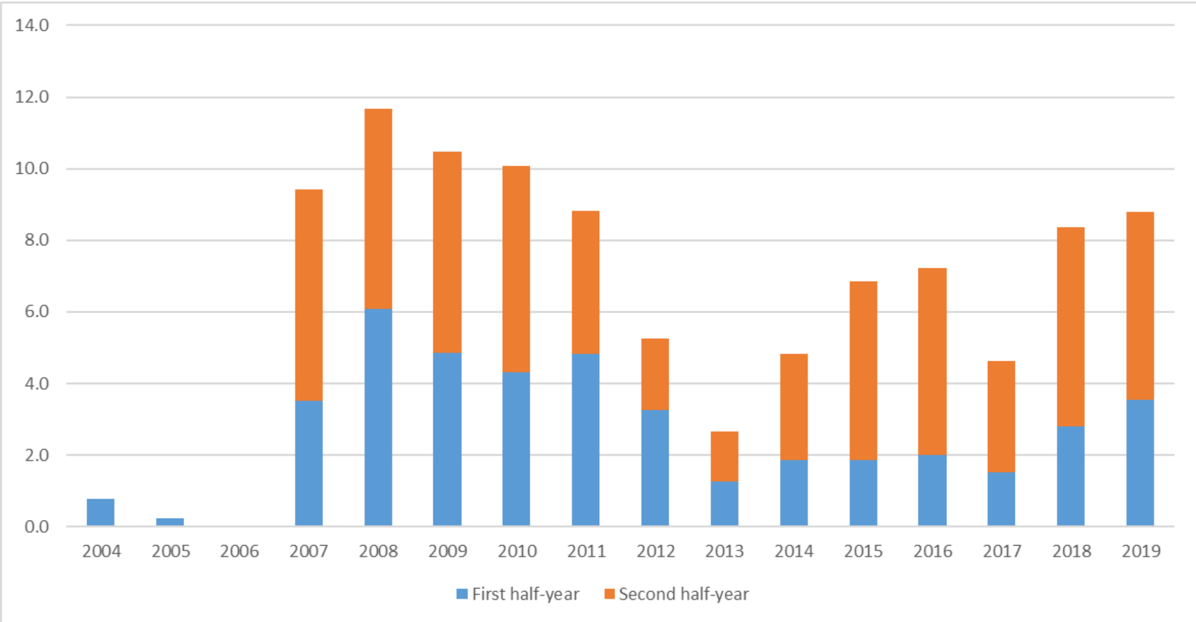

Figure 9. Thousands of passengers carried per half-year on air route ES02. Source: Own work based on data collected from the official database [20].

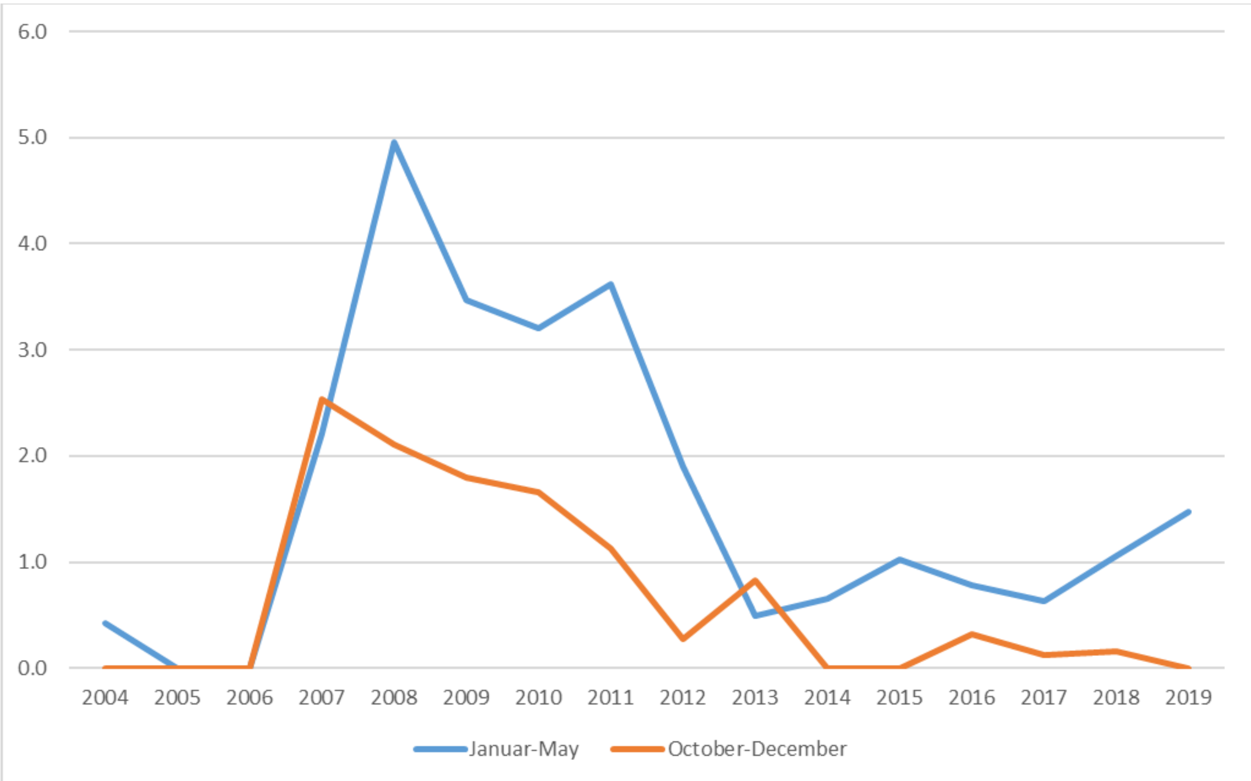

Figure 10. Thousands of passengers carried in down seasons on air route ES02. Source: Own work based on data collected from the official database [20].

6.1.2. Specific assessment on considerations related to freight traffic

As regular air transport services on this route have been occasionally operated over past years by operating regional airliners, there are three years (2008, 2010, and 2013) whose data obtained has shown some amount of goods transported (see Figure 11). Although the results obtained are quite insignificant for the study period considered, Figure 12 shows a curious overlap during low seasons from 2012 to 2014 with no apparent cause.

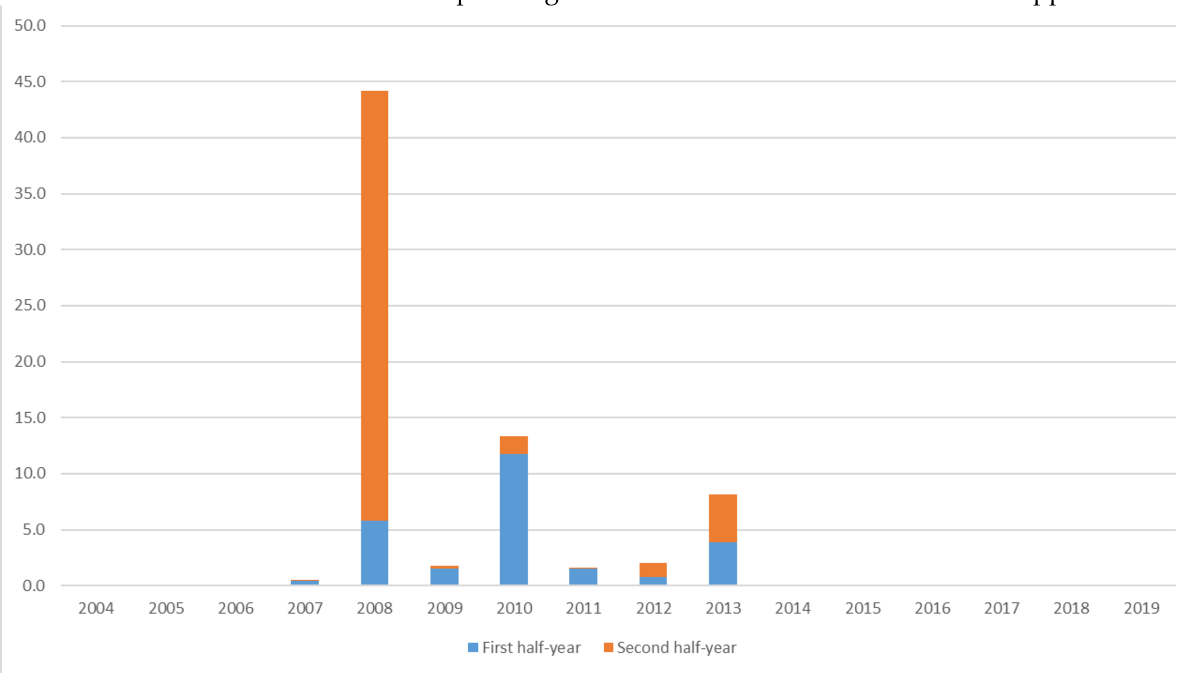

Figure 11. Tons of goods carried per half-year on air route ES02. Source: Own work based on data collected from the official database [20].

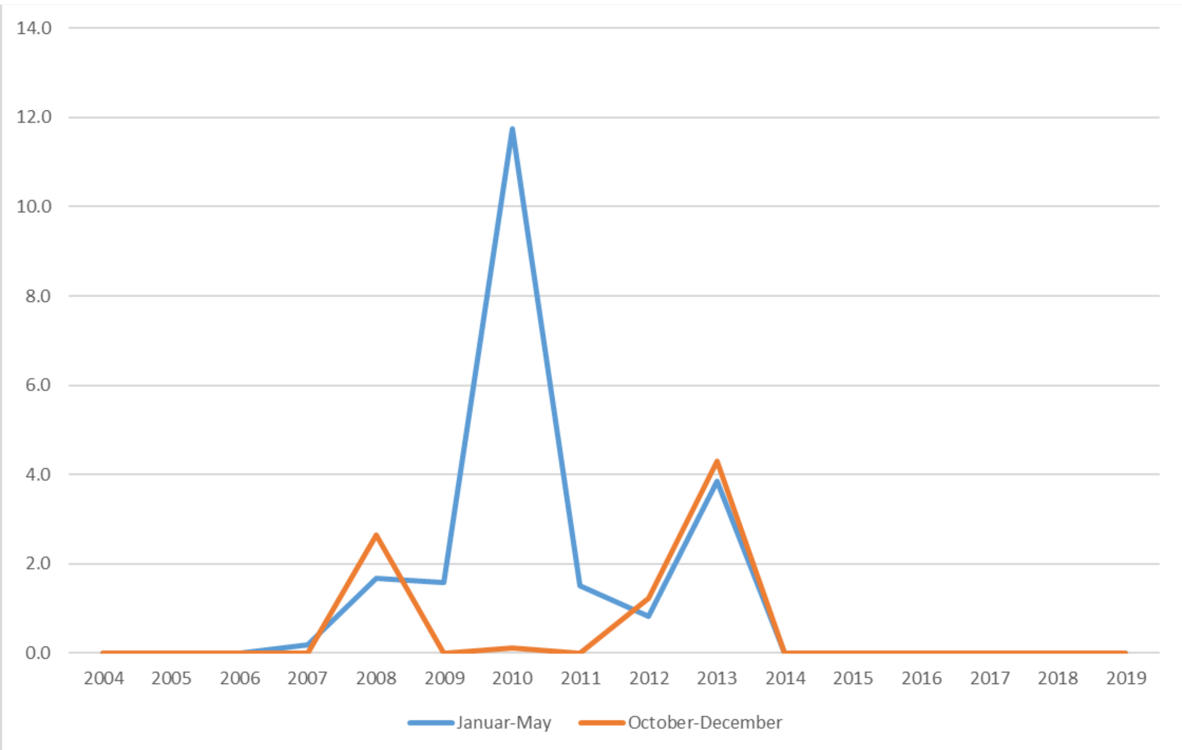

Figure 12. Tons of goods carried per year during down seasons on air route ES02. Source: Own work based on data collected from the official database [20].

6.2. Evaluation of findings concerning the PSO imposition on air route ES04

The route between Palma de Mallorca and Ibiza represents the most important passenger air transport services among Balearic islands in terms of passenger carried, as can be seen in Figure 3. Moreover, the route has enjoyed a considerable level of competence according to Table 8, with up to three airlines (YW, UX, AB) operating until May 2016.

6.2.1. Specific assessment on considerations related to passenger traffic

As can be seen in Figure 13, the passenger demand on this route has experienced continuous growth over past years, especially noticeable since 2013. This coincided with the extension of the resident subsidy (50 percent discount on airfares as of April 2013) to relatives of legal permanent residents as well as non-EU residents. Moreover, Figure 14 shows a slight seasonal trend of the passenger demand for the period May-September.

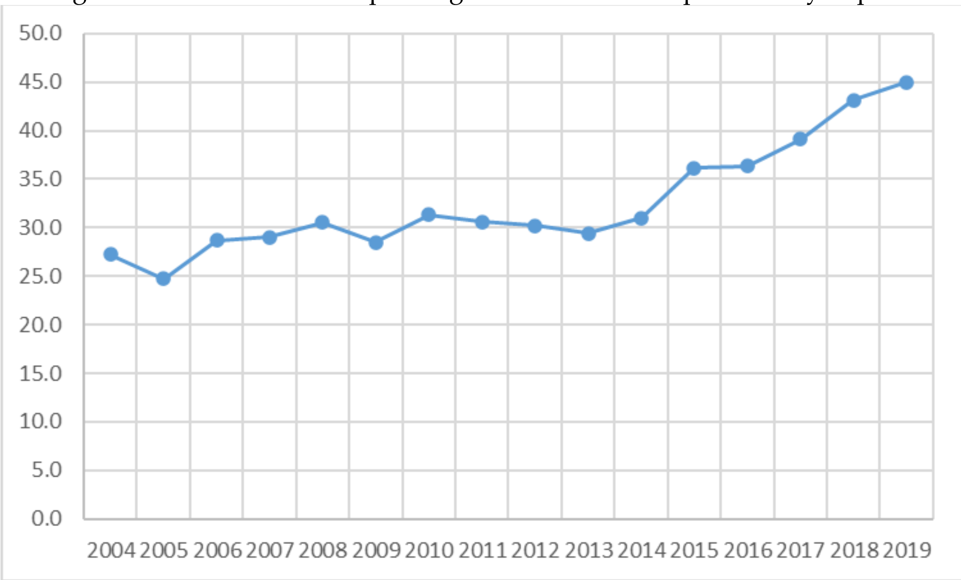

Figure 13. Yearly average of passengers carried in air route ES04 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [20].

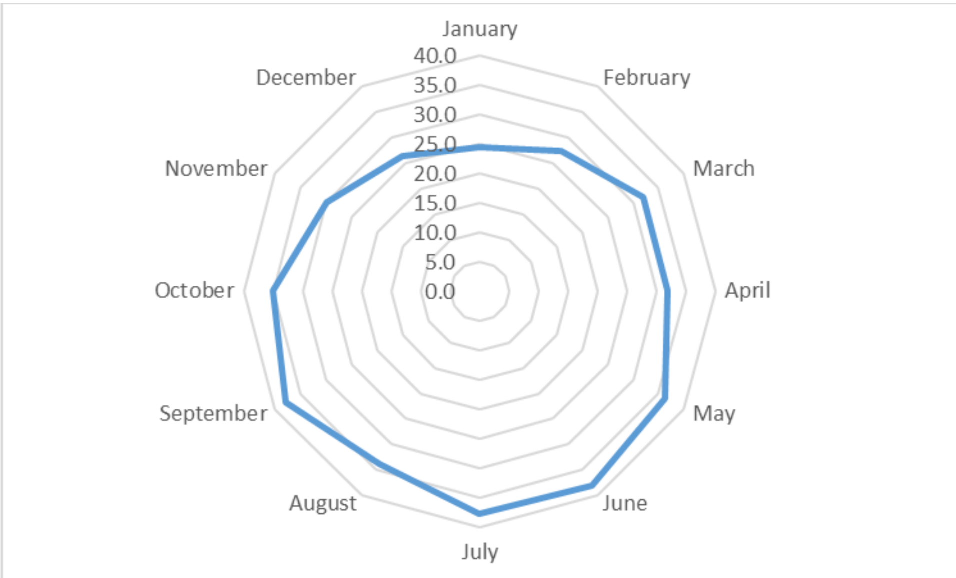

Figure 14. Monthly average of passengers carried in air route ES04 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [20].

The passenger demand has experienced better performance in each second semester over past years, as shown in Figure 15. In contrast, when eliminating the effect of peak seasons mostly due to the tourism effect, the situation changes radically (see Figure 16).

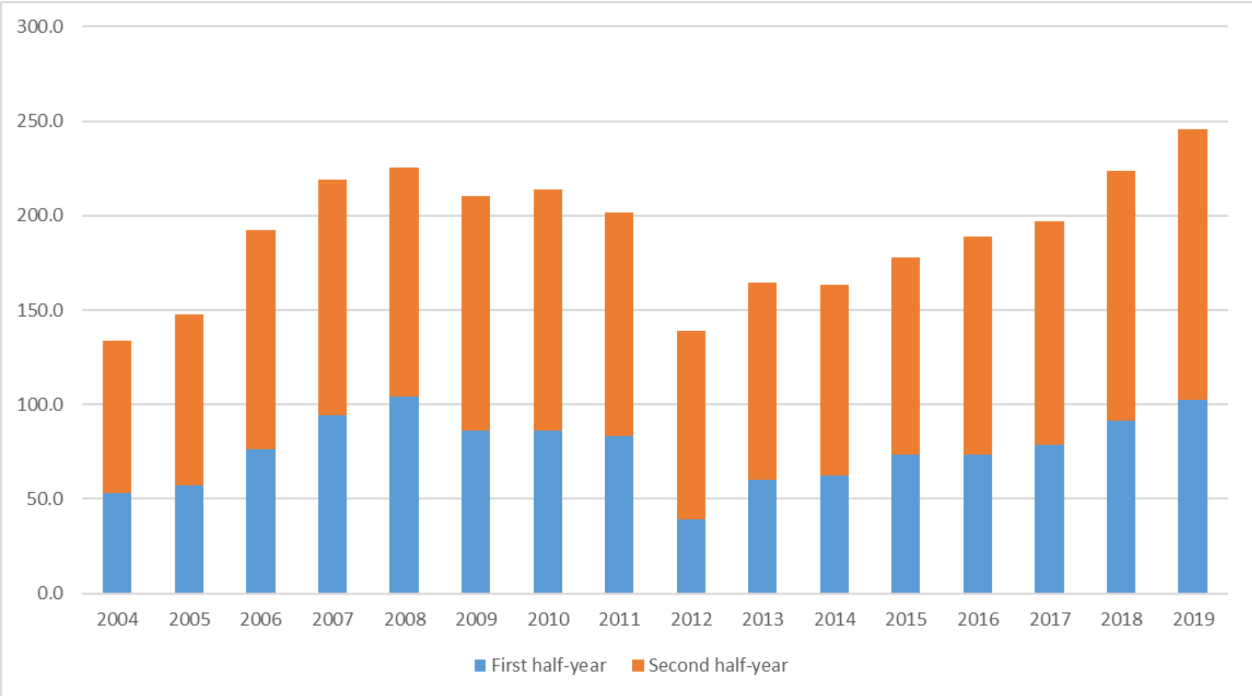

Figure 15. Thousands of passengers carried per half-year on air route ES04. Source: Own work based on data collected from the official database [20].

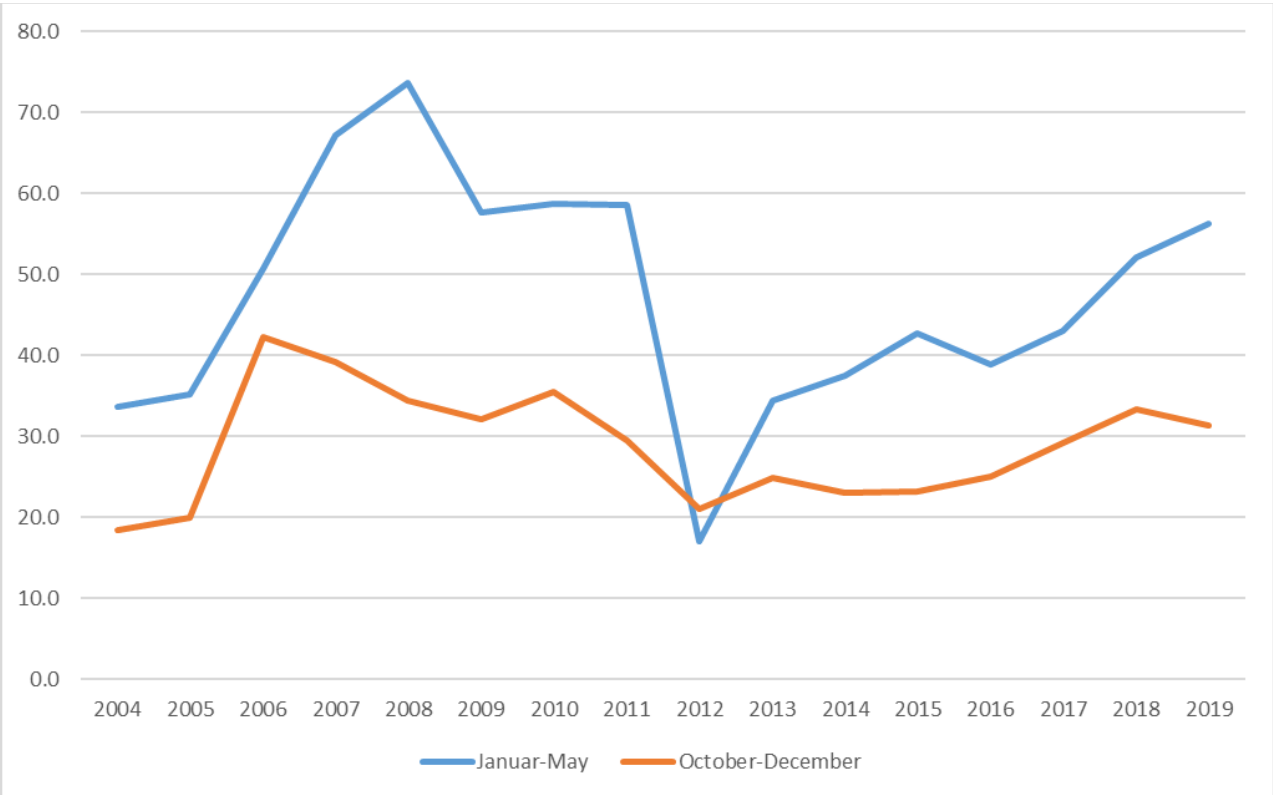

Figure 16. Thousands of passengers carried during low seasons on air route ES02. Source: Own work based on data collected from the official database [20].

6.2.2. Specific assessment on considerations related to freight traffic

Concerning goods transported on this PSO route, as shown in Figure 17, there has been a dramatic fall from the peak in 2006 to practically zero since 2013. As can be seen in Figure 18, the significant loss of the number of freights appears to not depend on seasonality. With the results obtained from the research, no convincing reasons have been found to clearly explain this fact on this route. Apparently, the type of aircraft operating the route may be one of the causes, as Air Belin had not scheduled these flights by using regional airliners, but with bigger aircraft, such as B737 and A320 families.

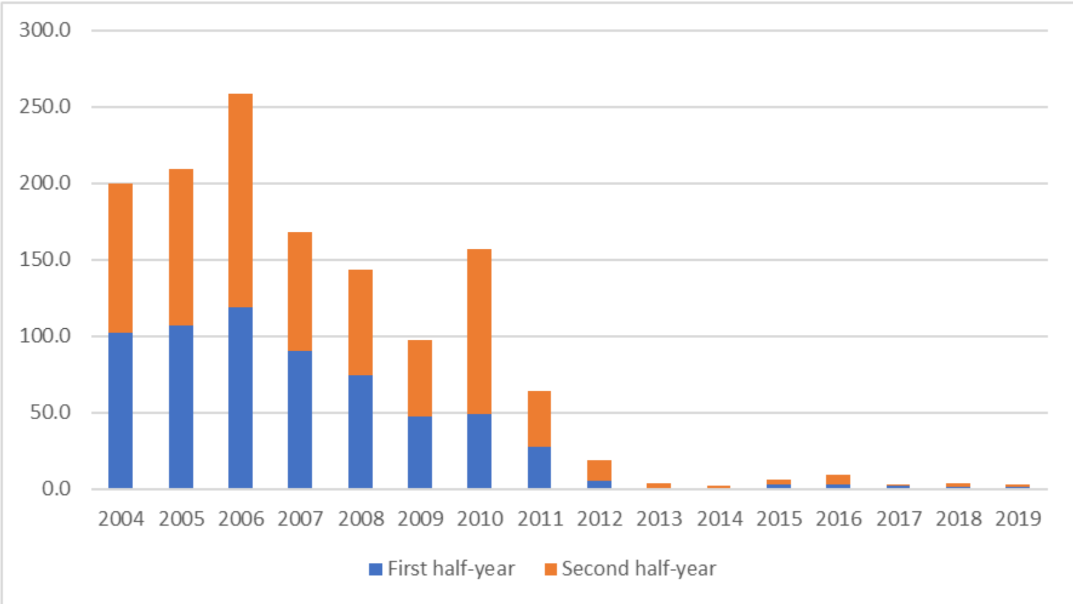

Figure 17. Tons of goods carried per half-year on air route ES04. Source: Own work based on data collected from the official database [20].

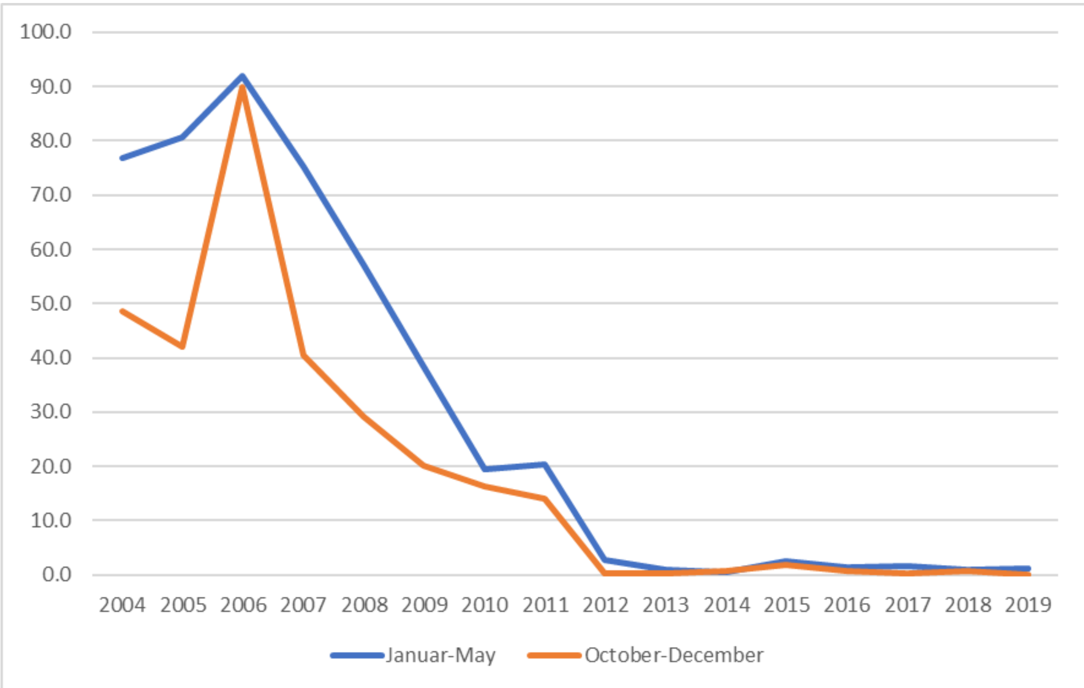

Figure 18. Tons of goods carried per year during low seasons on air route ES04. Source: Own work based on data collected from the official database [20].

6.3. Evaluation of findings concerning the PSO imposition on air route ES05

The interisland air transport services between Palma de Mallorca and Menorca is a key route in the regional air transport network concerning territorial cohesion in the Balearic, specifically, the second one in terms of passenger carried, as shown in Figure 3.

6.3.1. Specific assessment on considerations related to passenger traffic

Based on Figure 8, it is observed that the route has been habitually operated by two airlines (YW and UX) in previous years, and sporadically by a third party (AB) until 2016. But without a doubt, YW has become the dominant player in providing these regular transport services. Yearly average passenger traffic calculated (see Figure 19). In the case of results from Figure 20, no significant seasonality has been noted, indicating that the demand is set to remain practically constant in the 2004 to 2019 period.

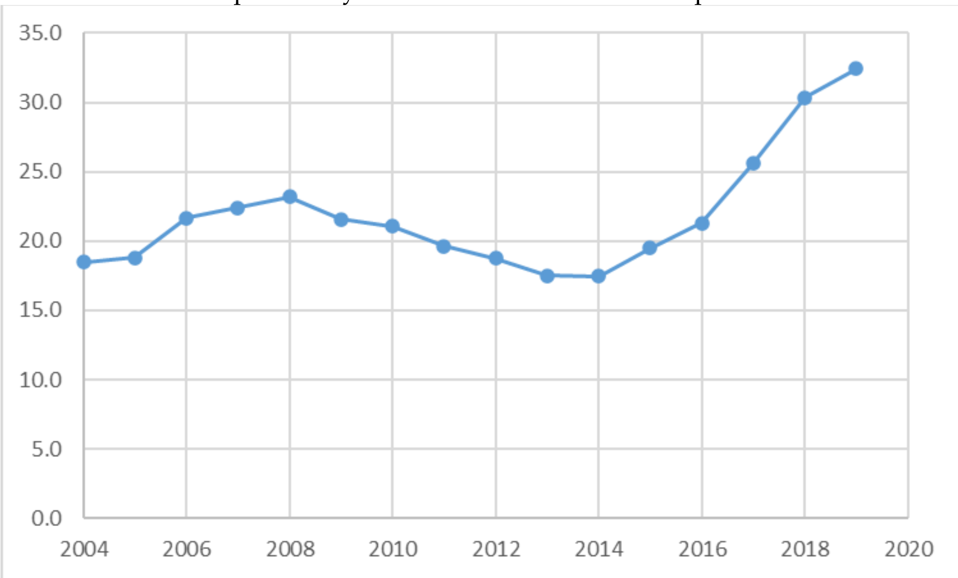

Figure 19. Yearly average of passengers carried in air route ES05 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [20].

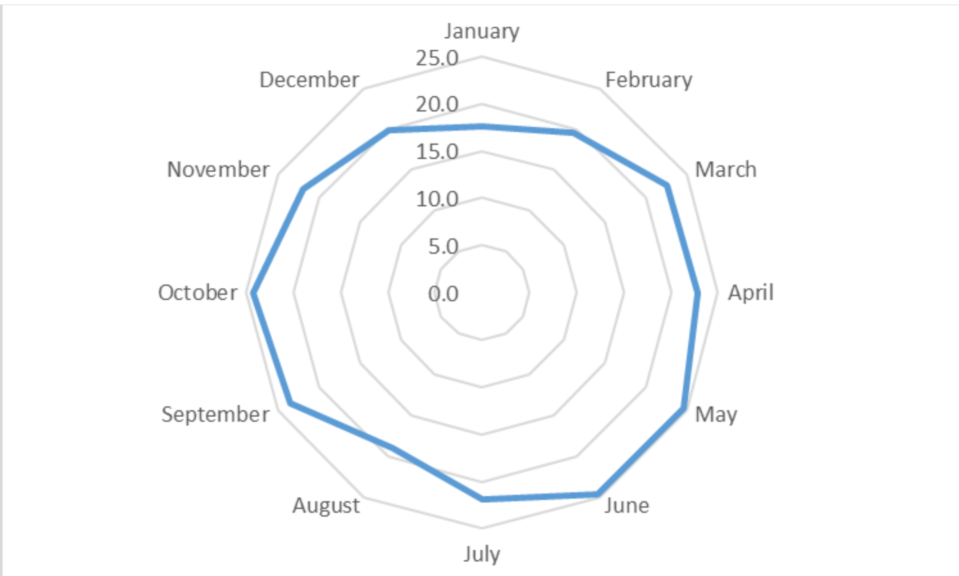

Figure 20. Monthly average of passengers carried in air route ES05 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [20].

6.3.2. Specific assessment on considerations related to freight traffic

In the previous years, as can be seen in Figure 21, goods transportation on the route ES05 has fallen dramatically, with a very similar behavior to the previous case (see subsection 2.2.2), to practically zero since 2013. In addition, Figure 22 shows an identical trend in demand for freight transported in the route, when eliminating the summer effect.

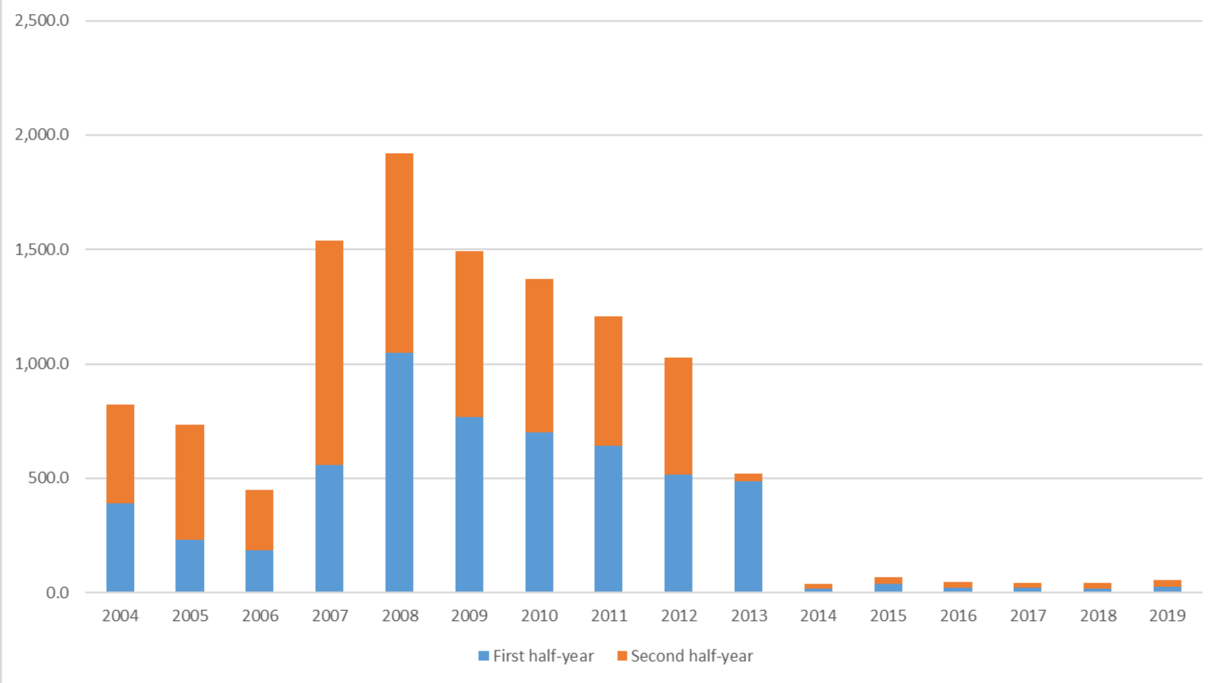

Figure 21. Tons of goods carried per half-year on air route ES05. Source: Own work based on data collected from the official database [20].

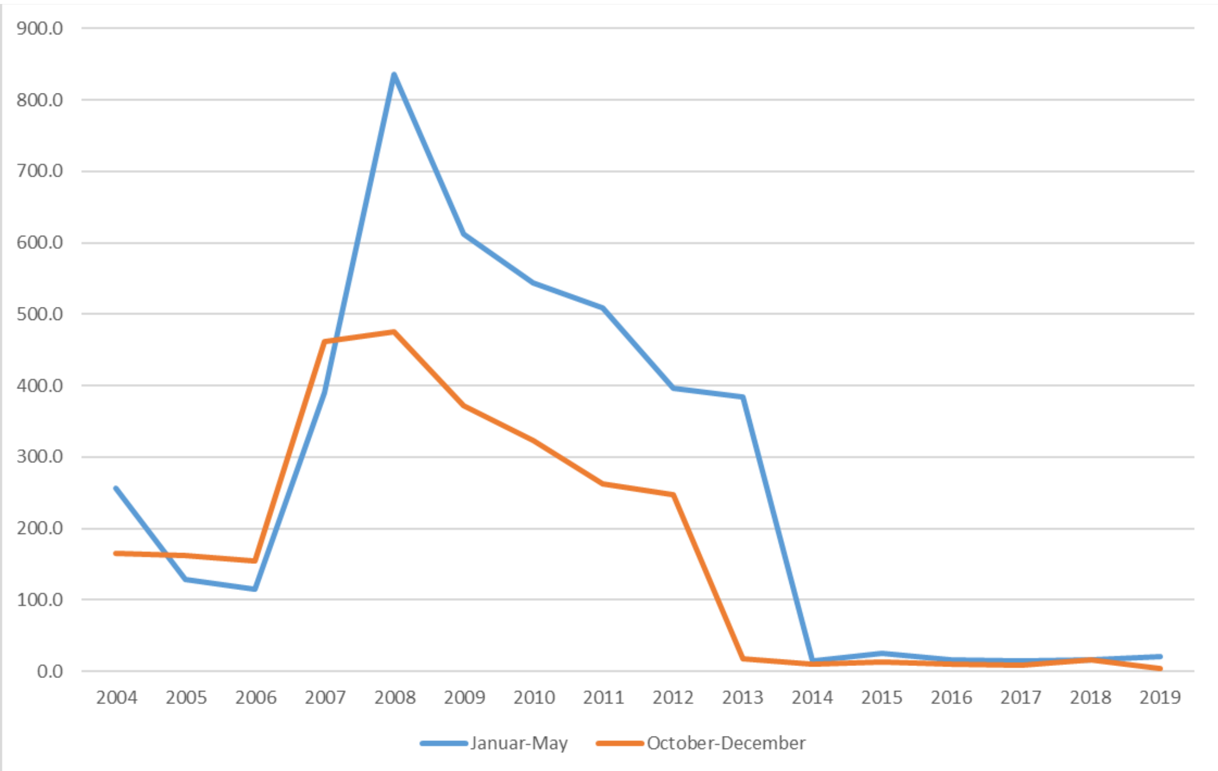

Figure 22. Tons of goods carried per year during low seasons on air route ES05. Source: Own work based on data collected from the official database [20].

7. Conclusions

The main objective of this paper has been to provide an empirical approach to the PSO schema applied in island territories within the EU single market in aviation through an analysis of the interisland routes in the Balearic. This study should shed some light on the details of how the imposition of a PSO on air routes serving scattered population living in not mainland territories can be useful to enhance the regional public transport market. Since the related EU regulation [8] only covers the internal market, the research has been focused on the particular study of three interisland air routes operated under a PSO imposition, but not carried out with a public contract for the provision of scheduled air services. Thus, in this study case and departing from the complexity of the research topic as expressed previously, it has been attempted to stress in the paper that it is not possible to approach this rarely studied area from earlier studies concerning public efficiency and socioeconomic sustainability, since the preview literature is almost inexistent on this matter. Moreover, the complexity of the PSO schema applied within the EU single market in aviation forces to study each imposition of a PSO on air routes by comprehensively analyzing the domestic transportation market concerned. That is precisely the main problem with this issue and its originality at the same time.

Since the PSO schema can be implemented on either air routes or airport managing bodies, being considered as services of general economic interest [26], this form of public intervention should be applied carefully in avoiding market distortions. Throughout the paper, the analysis of the legal framework of the PSO system at the EU level, as well as the way of implementing it at the national level, has not only identified some of its strengths but some of its weaknesses. For instance, common assessment criteria based on socioeconomic needs (thin, peripheral, or development transport services) in designing PSO routes across the EU single market, and the lack of effective supervision of the performance of PSO impositions and related public contracts, respectively. In this concern, the Directorate-General for Mobility and Transport (DG MOVE) on behalf of the Commission should strengthen monitoring tasks, even beyond the surveillance system towards a unified governance code for the PSO impositions and related tender processes. In the case of PSO contracts tendered so far in Spain, including that of the PSO considered in this study (118V2020), related procurement procedures have been carried out from a single electronic platform at the national level, and since 2018 all of them tendered under a full e-procurement process [27]. Nowadays, however, not all EU state members have awarded their PSO contracts by tendering from a state contracting platform, but through various regional platforms (i.e. France, Italy, and the Czech Republic), and some, even not publishing all tender documents (i.e. Lithuanian and Croatian).

While a PSO air route can be designed exclusively for freights based on EU regulation [3], there has so far been no PSO imposition on cargo air route within EU Single Market, excepting one in Portugal imposed an air cargo/mail PSO from the mainland to the Azores in 2015. However, the related tender procedure has remained unsuccessful, as it did not find any airline to cover the route, so the imposition expired. In the case study of PSO routes on the Balearic island. Since no PSO has been imposed so far in Spain on freight grounds, the use of PSO air routes for cargo transportation in the Balearic has fallen drastically over the past years, especially given that the three routes have been operated by using airliners (either CRJ or ATR72 series) not very suitable for massive transport of goods (parcels, newspapers, and drugs only). As also discussed previously, prices could have raised artificially over the last few years due to the existence of a generous resident subsidy, and thus creating a market distortion. However, because of the complex nature of the issue, besides the lack of reliable price data over past years, there is not enough evidence that confirms this fact. A regulated single rate on each inter-island route would be a solution in stabilizing airfares concerned, such has been implemented by PCAA in the Azores islands. This public measure may, however, have the disadvantage of causing substantial price imbalance in the liberalized aviation market. Another solution would be a discount schema depending on the income level of the eligible passenger.

8. Future Directions and Research Limitations

In this paper, no theories are tested due to the scarce literature existing on the research area in terms of efficiency and sustainability from the PSO schema applied in EU island territories. However, some implications for theory development can are derived from the findings in this paper. This paper focuses on a relevant and rarely studied area in the field of transport economy, such as the effects of the PSO impositions on regional transportation in terms of efficiency and sustainability for the case of the Balearic Islands. It may also be appropriate to analyze possible transportation solutions for better sustainable mobility in island territories through an intermodal system network, combining both sea and air modes under a comminated ticket issued by a regional transport consortium with the participation of the national government. Moreover, based on some earlier studies, though not directly linked to sustainability of the PSO schema, an approach to the relationship between the social inclusion and economic development in those EU regions whose air transportation is considered essential and supported by PSO contracts. would also be very well suited to the issue [28]. Furthermore, further studies based on the efficient procurement of public air services could be useful for designing a theorical model that can be consistent with the necessities of a comprehensive system for the provision of regular air transport services such as the PSO schema [29]. Nevertheless, the lack of sufficient reliable data from a liberalized market whose players are no longer compelled to share their core busines information (such as fuel consumption, emissions, PLF, aviation fuel price agreements, etc.) with third parties, since most airlines are mostly private owned-companies, is one the most important research limitation on this topic.

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Institutional Review Board Statement: Not applicable.

Data Availability Statement: Not applicable

Informed Consent Statement: Not applicable

Appendix A

Airlines named in the paper (IATA code): Air Europa (UX), Air Belin (formerly AB), Air Nostrum (YW), Binter (NT), Easyjet (DS, U2, EC), Ryanair (RK, FR, RR), Vueling (VY).

Airports named in the paper (IATA code): Adolfo Suárez Madrid–Barajas (MAD), Almería (LEI), Badajoz (BJZ), Josep Tarradellas Barcelona-El Prat (BCN), El Hierro (VDE), Fuerteventura (FUE), Gran Canaria (LPA), F.G.L. Granada-Jaén (GRX), Ibiza (IBZ), La Gomera (GMZ), La Palma (SPC), Lanzarote (ACE), Málaga-Costa del Sol (AGP), Melilla (MLN), Menorca (MAH), Palma de Mallorca (PMI), Sevilla (SVQ), Tenerife Norte (TFN), Tenerife Sur (TFS).

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Subsection 3.2.c

THE PSO ROUTE BETWEEN MENORCA AND MADRID (ES03)

Impact of public service obligations in the island areas: The case study of scheduled air services for goods and persons between Menorca and Madrid

Impact of public service obligations on air route serving island areas: The case study of scheduled air services for goods and persons between Menorca and Madrid

ABSTRACT

Background: Thanks to intense efforts and determined action at the European level to liberalize the aviation sector, it has moved towards the formation of a genuine internal market of air services across the European Union (EU). In this regard, both the sharp rise in air traffic and the significant reduction of flight fares are some of the successes achieved through the consolidation of the European Single Market. However, the free market cannot always ensure a sufficient transportation level in certain areas, particularly in peripheral and remote regions. When basic transport needs of affected populations cannot be met in a proper way, the Public Service Obligation (PSO) schema usually becomes an effective tool for resolving this lack of adequate transport. Moreover, in the case of island territories, this matter needs to be addressed as a key socioeconomic issue for regional development, which is closely linked to the concept of territorial cohesion. Therefore, this study aims at understanding the importance of this form of public imposition on regular air services not only for passengers but also even as a rapid transport for certain goods between islands and the mainland. To that end, this research analyzes the impact of such administrative concession on passenger and good traffic relating to the air route between Menorca and Madrid.

Methods: To address the purpose of this research, primary data concerning this case study was collected from trusted sources for the reference years 2004 to 2018. Besides the legislation directly related to the PSO schema, the scarce literature existing on PSO routes liking island territories across the EU was also consulted in order to focus the research correctly.

Results: The findings of this research indicate that the PSO schema becomes an effective tool for thin routes linking island territories. However, the public contracts tendered so far have not stimulated the entry of more bidders.

Conclusions: The PSO schema may stimulate demand for domestic routes, but also considered vital for the economic development in peripheral or isolated areas. In the cases examined for this study, the introduction of resident subsidy (currently as of 75% discount off) has increased the demand for air transport services.

Keywords: aviation, European Single Market, Public Service Obligation, transportation, regional development, territorial cohesion, public intervention

INTRODUCTION

The mobility in the EU single market has been traditionally considered as a part of social cohesion policies, which is also intrinsically linked to its four freedoms of movement, in particular those related to goods and persons. On one hand, the existence of adequate means of transport in terms of availability and fares, indeed, encourages a proper transportation system, and therefore the mobility factor. Besides, transport needs in peripheral and remote areas usually lead to a special consideration, when there exists no realistic alternative to air transport, particularly for persons in terms of journey time and travel fares. On the other hand, the liberalization of EU airspace has undoubtedly led to a remarkable expansion of air services market. The deregulation packages, implemented in 1987, 1990, and 1993 respectively, have made possible not only the creation of the EU Single Market in aviation but also a genuine European area of air services, based on common procedures and full harmonization of the legal standard, where both goods and persons can be carried as freely as possible across its internal market. However, this does not necessarily increase the amount of domestic flights, in particular those related to air services on routes serving peripheral airports. In this regard, Dobruszkes [2009] points out that the competition primarily has benefited hub airports, as well as regional airports in peripheral areas with a significant tourist component, but many of them without a sufficient level of competition. Selymes [2010] points out that the social aspects of air transport by focusing on its role in the promotion of tourism. In fact, the lack of air services on development regions and peripheral territories. In recent years, several authors have analyzed the impact of PSO air routes on local economies through certain case studies. For instance, referring to the case of PSOs imposed on air routes in Scotland, Smyth et al [2010] wonders whether air transport is a necessity for social inclusion and economic development. In the case of Greece, Dimitriou & Sartzetaki [2018] argues that air transport has been essential for developing the national economy model because of its high dependence on tourism sector. It highlights the idea of establishing social aspects of air transport. Therefore, the air transport sometimes can need be intervened by public administrations in order to ensure the mobility of goods and persons in these regions, and thus to achieve greater territorial cohesion. on passenger and cargo movements. In the case of island or isolated territories, the transport needs is greatest. passenger and cargo movements. European Commission (EC)

AIR SERVICES BETWEEN MENORCA AND MADRID – A CASE STUDY OF PSO

The needs of transportation in peripheral areas usually represent a challenge to conventional transportation to solve the mobility needs of their populations. In the case of islands, air transport is indeed the fastest means of transport to carry goods and persons into mainland territories. Nevertheless, the fastest one does not necessarily mean the most suitable one in terms of efficiency and sustainability, particularly in the case of freights. This is precisely the case with the air corridor between Menorca (MAH) and Madrid (MAD), whose divergent evolution has been marked by a high seasonality of demand for air transportation and a considerable loss of competitiveness due to a lack of sufficient supply of such services, mainly as a result of an unprofitable operation during the winter season. In fact, among all PSO regular air services in Spain so far imposed, this route has joined the highest number of tendering processes related to procurement for PSO air services, some of which remained unsuccessful due to a lack of bids (see Table 1). Another important finding of this case study is that the scope of the PSO imposition has been limited to air services during the low season for each operating year (see Table 2). As a result of such poor demand, which even derived cessation of air operations on the route between the years 2011 and 2012, the requirements related to this air service had to be adapted to market circumstances by amending the corresponding PSO imposition (see Table 3). In the case under consideration in this study over 15 years, from 2004 to 2019, it can be observed (see Figure 3. Most common air carriers in terms of passenger numbers operating MAH-MAD from January 2004 to October 2019Figure 3) that the route enjoyed the interest of several airlines until the outbreak of the Great Recession, and thus resulted in a sharp decline of supply of air services. It is a precise example of how certain air routes, formerly profitable for carriers on free-market conditions, may lead to a need for impositions of a PSO. All this resulted in a singular nature of this case that gave rise to this research with the goal of developing a better understanding of issues related to regional transportation for goods and persons through the PSO schema. For this purpose, whenever possible, freight and passenger transport statistics have been derived from primary sources, such as airport operators or related public bodies. Moreover, information concerning tendering processes of PSOs has been collected from the national civil aviation administration and competent Community authorities, who have agreed to assist this research. Unfortunately, the same cannot be said when it comes to the question of airline sector collaboration: particularly the airlines recently operating on this route have refused to participate in this study. However, this challenge has been overcome by seeking alternative information sources, thanks to the researcher's relevant knowledge within the air transport industry.

Subsidization from tendering processes related to PSO imposition on the air route "ES03"

As noted earlier, the air route linking MAH and MAD (hereafter "ES03") has some peculiarities derived from its seasonal character, in addition to an erratic path of market supply of regular air transport services on this route. Between the years 2004 and 2012, several airlines operating this route had ensured adequate supply of these services, mostly for passenger air transport, even in the winter season. However, with the removal of this route from two key domestic market players, such as Air Nostrum [currently YW] (1994-ongoing) and Spanair [formerly JK] (1988-2012), precisely those operating mostly in the period of lowest demand, it became necessary to design a PSO route under type 3. Consequently, during the 6 (formerly 8) months of implementing each calendar year of a PSO contract, the awarded airline operating this route had been entitled to receive a fixed annuity compensation. As seen in Table 2, the corresponding tender procedures have not included a 12 months contract, and they have been largely connected to specific needs of each situation at all times. Indeed, this seems to have contributed to their ability to adapt the PSO schema to particular socio-economic circumstances of this route, in addition to the implementation of e-procurement procedures (since the contract "η"). Furthermore, Table 3 shows how significant the evolution of supply of scheduled air services on the "Spain – 3" from a route under a free market regime into a restricted route to one carrier and, as a result, what impact such conversion has had on the number of market players operating this route. It also seems that the supply trend on this route tends to consolidate a dual behavior, depending on whether it is in a high or a low demand season. Thus, this marks a PSO regime from November to April, while seen an open market from May to October.

Table 1. Summary of tender processes for PSO contracts of air services on the regular route "Spain – 3" (as of 31.12.2019)

Tender process	Tender budget	Award amount	Contract duration	Number of bids	Contract status
α: 197/A12	2,400,000.00	1,519,293.00	11 [i]	1	awarded
β: 155/A14	2,400,000.00	-	-	0	unsuccessful
γ: 155/14BIS	2,400,000.00	2,400,000.00	16	1	awarded
δ: 46/A16	2,071,835.00	2,071,835.00	16	1	awarded
ε: 177A18	180,000.00	180,000.00	2	1	awarded
ζ: 281A19	725,144.00	725,144.00	4	1	awarded
η: 209A19	1,200,000.00	-	16	0	unsuccessful
θ: 123A2019	1,390,000.00	1,389,821.00	12	1	awarded
ι: unrevealed	-	-	8 [ii]	-	expected
Σ (α, γ, δ, ε, ζ, θ)	9,166,979.00	8,286,093.00			

Source: Own work. Figure notes: i) On 29 March 2014, the PSO contract "α" was terminated before the contract ended. However, the awarded carrier (YW) decided to continue operating the route under free market regime, from 29 March to 31

May 2014; ii) The PSO contract "θ" is currently being performed until the end of April 2020, and it is expected that a new tender procedure could be launched throughout the year 2020.

While the Air Services Regulation 1008/2008

Table 2. Summary of tenders for PSO contracts imposed on the regular air route "Spain – 3" (as of 31/12/2019)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
2004	●	●	●	■	●	■	■	■	■	●	●	●
2005	●	●	●	●	●	■	■	■	■	●	●	●
2006	●	●	●	■	■	■	■	■	■	■	■	■
2007	■	■	■	■	■	■	■	■	■	●	●	●
2008	■	■	■	■	■	■	■	■	■	■	■	■
2009	■	■	■	■	■	■	■	■	■	■	■	■
2010	■	■	■	■	■	■	■	■	■	■	■	■
2011	■	■	■	■	■	■	■	■	■	■	■	■
2012	■	■	■	■	■	■	■	■	■	■	●	●
2013	■	■	α	α	α	●	●	●	●	α	α	α
2014	α	α	● [a]	● [a]	● [a]	●	●	●	●	γ	γ	γ
2015	γ	γ	γ	γ	γ	●	●	●	●	γ	γ	γ
2016	γ	γ	γ	γ	γ	●	●	●	●	δ	δ	δ
2017	δ	δ	δ	δ	δ	●	●	●	●	δ	δ	δ
2018	δ	δ	δ	δ	δ	●	●	●	●	●	ε	ε
2019	ζ	ζ	ζ	ζ	●	●	●	●	●	●	θ	θ
2020	θ	θ	θ	θ	●	●	●	●	●	●	θ	θ
2021	θ	θ	θ	θ	●	●	●	●	●	●	ι	ι

Source: Own work. Black circle "●" denotes the presence of a free regime market with only one carrier operating scheduled air services on this route, while black square "■" indicates the presence of a free regime market with some carriers operating scheduled air services on this route.

Table 3. Overview of PSO impositions on air services MAH-MAD (as of 30/11/2019)

Administrative act	Contract amount	Reference fare (€)	Minimum daily flights [a]	Operating period	Minimum number of seats available
Resolution of General Secretariat for Transport	22 June 2012	130	2	1 Oct - 31 May	90,000
Resolution of General Secretariat for Transport	28 February 2014	130	2[i] / 1[ii]	1 Oct - 31 May	74,000

Source: own work based on data from Spanish Ministry of Public Works and Transport. Explanatory notes: a) per leg. Figure notes: i) Thursday, Friday and Sunday, and Monday (excepting from June to September); ii) On other days within operating period.

Overview of transportation system between Menorca and Madrid

As of 2018, the island of Menorca has a population of 91,920 [INE, 2019], in addition to a positive migratory balance of 23,919 [IBESTAT, 2019]. The airport of Menorca (MAH), as part of air transportation network serving the Balearic Islands, is linked to both airports nearby, Palma de Mallorca (PMI) and Ibiza (IBZ). Furthermore, these airports are widely linked to several European cities, mostly in IATA Summer Season. Regarding scheduled transport services Madrid (MAD), peripheral areas usually represent a fundamental challenge to conventional transportation toward solving mobility needs of their populations. In the case of island areas, air transport is indeed often the fastest means of transport to carry goods and persons into mainland territories with the minimum of daily frequencies.

RESULTS AND DISCUSSION

This section aims to deeply describe how the authors gathered the air traffic statistics for this research and which results obtained from analyzing the issue were considered to answer the research questions. Firstly, passenger movement data relating to the air route “Spain – 3” from 2004 to 2019 was analyzed, and a significant impact of the effect of introducing scheduled air services from a PSO imposition under type 3 on such air route was observed. As discussed later, it appears that the particular manner to apply this form of public intervention restricting regular air services to one carrier but only in those during low demand season has had an important effect on the evolution of passengers carried on this air route. The introduction of a PSO for the provision of regular air transport services has slightly increased the number of passengers carried on a route not too seasonal. However, the increase of resident subsidy has not led a significant effect on the route performance, as would be desirable. It appears that air fares have not fallen sufficiently to stimulate the demand, despite the increase of resident subsidy. These challenges have not been fairly reflected in the key success factors considered in the study for the imposition of a PSO in seasonal manner while coexisting with a generous subsidy schema that does not differentiate between high and low incomes.

Approach on the issue from analyzing the facts relating to passenger transport

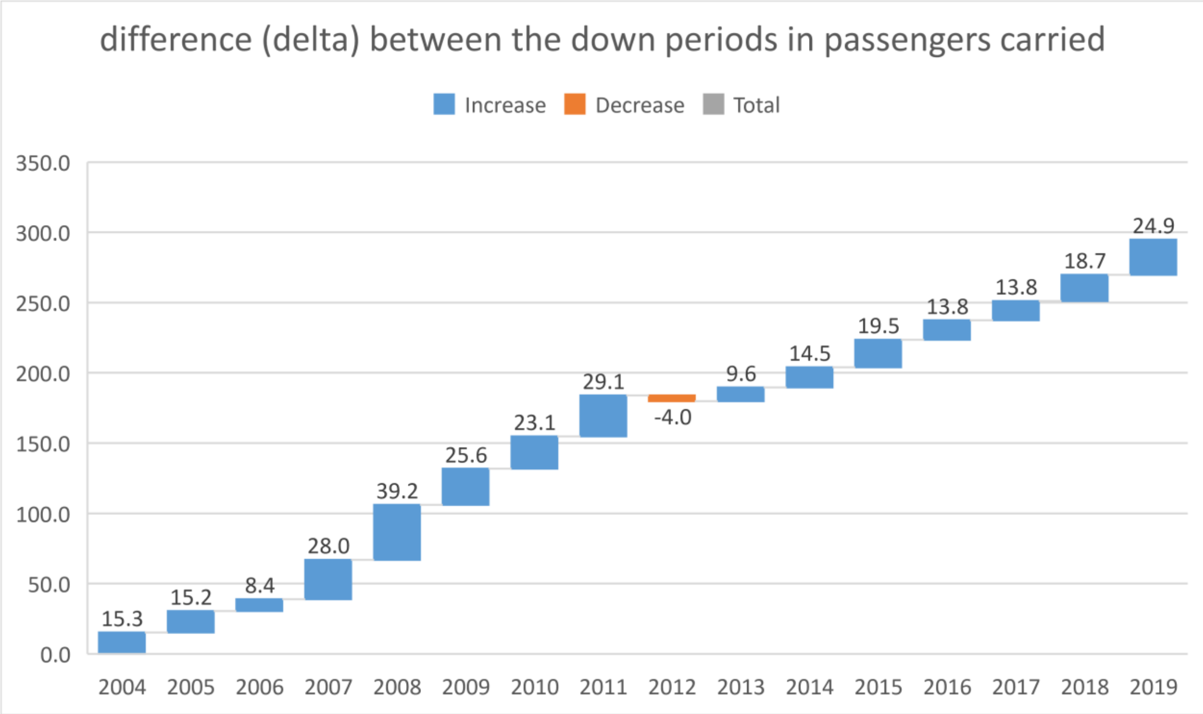
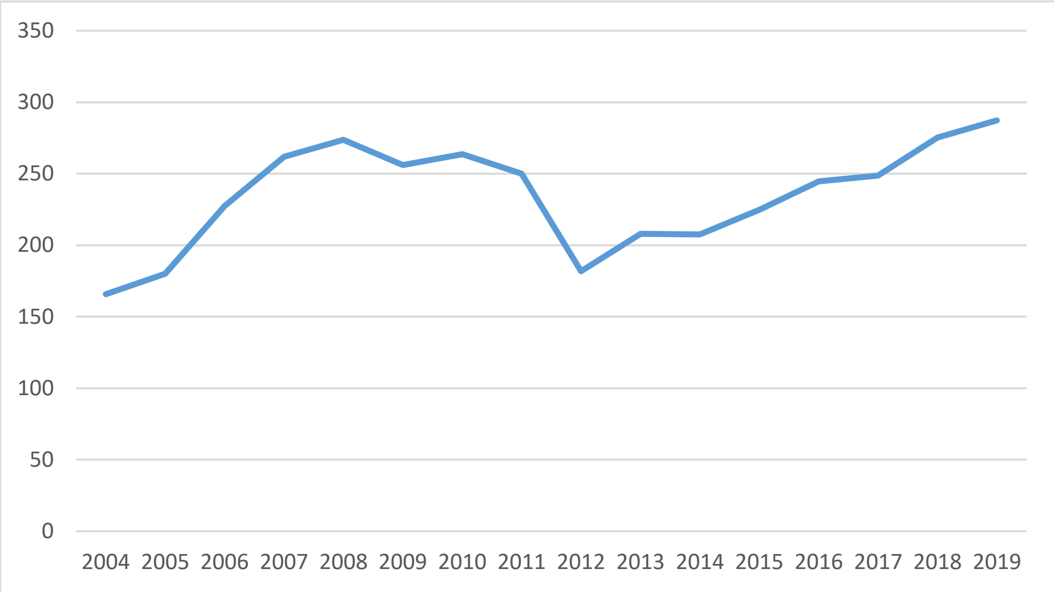


Figure 1. Annual number of passengers carried (in thousands).



Source: Own work from collecting data provided by AENA (2019).

Figure 2. Most common aircrafts in terms of passenger numbers operating MAH-MAD from January 2004 to October 2019

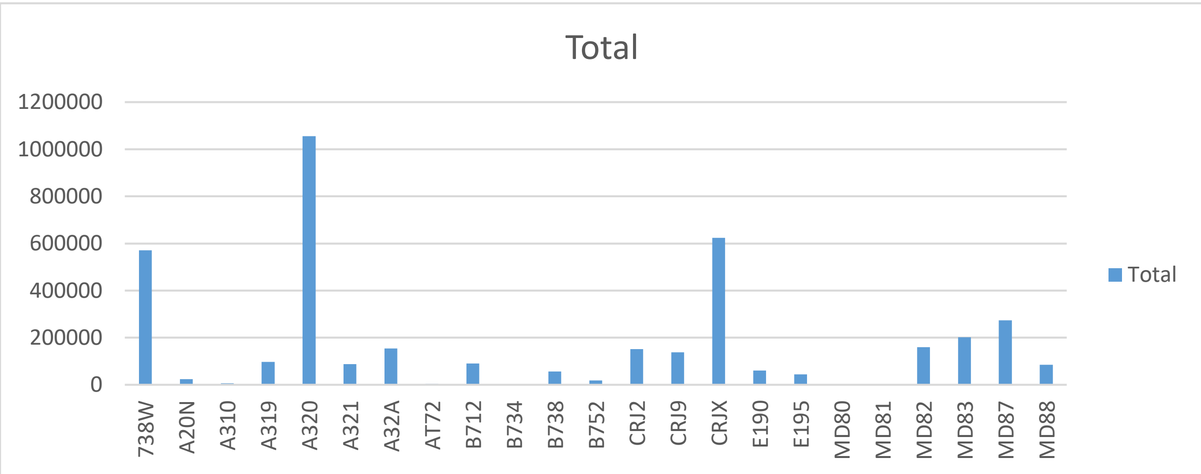
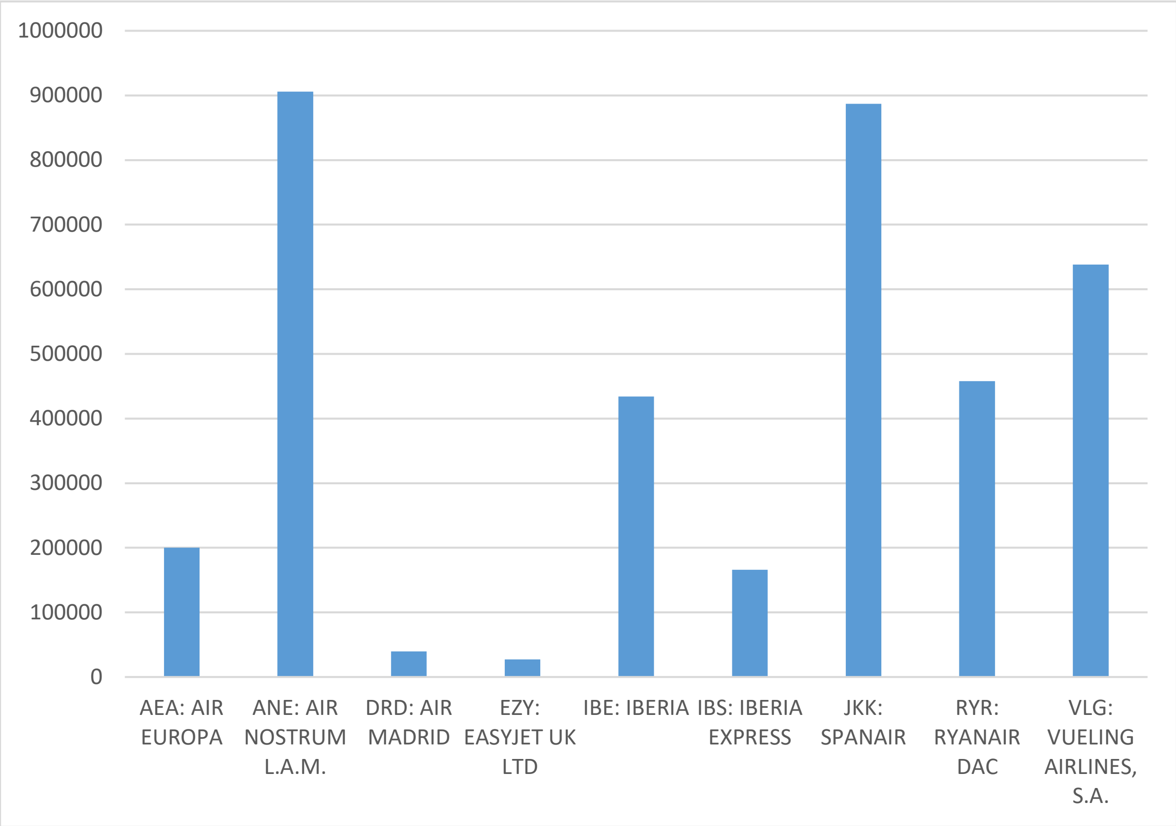
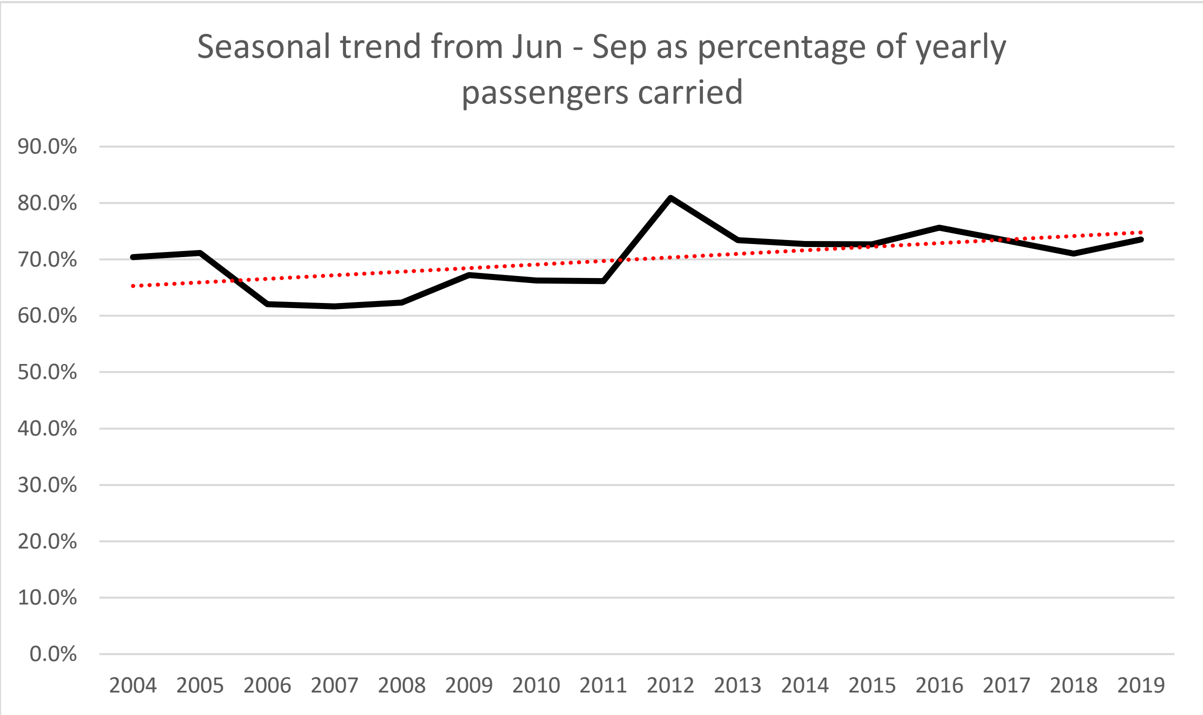
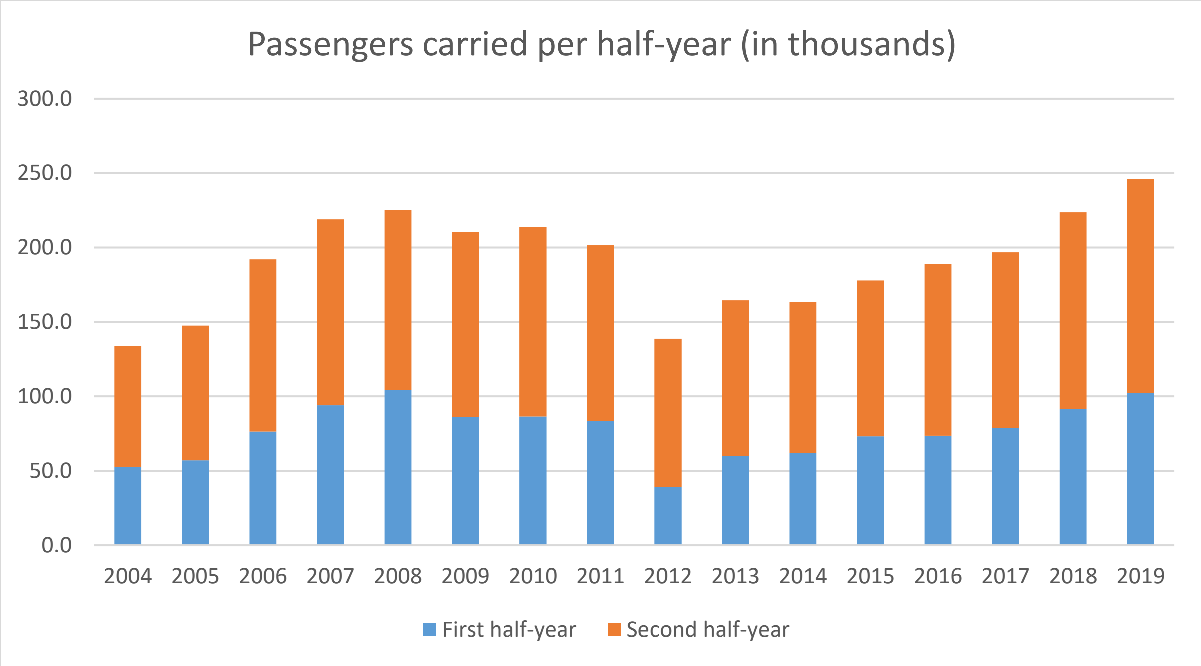


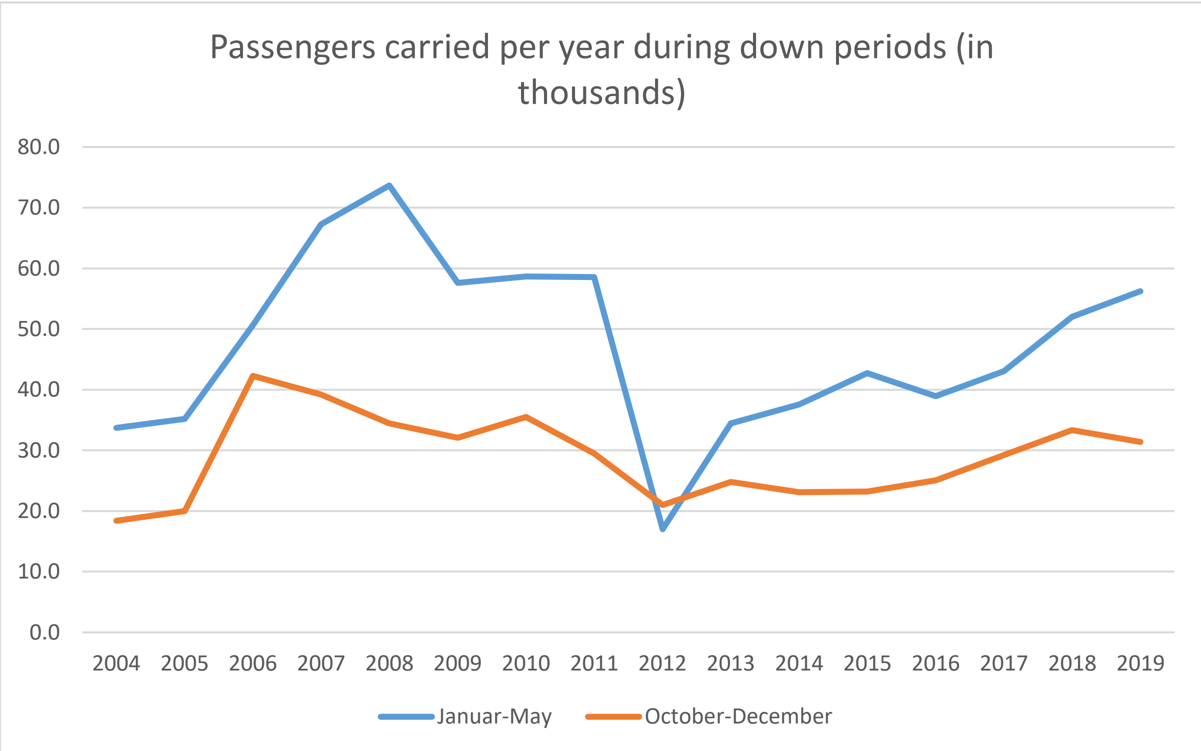
Figure 3. Most common air carriers in terms of passenger numbers operating MAH-MAD from January 2004 to October 2019



Source: Own work based on data provided by AENA. Explanatory note: Reference leg referred to the one-way route MAH-MAD.

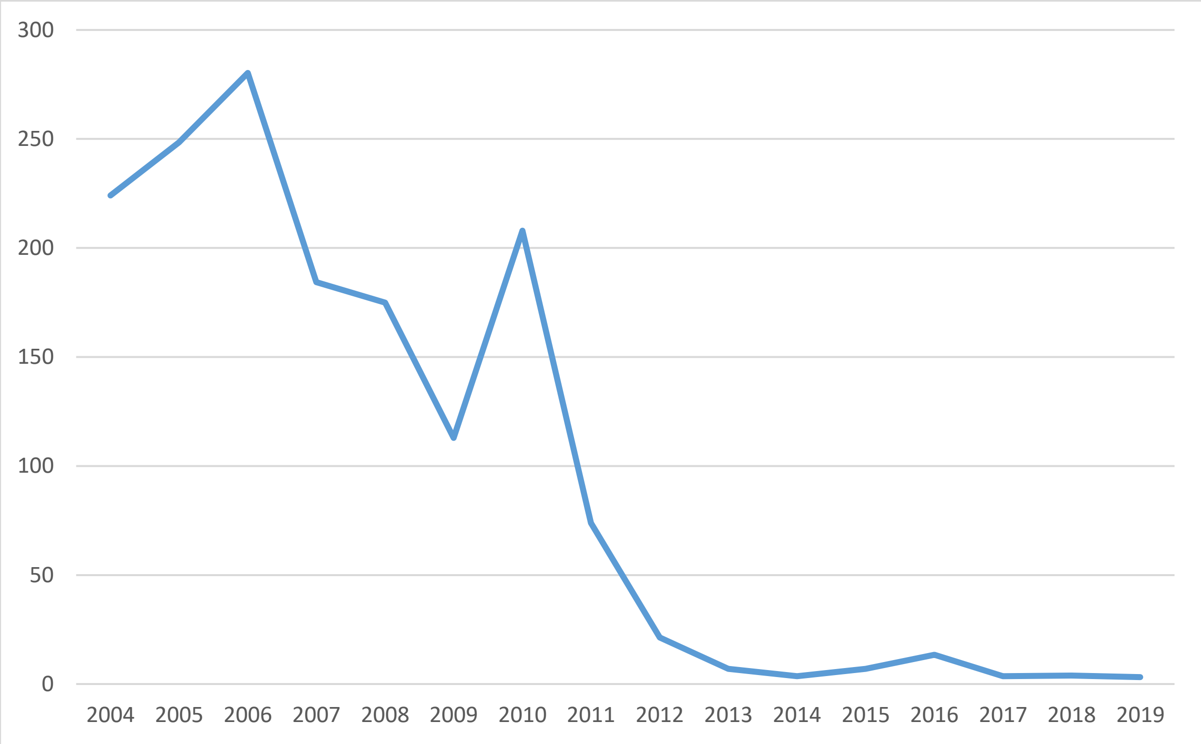



Passengers carried per half-year (in thousands)
300.0
250.0
200.0
150.0
100.0
50.0
0.0
2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
First half-year
Second half-year


Passengers carried per year during down periods (in thousands)
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
Januar-May
October-December

Approach on the issue from analyzing the facts relating to freight transport

Figure 4. Annual volume of goods carried (in tons).



Source: Own work based on database of AENA (2019). Explanatory note: The reference leg has been considered as of MAH-MAD.

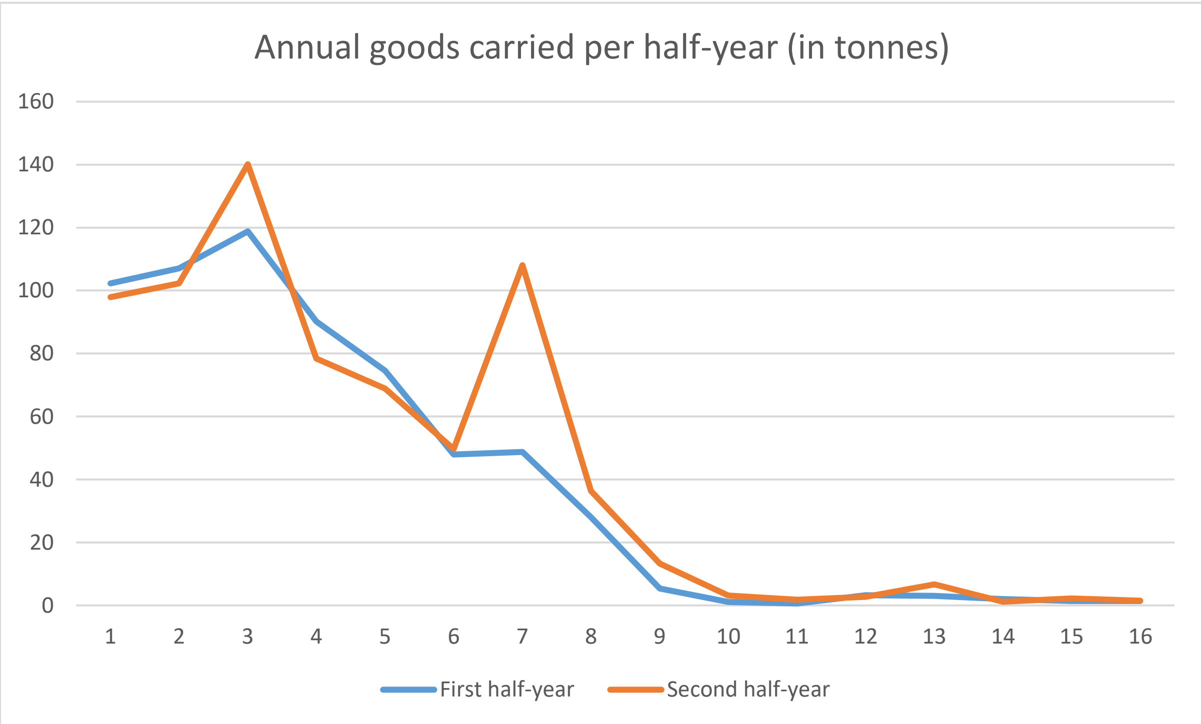
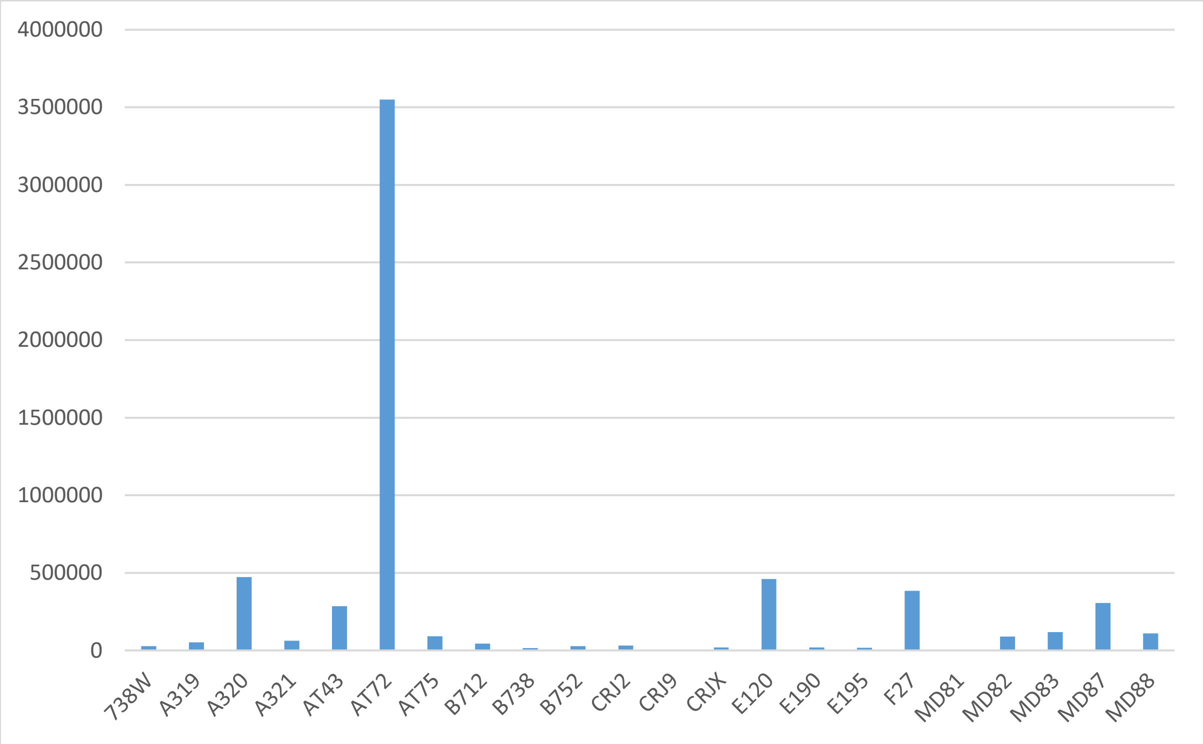


Figure 5. Aircrafts most operated to carry freights (in kgs.) from January 2004 to October 2019



Source: Own work based on data provided by AENA. Explanatory note: The reference leg has been considered as of MAH-MAD.

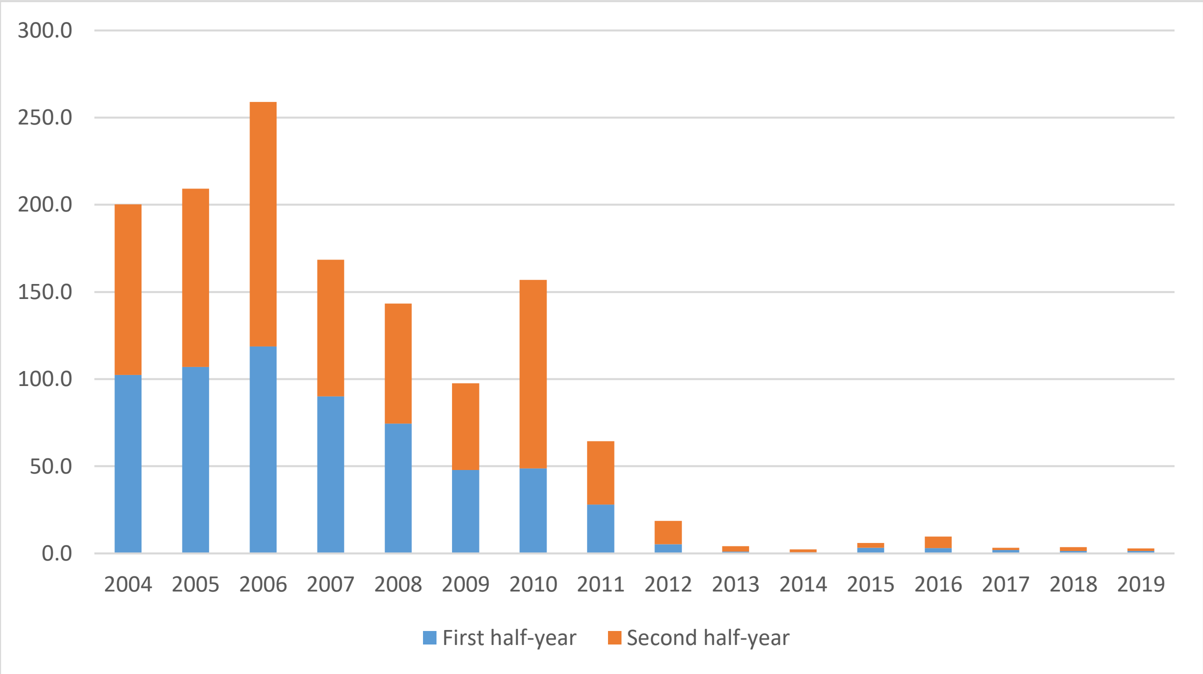


Figure 6. Annual volume of goods carried per half-year (in tons). Source: own work based on database of AENA (2019).

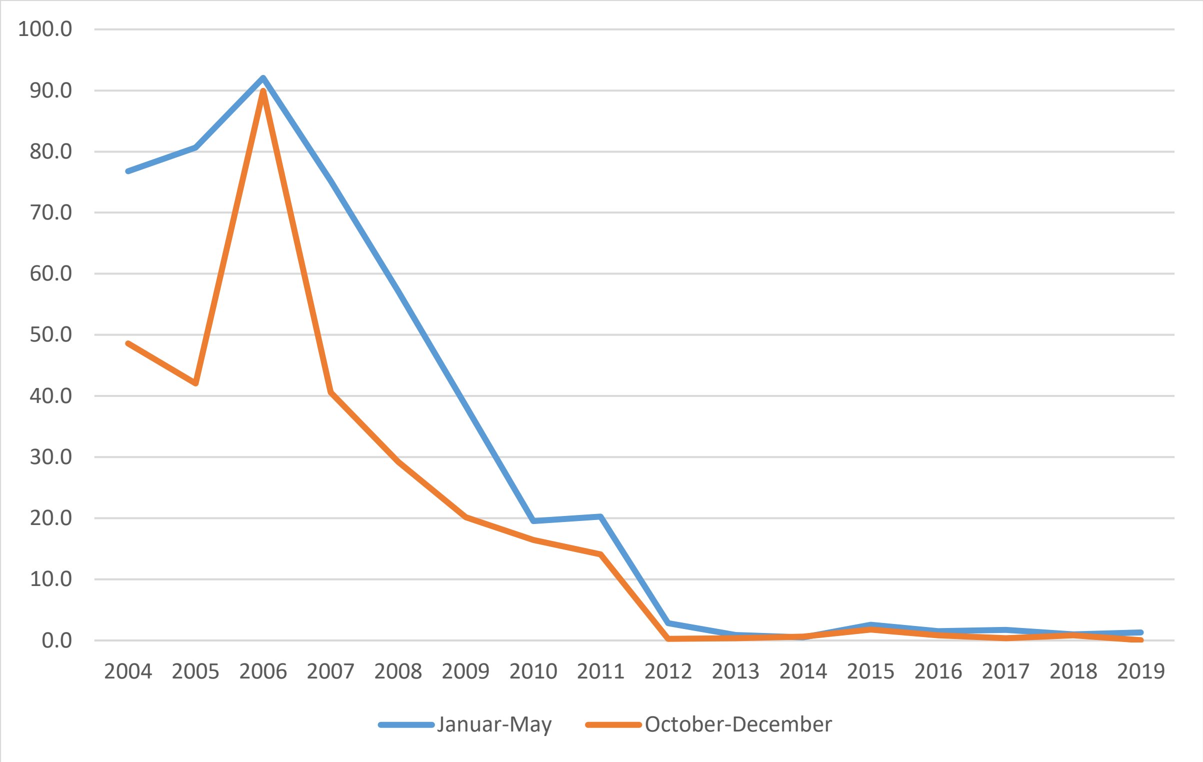


Figure 7. Annual volume of goods carried per year during down periods (in tons)

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Subsection 3.2.d

THE PSO INTERISLAND ROUTES IN THE CANARIES (ES06-18)

Efficiency and Sustainability of Regional Aviation on Insular Territories of the European Union: A Case Study of Public Service Obligations imposed on Scheduled Air Routes within the Canary Islands

Tentative Article

Efficiency and Sustainability of Regional Aviation on Ultraperipheral Territories of the European Union: An Approach to Public Service Obligations imposed on Scheduled Air Routes in the Canary Islands.

Part of Doctoral Thesis "The European Single Air Transport Market: An Empirical Approach on the Efficiency and Sustainability of Public Service Obligations in the Spanish Domestic Routes".

Abstract: Since the effective opening-up of the aviation market in the European Union (EU) from the entry in force of the third liberalization package to the start of 1993, the combination of low airfares and rapid expansion of short-haul flights between the Community Member States has gradually become a mainstream trend in the EU single market, leading better access to transportation. While liberalization eliminated the concept of cabotage in practical terms for any airline with a valid Air Operator Certificate (AOC) from an EU country and operating regular air services within another member state, several domestic flights, in most member states, have been traditionally operated by domestic airlines. Even though the liberalization measures had moved towards the formation of a genuine internal market for air transport services, air carriers, majority privately owned, have typically concentrated their supply of regular flights on profitable routes, especially those serving either tourist or business destinations. This causes the market to focus the offering of regular flights mainly on high yielding routes. As a result, some communities have suffered the lack of affordable air transportation, particularly those located in remote and peripheral regions. With the purpose of solving this market failure, the Public Service Obligation (PSO) schema has been introduced from the Articles 16-18 of the Air Services Regulation 1008/2008. This paper aims to provide an approach to the PSO system imposed on interisland routes serving the regional transport needs of the Canary archipelago. This study has analyzed data relating to freight and passenger traffic in the period between 2004 and 2019 from scheduled air transport services on 13 PSO air routes applied so far in the Canary Islands (as of 18 September 2019). Results obtained in the study suggest that the PSO impositions, together with significant improvement in the resident subsidy schema (from 50% to 75%), have recently led to a sharp increase in the demand for passenger air services on the routes considered; thus, avoiding the tender for the award of a public contract from the PSO schema. However, this has not been translated into cheaper fares in general terms, but only for residents due to the subsidy concerned. Moreover, this does not seem to have had a noticeable impact on freight transport, since this public intervention on the liberalized aviation market has only sought to ensure the mobility of passengers. Since the EU Single Market in aviation is faced with the sustainability of operations in air transportation, this research has also analyzed certain details on performance by operating regional airplanes, either turboprops or turbofans, for better sustainable development.

Keywords: European Union (EU); public transportation; Public Service Obligation (PSO); regional transport; passenger traffic; scheduled air services; freight transport; public intervention; mobility.

1. Introduction

Up to the end of 2019, the aviation industry had experienced significant growth and expansion in the European skies due to the existence of an effective internal market for air transport services, whose scope is consequently wider than the mainland Europe, as includes the European Union (hereafter EU) and European Free Trade Association (hereafter EFTA). The deregulation had been carried out, among other reasons, thanks to an orderly process of measures to open the air transport market, so-called liberalization packages, that successively were approved in December 1987, June 1990, and July 1992. Following the entry into force of the third package on 1 January 1993, the market-opening process gave way to the formation of a genuine single market for air transport services. As can be seen in Table 1, market liberalization has been underpinned by a coordinated legislative approach towards common legal framework across the European internal market in aviation. In order to provide European airlines with the same market access opportunities as other national carriers in operating regular air services on domestic routes (also known as cabotage), it was necessary to introduce the concept of 'community air carrier' to harmonize the level of legal protection of those airliners with a valid Air Operator Certificate (AOC) granted by any national civil aviation administration at the EU level.

Despite the huge efforts made from the European Commission (hereafter the Commission) to stimulate more competition in the aviation market, there was not a fourth air package which should have used to encourage a truly competitive airport market, especially given that it is one of the key constraining factors that represent a bottlenecks to equitable growth in air transportation across the EU territory. This is particularly relevant for those communities whose needs of affordable transportation are usually vital for socioeconomic development. This concern prompted the creation of a Public Service Obligation (hereafter PSO) schema with the expectation that transport services may be ensured from the related imposition due to social interest and public service of the air transportation, particularly when this cannot be met by alternative modes of transport in terms of frequencies and time travel.

Table 1. Key milestones from liberalization measures of the air transport market so far achieved.

First Air Package	Status	Air transport issues	Air service issues	Reference
Regulation (EEC) No 3975/87	No longer in force	■		[1]
Regulation (EEC) No 3976/87	No longer in force	■		[2]
Directive 87/601/CEE	No longer in force		■	[3]
Directive 87/602/CEE	No longer in force		■	[4]
Second Air Package				
Regulation (EEC) No 2342/90	No longer in force		■	[5]
Regulation (EEC) No 2343/90	No longer in force		■	[6]
Regulation (EEC) No 2344/90	No longer in force	■		[7]
Third Air Package				
Regulation (EEC) No 2407/92	No longer in force	■		[8]
Regulation (EEC) No 2408/92	No longer in force	■		[9]
Regulation (EEC) No 2409/92	No longer in force	■		[10]
Regulation (EEC) No 2410/92	No longer in force	■		[11]
Regulation (EEC) No 2411/92	No longer in force	■		[12]
Regulation (EEC) No 95/93	In force		■	[13]
Air Services Regulation				
Regulation (EC) No 1008/2008	In force		■	[14]
Interpretative Guidelines	In force		■	[15]
Slot Regulation				
Regulation (EC) No 894/2002	In force		■	[16]
Regulation (EC) No 1554/2003	In force		■	[17]
Regulation (EC) No 793/2004	In force		■	[18]
Regulation (EC) No 545/2009	In force		■	[19]

Source: Own compilation based on the analysis of current EU legislation. Caption: Black square "■" denotes an application scoping mostly the field concerned while blank space indicates mainly not exclusively applicable.

2. Some considerations about the PSO schema in the EU single air transport market

Although the European aviation sector enjoys a high level of competition from the entry into force of the third package of market liberalization measures, (1993) and subsequent completion of the internal market (1997), the benefits of the liberalized market has not been distributed in a balanced and equitable manner across the EU. That is particularly true in peripheral air links serving small-community airports, most of them even with low demand for regular passenger services (also known as 'thin routes'), since airlines usually focus their commercial action on those routes with high yields from either revenue passenger mile (RPM) or revenue ton mile (RTM), being much more prevalent in the case of major airlines (including certain low-cost carriers). Apart from such routes on which domestic carriers, either regional or national airlines, usually operate to feed the network of a major airline, certain communities may be under-connected due to the lack of supply of public transportation in certain routes. Thus, the PSO schema is aimed at solving such market failure by providing a common mechanism for implementation from any EU state member. However, this system is not implemented from a centralized system at the EU level neither for executive administration nor for public funding purposes. The PSO schema has been used so far as a remedy for the lack of scheduled air transport services on 176 air routes across thirteen EU state members (as of 18 September 2019). As summarized in Table 2, this also applies to scheduled flights operating from either open or closed PSO imposition. If the provision of related transport services needs to be ensured with a public contract, the procurement procedure is organized at the domestic level, although it has to be announced at the EU level through the EU official journal (hereafter EUOJ), with the exception of those impositions whose expected number of passengers is less than 10,000 per year according to articles 16(5) and 17(2) of [14]. Moreover, in order to prevent unnecessary distortions in the EU internal market, competent national authorities have to provide the Commission with evidence that the requested PSO imposition is both necessary and adequate and that it also meets the eligibility criteria for the provision of regular transport services according to EU regulation (Article 16(3) of [14].

Table 2. Key features of PSO schema for scheduled air services under the regular procedure.

	Type 1 (Open PSO)	Type 2 (Closed PSO)	Type 3 (Closed PSO)
PSO Justification	■	■	■
PSO Imposition	■	■	■
PSO Limitation [a]	●	●	●
Call for tender			■
Information notice in the EUOJ	■	■	■
Restricted access to one carrier		■	■
Preference fares for residents [d]	●	●	●
Maximum fares [e]	●	■	■
Reference rates	■		
Weekly frequencies	●	■	■
Annual seating capacity	●	■	■
Economic compensation			■
Contract duration [b]			■
Equipment [c]	●	●	●

[1] Source: Own work based on an analysis of current EU legislation, [14] and [15]. Caption: Black square "■" denotes a mandatory requirement from a PSO imposition while blank space indicates "not applicable" under the imposition of a PSO on regular air routes concerned. Black circle "●" denotes a specification not strictly necessary. Explanatory notes: a) If air services have not been operated in 12 months on the air route concerned, the imposition shall be expired and then moved on to operate in the free regime (Type 0); b) Up to 4 years (5 years for overseas routes); c) Type of aircraft recommended; d) Not to be confused with resident subsidy regimes existing in certain special territories in the EU according to the Article 107(1) of the Treaty of the Functioning of the European Union (TFUE); e) Habitually referred to references rates (i.e. in the case of Spanish impositions they are usually calculated up to 25% thereof).

3. Basic aspects of the PSO impositions applying in Spanish air domestic market

Given the fact that Spain is the state member with the EU-27's largest surface area (505,990 km^2), but the fourth country (47,329,981) in population according to Eurostat (as of 24 November 2020), besides an extensive coastal line with great population areas and some regions with highly rugged orograph, it is not that simple to form an efficient public transportation network in meeting citizens' mobility needs that are necessary to economic progress and growth throughout the national territory. This is most evident when people are living in remote areas, as well as peripheral territories and isolated cities. In the case of the Canary island (see Table 3), this is even more noteworthy taking into account that they are considered ultraperipheral territories in the EU. Situated far away from European mainland, most peripheral areas do not enjoy affordable transport services in comparison with those living in populated areas and urban centers located near transport hubs. Additionally, ultraperipheral regions have traditionally suffered from a lack of affordable transportation connecting regular passenger services to hub airports, especially during periods of slack demand. Since low seasons usually coincide with those where tourist activity decreases, air carriers usually tend to adjust the supply of regular services to the real demand by adapting flight schedules that, moreover, are often released up to six months before starting operations., even when exposed to a high seasonality due to heavily dependent on tourism. Although thing routes may be unprofitable, regional authorities and national governments have often advocated to ensure direct flights for socioeconomic reasons, as they may be indispensable for the development of regional economies, in addition to territorial cohesion. To that purposes, special member state territories (for instance, those located on the Atlantic sea, such as the Spanish Canary islands or the Portuguese Azores and Madeira islands), enjoy a specific tax regime that is different from that applied in the EU mainland territory. Although the challenge to the economic and social cohesion of the less favored regions, including ultraperipheral areas, was shortly reflected in Article 174 of the Lisbon Treaty, there has been attempt at unifying a special fiscal framework for island territories within the UE tax regime. Since it was recognized the condition of insularity at the national level for the Canary Islands, a special tax regime has been introduced [2]. Besides specific measures, such as resident subsidies or public benefits, so far applied for those legally living in the Canary Islands, there is an economic and fiscal regime from the Economic and Fiscal Regime (REF), in addition to the Special Economic Zone (ZEC).

Table 3. Existing PSO air routes in the Spanish domestic air transport market (as of 1 March 2020).

Route code	Airport (from/to)	IATA [b] code	Airport (to/from)	IATA [b] code	Last PSO contract	Airline Operating [c]	Current PSO type
ES06	G. Canaria	LPA	El Hierro	VDE	20/A16 [ii]	NT, PM	1
ES07	G. Canaria	LPA	Tenerife S.	TFS	20/A16 [ii]	NT	1
ES08	G. Canaria	LPA	Fuerteventura	FUE	-	NT, PM	1
ES09	G. Canaria	LPA	Lanzarote	ACE	-	NT, PM	1
ES10	G. Canaria	LPA	Tenerife N.	TFN	-	NT, PM	1
ES11	G. Canaria	LPA	S. C. Palma	SPC	-	NT, PM	1
ES12	La Gomera	GMZ	La Palma	LPA	15/A18 [i]	NT	3
ES13	La Gomera	GMZ	Tenerife N.	TFN	15/A18 [i]	NT	3
ES14	S. C. Palma	SPC	Lanzarote	ACE	-	NT, PM	1
ES15	Tenerife N.	TFN	El Hierro	VDE	-	NT, PM	1
ES16	Tenerife N.	TFN	Fuerteventura	FUE	-	NT, PM	1
ES17	Tenerife N.	TFN	Lanzarote	ACE	-	NT, PM	1
ES18	Tenerife N.	TFN	S. C. Palma	SPC	-	NT, PM	1

Source: Compilation based on information collected from both [20] and [21]. Key notes: i) In force; ii) No longer in force. Explanatory notes: a) That obligation is not applicable during the period between May and October; b) International Air Transport Association (IATA); c) Carries with scheduled flights only on the route.

4. Addressing the issue of ensuring regional air transport in the Canary through PSOs

In the scope of PSO impositions serving island airports, those connecting islands with each other within an archipelago deserve particular attention, given that the provision of regular air transport services has been usually considered essential for socio-economic development in island territories. This is particularly the case of the PSO system applied in the Canary Islands that comprises 13 air routes (see Figure 1) and 8 airports (see Table 4). This public transportation network involves 8 airports belonging to a state-owned company (hereafter referred to as Aena). Some of them are also an essential part of the national airport network in terms of passenger traffic, as they are among the Spanish top ten airports (LPA and TFS). As can be seen in Table 3, most of them have led to a steady growth in passenger traffic in recent years, which is fundamentally due to tourism activities. All of this reinforces the idea that the existence of accessible and affordable transportation is vital for the tourism sector of the Canary Islands, and therefore for the regional economy. Moreover, the interisland traffic has a social component that cannot be overlooked in the analysis of whether the regional passenger air transport is efficient, but also environmentally sustainable. To achieve this, public efforts have focused on the enhancement of regular air transport services over past years by imposing a PSO on the air routes considered, in addition to introducing a special subsidy for residents (recently increased from 50% to 75%) [22]. In 1998, the three routes commenced to be operated under the first PSO imposition, and subsequently under the two imposition changes (2006 and 2011, respectively). The existence of a PSO on these Canary routes had been successful in ensuring passenger air transport services in terms of availability and continuity until the outbreak of the recent crisis due to the coronavirus pandemic (COVID-19). Since the beginning of 2020, and as discussed in the following section, this worldwide event has become disruptive in the tourism sector, and thus in the aviation industry. Although some earlier papers have focused the study on the PSO schema serving island territories, in the case of interisland air routes, the scarce literature existing on PSOs implanted in the two Spanish archipelagos regarding efficiency and sustainability is completely non-existent today. Although the first PSO impositions were introduced in 1998 from the first package of 13 interisland routes in the Canary Islands, market liberalization has resulted in certain dysfunctions of mobility and public transport, thus affecting territorial cohesion [23]. This often causes high fares, especially on routes with a demand seasonality, such as in Sardinia [24]. Similar considerations in this regard can be applied to the Azores routes, fully operated under a PSO system with varying degrees of success, as it should have been aimed at maximizing social welfare instead of minimizing total social costs [25], or even towards an approach combining cost and level-of-service objectives without crisis scenario [26].

Table 4. Key facts of air passenger traffic at airports considered (2004-2019).

IATA Code	Airport Group [a]	Airport Typology [b]	Airport Category [c]	Average Annual Passenger Traffic [d]	CAGR (%) [e]
LPA	Canary	Touristic	Level 3	10,747,000	0.5
VDE	Canary	Regional	Level 2	185,000	1.0
TFS	Canary	Touristic	Level 3	9,099,000	0.4
TFN	Canary	Regional	Level 2	4,178,000	0.9
FUE	Canary	Touristic	Level 3	4,689,000	0.5
SPC	Canary	Touristic	Level 2	1,108,000	0.6
GMZ	Canary	Regional	Level 2	185,000	1.0
ACE	Canary	Touristic	Level 3	5,910,000	0.4

Source: Own calculation based on information from Aena database [27]; additional information provided by the Spanish Directorate-General for Civil Aviation (DGAC) upon request. Explanatory notes: a), b) According to the classification provided by Aena; c) According to the categorization under Article 3 of [13] and Article 4 of [28], Spanish air facilities are classified as non-coordinated airports (Level 1), airports with schedules facilitated (Level 2), or coordinated airports (Level 3); d) Total amount including both arrivals and departures at each airport; e) Compound annual growth rate.

Regarding sustainability of air routes from Table 5, operating such short-haul flights are practically compelled to have a competitive fleet that includes regional airliners designed to carry up to 100 passengers. Concerning the travel distances considered in the case study (less than 500 kilometers), besides route performances concerned, a turboprop plane is much more better choice (i.e. ATR-42/72 series) than a turbojet plane (i.e. Embraer E-family), as can be seen in Figure 2 and Figure 3, respectively.

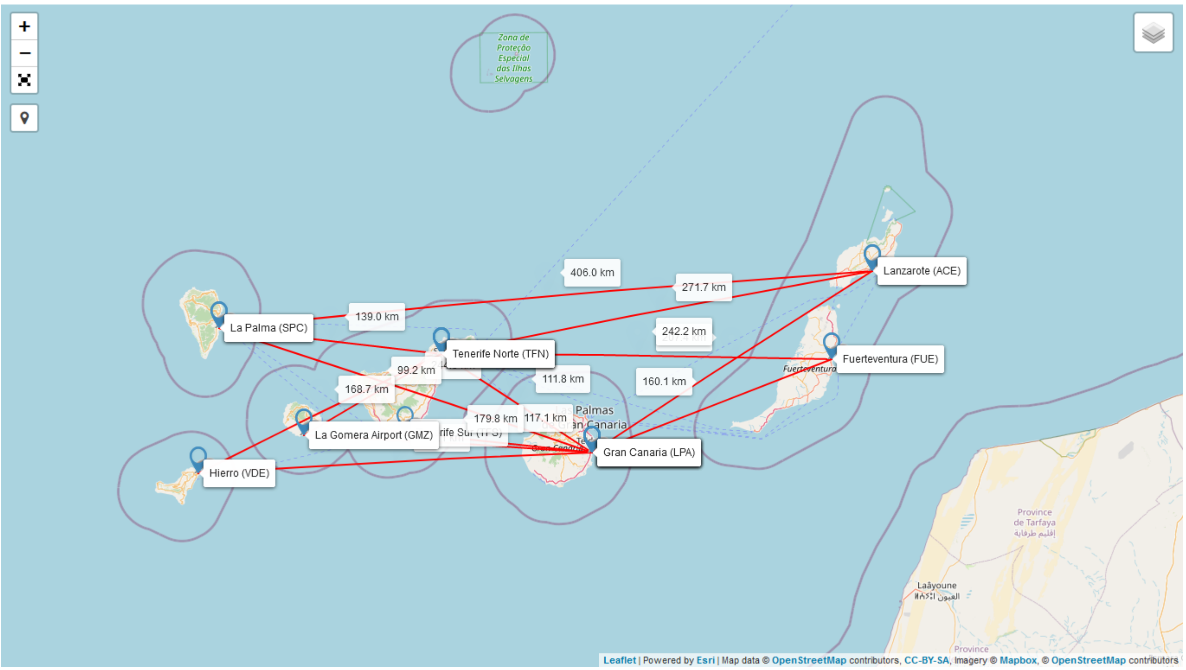

Figure 1. PSO air routes in the Canary Islands (since 1 May 2019). Source: Prepared with FreeMapTools.com

Table 5. Some operational facts of PSO air routes serving the Canary Islands (as of 31 December 2019)

Route Code	Distance (km) [a]	Travel time (h)	Heading Direction	Block Fuel (kg) [b, c]	CO2 Emissions (kg) [b, c]	Standard Aircraft	Emissions CO2/PAX (kg) [b, c]
ES06	247	0:49	268° (W)	434.3	1,368.1	ATR72	19.0
ES07	117	0:34	276°(W)	205.7	648.1	ATR72	9.0
ES08	160	0:39	68° (ENE)	281.3	886.2	ATR72	12.3
ES09	208	0:44	57° (ENE)	356.7	1,152.1	ATR72	16.0
ES10	112	0:33	303° (WNW)	196.9	620.4	ATR72	8.6
ES11	245	0:49	289° (WNW)	430.8	1,357.0	ATR72	18.8
ES12	180	0:41	93° (E)	316.5	997.0	ATR72	13.8
ES13	99	0:32	59° (ENE)	174.1	548.4	ATR72	7.6
ES14	407	1:08	84° (E)	639.8	2,015.2	ATR72	28.0
ES15	169	0:40	244° (WSW)	297.2	936.1	ATR72	13.0
ES16	243	0:49	90° (E)	427.3	1,346.0	ATR72	18.7
ES17	272	0:52	78° (ENE)	478.3	1,506.6	ATR72	20.9
ES18	139	0:36	277° (W)	244.4	769.9	ATR72	10.7

Source: Own calculation partially based on a performance study provided by ATR upon specific request. Explanatory note: a) Orthodromic distance; b) Standard assumptions: Jet A1 density as of 0.804 kg/l, CO_2 emissions as of 3.15 kg of CO_2 per kg of Jet A1; c) En-route assumptions: Max. payload, no wind, 1 aircraft per leg under technical specifications by International Standard Atmosphere (ISA), Joint Aviation Requirements (JAR), European Union Aviation Safety (EASA).

Figure 2. Aircraft type, ATR72-600, most operated on interisland routes in the Canaries (courtesy of Binter)

Figure 3. Aircraft type, E2-195, recently added to the regional leading airline operating in the Canary Islands (courtesy of Binter)

5. Overall Findings and Key Results from the Study

Beyond shaping a fundamental part of the EU special territories, ultraperipheral territories have been put at a competitive disadvantage as most of them have faced specific public measures that facilitate a more inclusive social policy in terms of territorial cohesion. In the case of the Canary Islands, one of the nine Outermost Regions (OMR) in the EU, transportation issues have not been only subject to the mobility needs for traveling into Spanish mainland, but among the islands of the archipelago. In the case of the Canary Islands, one of the nine Outermost Regions (OMR), the provision of scheduled flights for passengers has been operated continuously from a PSO imposition since 2003. Moreover, the provision of the related public services on the Canary routes (except for ES06 and ES07, ES12 and ES13) had been ensured without the need for a PSO contract until the entry into force of the state of emergency from entire territory in Spain due to the COVID-19 [22]. As shall be seen later, this situation has obliged central administration to ensure minimum air transport services for those persons entitled to move within the national territory (i.e. essential workers) through the PSO contracts and to fly up on interisland routes.

Once the selected routes had been selected as an essential service in accordance with Article 95 [30], related transport services were therefore designed on the premise that certain segments of the population with fewer resources may have more difficulty in accessing transportation, in addition to the protection of vulnerable groups as old and young people. In the period considered for the case study, two major features have been observed from the original imposition (1998) of a public obligation for the provision of regular passenger transport services on air routes in the Canary Islands, and subsequent amendments (2006 and 2011), which is also connected to the two legislative reforms relating to the implementation of PSO schema in Spain so far carried out. The first being pro-competitive and the second being restrictive, entered into force in 2006 and 2011 respectively [31]. Firstly, the original public obligations in the interisland air routes of the Canary Islands had been set out for the first time in Spain (1998), even before a common framework for PSO impositions at the EU level started (2008). It has aimed to provide a stable operational framework for those airlines interested in scheduling flights under certain conditions from a PSO imposition on the 13 air routes considered. All of them (except the ES06, ES07, ES12, and ES13, under either type 2 or 3) had been initially operated under type 1 until the entry into force of state alarm due to COVID-19 [32]. It was then that the one (PM) of the two carriers (NT, PM) operating interisland routes in the Canary Islands by the end of 2019 was forced to cease temporarily operations in March 2020. As a result, one carrier (NT) has become the only airline operating scheduled air transport services among the Canary Islands.

Table 6. Operational facts of PSO contracts on air routes at Canary airports awarded so far

Symbol Caption	Contract Reference	Public Funding	Tender Budget	Award Amount	Contract Period	No. of Bidder	Awarded Airline
α	108/A14 [a]	National	€6,200,000	Unsuccessful	16 months	1	-
β	108 BIS/A14 [a]	National	€6,200,000	€6,149,904	16 months	1	NT
γ	20/A16	National	€5,581,000	€5,580,000	24 months	1	NT
δ	15/A18	National	€5,731,000	€5,179,200	36 months	1	NT
ε	79/A18	National	€0 [b]	Unsuccessful	24 months	1	-
ζ	141V2020	National	€368,000 *	€368,000	16 days	1	NT
η	161V2020 [c]	National	€500,000 *	€500,000	14 days	1	NT
θ	161V2020 [c]	National	€500,000 *	€500,000	14 days	1	NT
ι	161V2020 [c]	National	€607,142.86 *	€607,142.86	17 days	1	NT

Source: Own compilation based on data collected from tender dossiers concerned. Explanatory note: a) Only applicable for ES06 and ES07, ES12, ES13; b) As pre-calculated operating deficit over a two-year period; c) Extended contract. Additional note: (*) Emergency procedure according to Article 16 of Royal Decree-Law 7/2020, of 12 March, adopting urgent measures to respond to the economic impact of the COVID-19 and Article 120 of Law 9/2017, of 8 November, of Public Sector Control.

Given the critical situation due to the pandemic, the national government was forced to ensure the provision of essential air transportation among the Canary islands in awarding these transport services resulting from tendering for two public contracts (1412V2020 and 161V2020) for a total of €368,000 and €1.607.142,86, respectively (see Table 6).

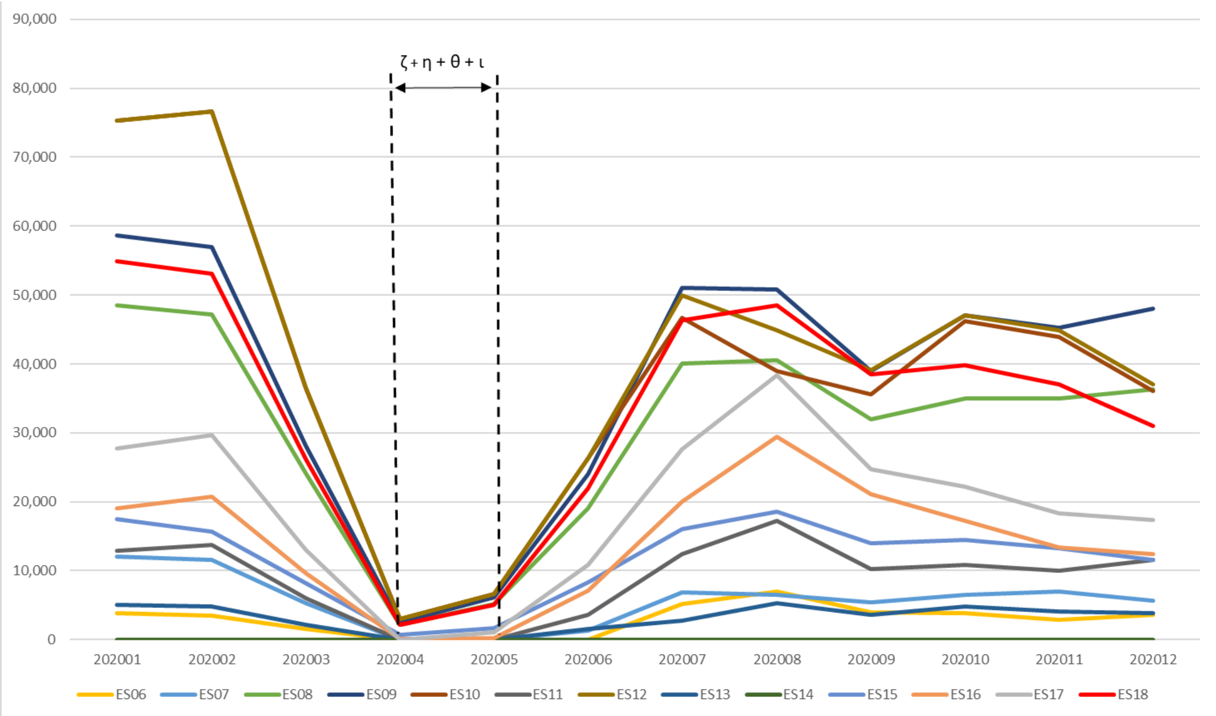

Figure 4. Monthly passengers carried on PSO routes serving the Canary Islands in 2020. Source: Own work based on data collected from air traffic statistics [28].

Table 7. PSO contracts relating to the provision of regular transport services in the Canary Islands (as of December 2020)

PSO	α	β	γ	δ	ε	ζ	η	θ	ι
ES06	x	x	x		x				
ES07	x	x	x						
ES08						x	x	x	x
ES09						x	x	x	x
ES10						x	x	x	x
ES11									
ES12	x	x	x	x					
ES13	x	x	x	x					
ES14									
ES15						x	x	x	x
ES16									
ES17									x [a]
ES18						x	x	x	x

Source: Own compilation based on information collected from tender dossiers for PSO contracts concerned. Note: a) Starting operations on 13 May 2020.

Table 8. Operating regime of regular flights on air route ES06 and ES07 since 2004

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2004	●	●	●	●	●	●	●	●	●	●	●	●
2005	●	●	●	●	●	●	●	●	●	●	●	●
2006	●	●	●	●	●	●	●	●	●	●	●	●
2007	●	●	●	●	●	●	●	●	●	●	●	●
2008	●	●	●	●	●	●	●	●	●	●	●	●
2009	●	●	●	●	●	●	●	●	●	●	●	●
2010	●	●	●	●	●	●	●	●	●	●	●	●
2011	●	●	●	●	●	●	●	●	●	●	●	●
2012	●	●	●	●	●	●	●	●	●	●	●	●
2013	●	●	●	●	●	●	●	●	●	●	●	●
2014	●	●	●	●	●	●	●	β	β	β	β	β
2015	β	β	β	β	β	β	β	β	β	β	β	β
2016	●	●	●	●	●	●	●	γ	γ	γ	γ	γ
2017	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
2018	γ	γ	γ	γ	γ	γ	γ	●	●	●	●	●
2019	●	●	●	●	●	●	●	●	●	●	●	●
2020	●	●	■	■	■	■	■	■	■	■	■	■
2021												

Source: Own work based on data collected from tender dossiers concerning PSO air services on these three air routes. Explanatory notes: Black circle "●" denotes the existence of an open PSO with at least one carrier operating regular air transport services, while black square "■" indicates the existence of an open PSO without carriers operating regular air transport services concerned.

Table 9. Operating regime of regular flights on air route ES12 and ES13 since 2004

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2004	●	●	●	●	●	●	●	●	●	●	●	●
2005	●	●	●	●	●	●	●	●	●	●	●	●
2006	●	●	●	●	●	●	●	●	●	●	●	●
2007	●	●	●	●	●	●	●	●	●	●	●	●
2008	●	●	●	●	●	●	●	●	●	●	●	●
2009	●	●	●	●	●	●	●	●	●	●	●	●
2010	●	●	●	●	●	●	●	●	●	●	●	●
2011	●	●	●	●	●	●	●	●	●	●	●	●
2012	●	●	●	●	●	●	●	●	●	●	●	●
2013	●	●	●	●	●	●	●	●	●	●	●	●
2014	●	●	●	●	●	●	●	β	β	β	β	β
2015	β	β	β	β	β	β	β	β	β	β	β	β
2016	●	●	●	●	●	●	●	γ	γ	γ	γ	γ
2017	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ	γ
2018	γ	γ	γ	γ	γ	γ	γ	●	●	●	●	●
2019	●	●	●	●	●	●	●	δ	δ	δ	δ	δ
2020	δ	δ	δ	δ	δ	δ	δ	δ	δ	δ	δ	δ
2021	δ	δ	δ	δ	δ	δ	δ					

Source: Own work based on data collected from tender dossiers concerning PSO air services on these three air routes. Explanatory notes: Black circle "●" denotes the existence of an open PSO with at least one carrier operating regular air transport services, while black square "■" indicates the existence of an open PSO without carriers operating regular air transport services concerned.

Table 10. Summary of conditions from the imposition of a PSO on interisland air routes in the Canaries (1998).

Resolution of 30.07.1998	Yearly minimum capacity (per leg) [a]	Daily minimum frequency (per leg) [b]	Maximum rate (pesetas) [c]	Social tariffs (discount rate) [d]
ES06	NWS: 3,500 seats NSS: 3,500 seats	LS: 2 flight PS: 2 flights	12,200	Up to 22 years old Older than 65 years Athletes/patients
ES07	NWS: 41,000 seats NSS: 58,000 seats	LS: 2 flights PS: 2 flights	6,700	Up to 22 years old Older than 65 years Athletes/patients
ES08	NWS: 142,000 seats NSS: 228,000 seats	LS: 7 flights PS: 9 flights	8,000	Up to 22 years old Older than 65 years Athletes/patients
ES09	NWS: 140,000 seats NSS: 250,000 seats	LS: 7 flights PS: 11 flights	9,200	Up to 22 years old Older than 65 years Athletes/patients
ES10	NWS: 260,000 seats NSS: 340,000 seats	LS: 10 flights PS: 13 flights	6,700	Up to 22 years old Older than 65 years Athletes/patients
ES11	NWS: 40,000 seats NSS: 70,000 seats	LS: 2 flights PS: 3 flights	11,250	Up to 22 years old Older than 65 years Athletes/patients
ES12	NWS: 41,000 seats NSS: 58,000 seats	LS: 2 flights PS: 2 flights	11,250	Up to 22 years old Older than 65 years Athletes/patients
ES13	NWS: 20,000 seats NSS: 29,000 seats	LS: 1 flight PS: 1 flight	8,000	Up to 22 years old Older than 65 years Athletes/patients
ES14	NWS: 3,500 seats NSS: 3,500 seats	LS: 2 flights PS: 2 flights	14,000	Up to 22 years old Older than 65 years Athletes/patients
ES15	NWS: 60,000 seats NSS: 96,000 seats	LS: 3 flights PS: 3 flights	8,000	Up to 22 years old Older than 65 years Athletes/patients
ES16	NWS: 40,000 seats NSS: 70,000 seats	LS: 3 flights PS: 3 flights	11,400	Up to 22 years old Older than 65 years Athletes/patients
ES17	NWS: 61,000 seats NSS: 100,000 seats	LS: 3 flights PS: 4 flights	12,300	Up to 22 years old Older than 65 years Athletes/patients
ES18	NWS: 185,000 seats NSS: 255,000 seats	LS: 9 flights PS: 9 flights [d]	7,200	Up to 22 years old Older than 65 years Athletes/patients

Source: Own work based on data collected from imposition documents [32]. Explanatory notes: a) Explicitly referred to each IATA Northern Summer and Winter Season (NSS and NWS, respectively), currently starting on 28 March 2021 and 31 October 2021, respectively; b) Explicitly referred to either low or peak season (LS or PS, respectively), covering the period from 1 January to 30 June, and from 1 October to 31 December, or the period from 1 July to 30 September, respectively; c) discount applied on each reference fare concerned; d) 10 flights for the leg TFN-SPC.

Table 11. Summary of conditions from the imposition of a PSO on interisland air routes in the Canaries (2006).

Resolution of 21.07.2006	Yearly minimum capacity (per leg) [a]	Daily minimum frequency (per leg) [b]	Reference fare (€) [c]	Social tariffs (discount rate) [d]
ES06	NWS: 6,000 seats NSS: 16,000 seats	LS: 1 flight PS: 2 flights	88	Up to 22 years old: over 10% Older than 65 years: over 10% Athletes: over 10%
ES07	NWS: 19,000 seats NSS: 38,000 seats	LS: 2 flights PS: 2 flights	52	Up to 22 years old: over 10% Older than 65 years: over 10% Athletes: over 10%
ES08	NWS: 274,000 seats NSS: 402,000 seats	LS: 13 flights PS: 14 flights	60	Up to 22 years old: over 10% Older than 65 years: over 10% Athletes: over 10%
ES09	NWS: 240,000 seats NSS: 378,000 seats	LS: 11 flights PS: 14 flights	67	Up to 22 years old: over 10% Older than 65 years: over 10% Athletes: over 10%
ES10	NWS: 295,000 seats NSS: 393,000 seats	LS: 12 flights PS: 14 flights	52	Up to 22 years old: over 10% Older than 65 years: over 10% Athletes: over 10%
ES11	NWS: 43,000 seats NSS: 74,000 seats	LS: 2 flights PS: 3 flights	82	Up to 22 years old: over 10% Older than 65 years: over 10% Athletes: over 10%
ES12	NWS: 11,000 seats NSS: 16,000 seats	LS: 2 flights PS: 2 flights	82	Up to 22 years old: over 10% Older than 65 years: over 10% Athletes: over 10%
ES13	NWS: 11,000 seats NSS: 16,000 seats	LS: 2 flights PS: 2 flights	60	Up to 22 years old: over 10% Older than 65 years: over 10% Athletes: over 10%
ES14	NWS: 6,800 seats NSS: 6,800 seats	LS: 3 flights PS: 3 flights	88	Up to 22 years old: over 10% Older than 65 years: over 10% Athletes: over 10%
ES15	NWS: 60,000 seats NSS: 100,000 seats	LS: 3 flights PS: 4 flights	60	Up to 22 years old: over 10% Older than 65 years: over 10% Athletes: over 10%
ES16	NWS: 65,000 seats NSS: 132,000 seats	LS: 3 flights PS: 6 flights	83	Up to 22 years old: over 10% Older than 65 years: over 10% Athletes: over 10%
ES17	NWS: 108,000 seats NSS: 180,000 seats	LS: 5 flights PS: 7 flights	88	Up to 22 years old: over 10% Older than 65 years: over 10% Athletes: over 10%
ES18	NWS: 274,000 seats NSS: 402,000 seats	LS: 13 flights PS: 14 flights	55	Up to 22 years old: over 10% Older than 65 years: over 10% Athletes: over 10%

Source: Own work based on data collected from imposition documents [32]. Explanatory notes: a) Explicitly referred to each IATA Northern Summer and Winter Season (NSS and NWS, respectively), currently starting on 28 March 2021 and 31 October 2021, respectively; b) Explicitly referred to either low or peak season (LS or PS, respectively), covering the period from 1 January to 30 June, and from 1 October to 31 December, or the period from 1 July to 30 September, respectively; c) discount applied on each reference fare concerned.

Table 12. Summary of conditions from the imposition of a PSO on interisland air routes in the Canaries (2011).

Resolution of 25.11.2011	Yearly minimum capacity (per leg) [a]	Daily minimum frequency (per leg) [b]	Reference fare (€) [c]	Social tariffs (discount rate) [d]
ES06	NWS: 10,000 seats NSS: 26,000 seats	LS: 1 flight PS: 1 flight	Unchanged	Unchanged
ES07	NWS: 21,000 seats NSS: 30,000 seats	LS: 1 flight PS: 1 flight	Unchanged	Unchanged
ES08	Unchanged	Unchanged	Unchanged	Unchanged
ES09	Unchanged	Unchanged	Unchanged	Unchanged
ES10	Unchanged	Unchanged	Unchanged	Unchanged
ES11	Unchanged	Unchanged	Unchanged	Unchanged
ES12	NWS: 11,000 seats [e] NSS: 16,000 seats [f]	LS: 2 flights PS: 2 flights	Unchanged	Unchanged
ES13	Unchanged	Unchanged	Unchanged	Unchanged
ES14	Unchanged	Unchanged	Unchanged	Unchanged
ES15	Unchanged	Unchanged	Unchanged	Unchanged
ES16	Unchanged	Unchanged	Unchanged	Unchanged
ES17	Unchanged	Unchanged	Unchanged	Unchanged
ES18	Unchanged	Unchanged	Unchanged	Unchanged

Source: Own work based on data collected from imposition documents [33]. Explanatory notes: a) Explicitly referred to each IATA Northern Summer and Winter Season (NSS and NWS, respectively), currently starting on 28 March 2021 and 31 October 2021, respectively; b) Explicitly referred to either low or peak season (LS or PS, respectively), covering the period from 1 January to 30 June, and from 1 October to 31 December, or the period from 1 July to 30 September, respectively; c) discount applied on each reference fare concerned; e) 17,000 seats, when the route is operated as a connecting flight via TFN; f) 25,000 seats, when the route is operated as a connecting flight via TFN.

As can be seen in Figure 4, the impact of the massive contraction of regional economic activity due to the COVID-19 has been reflected in interisland passenger traffic over the last year, since the demand for regular transport services dropped dramatically until the termination of the first alarm state on 21 June 2020, and subsequently slightly recovered during summer time. Once the summer holidays were over, a couple of these PSO routes (ES08, ES09, ES10, ES12, and ES18) have been able to maintain reasonable levels of passenger traffic. It also may demonstrate that the resilience of interisland routes depends on economic and social situation, especially in low seasons. Indeed, it is precisely for that reason that, as shown in Table 7, those PSO routes with a foreseeably more resilience had been operated from tendering for public contracts under an emergency procedure according to Article 9 of [14]. Moreover, as summarized in the Table 8 and Table 9, those thin routes (ES06, ES07, ES12, and E13) have been traditionally operated under a PSO of type either 2 or 3, especially the latter two routes.

Furthermore, it should be noted that the existing PSO system is a fundamental part of the regional transportation network in the Canary Islands, as it allows the central government to ensure that public air transport in this ultraperipheral region is maintained, and thus enhancing the mobility of their residents within the archipelago. For this purpose, the PSO system applied in the Canary routes has been adapted to the changing market conditions by amending twice the terms and conditions, as summarized in Table 10, Table 11, and Table 12. In that context, regarding the price evolution of the PSO routes considered, in the absence of reliable data of either weekly or monthly average prices, it has been analyzed the evolution of the maximum fares within the period between August 2006 and February 2013, as shown in Figure 5. Particularly striking is the clear alignment of growth rates among all prices considered since mid-2010. Since the revision of the PSO imposition carried out in 2006, as a result, it has led to the establishment of flexible fares, which generally must not exceed 25% of the reference ones. As can be seen in Figure 5, the evolution of the maximum fares within the period between August 2006 and February 2013 indicates that the introduction of a flexible price system has allowed the related air transport services to contain any abrupt air fare movement. All this without renouncing the application of a generous resident subsidy system designed to facilitate certain mobility problems in the Canary Islands arising because of its insularity. Under these circumstances, related short-haul operations would be viable for regional airlines and these regular air services may be profitable. Indeed, as noted in, it becomes clear that there is a slight increased maximum fare since February 2009. And all this exactly coincides with a significant change of demand trend for regular transport services on all routes considered between 2007 and 2013, as shown in Figure 6.

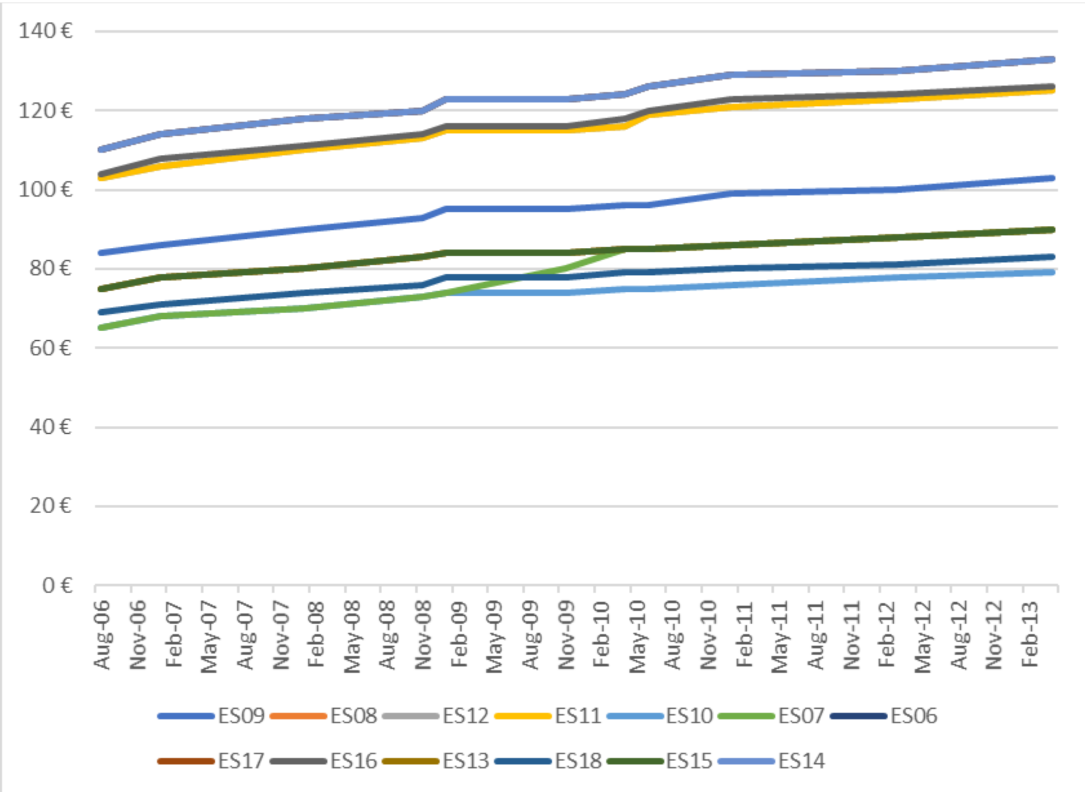

Figure 5. Maximum airfares for interisland routes serving the Canary from the entry into force of revised PSO imposition (2006). Source: Own work based on data collected from PSO documents in the public domain through [21], and other figures with specific access rights submitted to MITMA under special request. No available data since March 2013.

As shown in Figure 6, ES06, ES12, ES13 and ES14 are thin routes according to criteria from paragraph 20(b) of [14] with much less than 100,000 passengers carried. They have become increasingly similar behavior with significant growth since 2016. Similarly, this fact is shown in Figure 7 regarding the Passenger Load Factor (PLF) since November 2012.

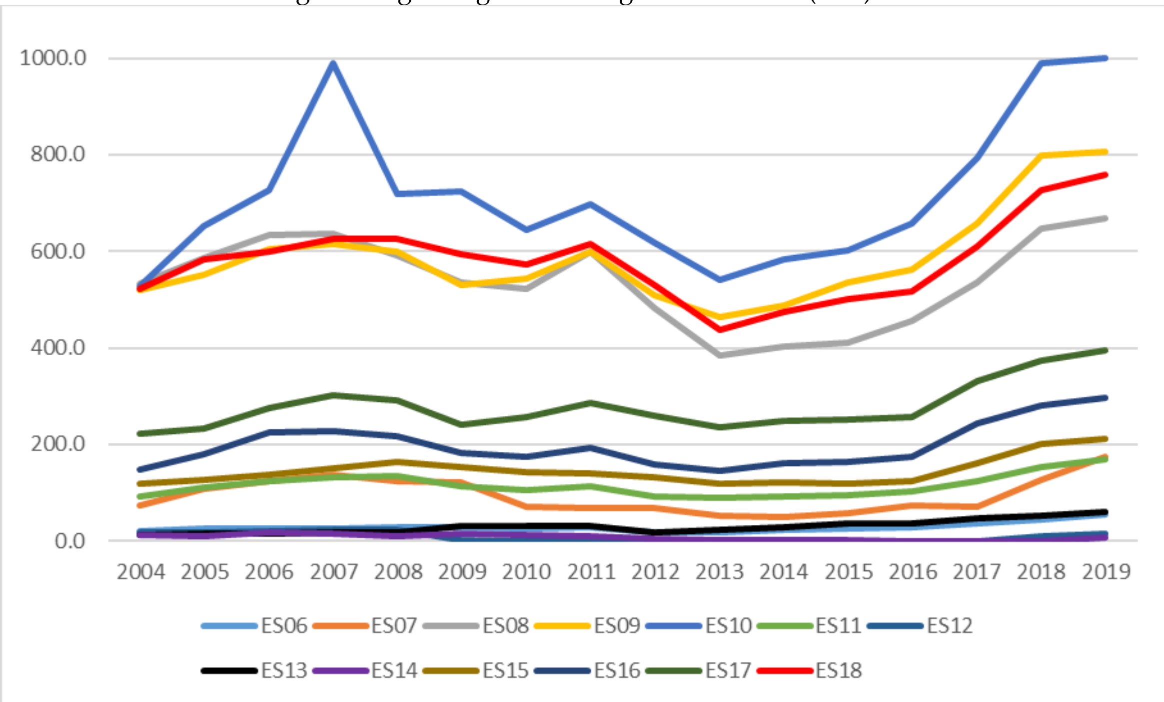

Figure 6. Annual air route performance on regular air services among the Canary Islands as thousands of passengers carried (2004-2019). Own Source: Own work based on data collected from air traffic statistics [28].

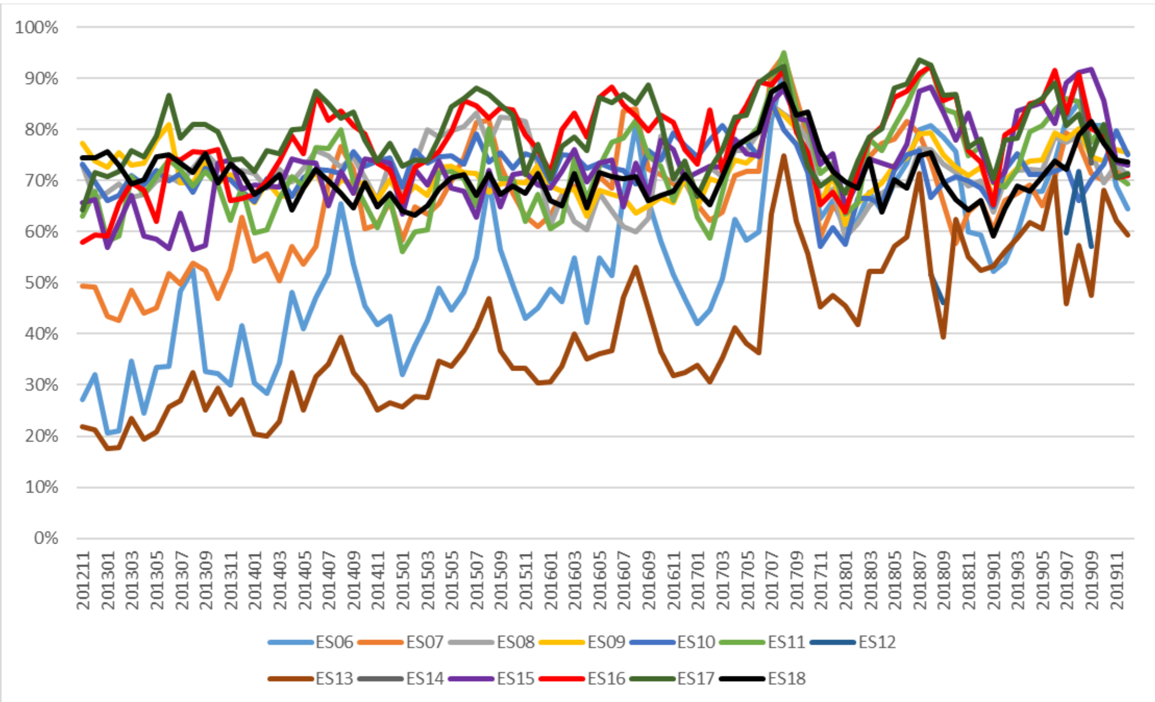

Figure 7. Annual performance as PLF (%) of PSO air routes among the Canary Islands in the period between November 2012 (201211) and December 2019 (201911). Source: Own work based on data collected from PSO documents in the public domain through [21], and other figures with specific access rights submitted to MITMA under special request. Note: Few data available for both ES12 and ES14.

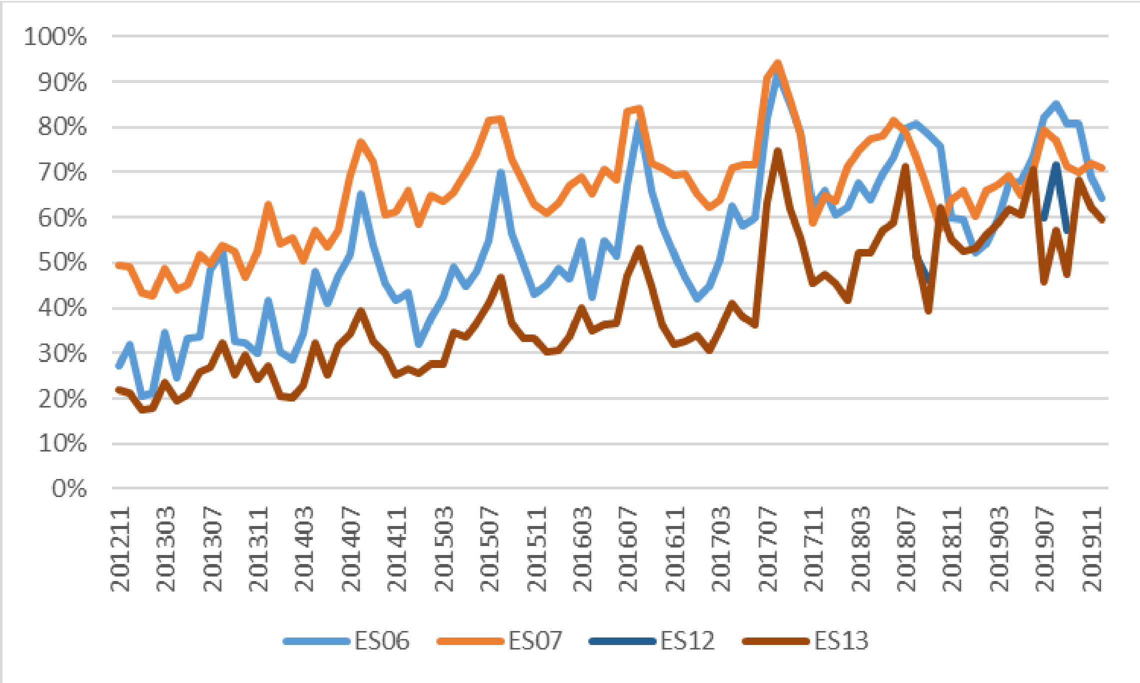

Figure 8. Annual performance as PLF (%) of air routes operated under a PSO of type either 2 or 3 in the period between November 2012 (201211) and December 2019 (201911). Source: Own work based on data collected from PSO documents in the public domain through [21], and other figures with specific access rights submitted to MITMA under special request. Note: Few data available for the ES12.

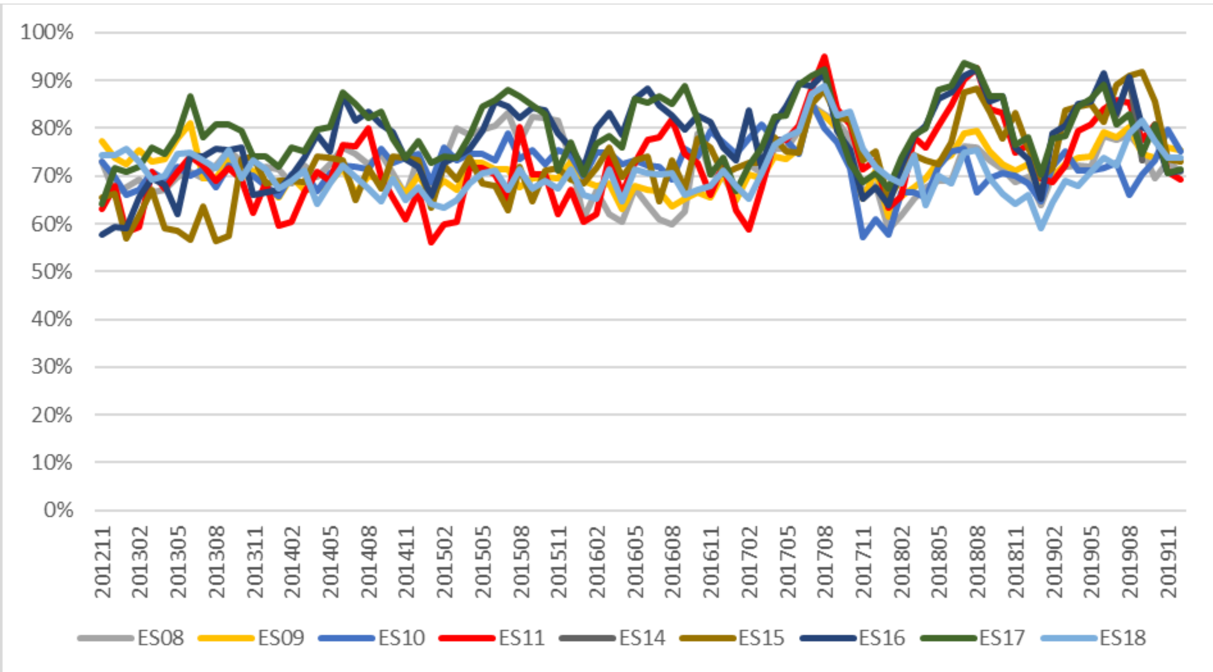

Figure 9. Annual performance as PLF (%) of air routes operated under a PSO of type 1 in the period between November 2012 (201211) and December 2019 (201911). Source: Own work based on data collected from PSO documents in the public domain through [21], and other figures with specific access rights submitted to MITMA under special request. Note: Few data available for the ES14.

6. Further Considerations and Related Discussion

In the case study at issue, the provision of regular air transport services across the Canary Islands has only sought to enhance an adequate provision of passenger transportation in terms of continuity, regularity, and prices. Having been operated habitually up to three airlines (see Table 13), especially in the summer season, the Canary air transport market has suffered a loss of capacity for regular services due to the withdrawal of the third player from the regional market, Air Europa Express (X5), which had operated ES10, ES15, ES16, ES17, and ES18, besides the route FUE-ACE, during the period between November 2017 and October 2019. This has not, however, resulted in a substantial decrease neither in the number of passengers carried nor PLF on these four PSO routes, as can be seen, both in Figure 6 and Figure 7, respectively. Regarding the route ES02, as already pointed out, scheduled passenger transport services have been operated infrequently, mostly in summer seasons and for four whole years (from 2008 to 2011). As shown in Table 14, one of Europe's largest regional airline, Binter Canarias (NT), has become the dominant leader in the Canary market of interisland routes. The entry of new players also seems difficult, once the global passenger traffic can return to pre-COVID-19 levels, as the largest Spanish regional airline, Air Nostrum (YW), is based in mainland Spain. Therefore, it can be assumed that the provision of regular passenger services on these routes shall be provided from an updated PSO imposition and presumably also with public contrast at least until 2024 in avoiding the Canary island can be under-connected among them. Considering that the increase of 25% in resident subsidy occurred in 2018 (a total of 75% as of 2019) [22] may have certain undesired effects on airfares for those passengers visiting the Canary Islands, the findings suggest that the future challenge will be faced in stimulating the concurrence in the local transport market, even enhancing the intramodality between air and sea transport (for instance, through a combined ticket). In terms of efficiency and sustainability, the ATR72 family seems the most appropriate aircraft in operating air routes across the Canary islands among all possible airliners from Table 14.

Table 13. Key facts of airline fleets operating interisland air routes in the Canary Islands (as of 11 August 2019)

Company name	Country	AOC	Estimated average fleet age	Category
Binter Canarias	Spain	ES.AOC.011	4.8	Regional
Canary Fly, S.A.	Spain	ES.AOC.100	12.1	Regional
Aeronova S.L. dba Air Europa Express [a]	Spain	ES.AOC.020	12.9	Feeder

Source: Own compilation. Caption: Black square "■" denotes a turbofan aircraft mostly operating the air route considered while black circle "●" denotes a turboprop aircraft mostly operating the air route considered. Explanatory note: a) This airline definitively left the regional market of interisland routes on 26 October 2019.

Table 14. Key facts of airline fleets operating interisland air routes in the Canary Islands (as of 31 December 2019)

Aircraft [Configuration]	Binter Airlines (seating configuration)	Canary Fly (seating configuration)	Air Europa Express [a] (seating configuration)
ATR 72-500 (72-212A)	7 (Y72)	7 (Y72)	3 (Y68-Y72)
ATR 72-600 (72-212A)	15 (Y72)	-	-
CRJ-1000 (CL-600-2E25)	3 (Y100) [b]	-	-
Embraer E195-E1 (ERJ 190-200)	-	-	7 (C12/Y108)
Embraer E195-E2 (ERJ 190-400)	3 (Y132)	-	-

Source: Own compilation based on data collected from air traffic statistics [20], and other figures provided by airlines. Explanatory note: a) This airline definitively left the regional market of interisland routes on 26 October 2019; b) Expected to leave the fleet in March 2020.

6.1. Evaluation of findings concerning the PSO imposition on air route ES06

The route linking Gran Canaria with El Hierro has been traditionally considered a secondary route within the transport network of regional air service in the Canary Islands. Although both destinations have a high dependence on the tourism sector, and thus a strong seasonal impact on the activity at their airports, the territorial component of the air transport in island territories should not be ignored. Figure 10 shows, in fact, a growing demand in passenger services, when the route is operated point-to-point. Because of its high seasonal demand (see Figure 11),

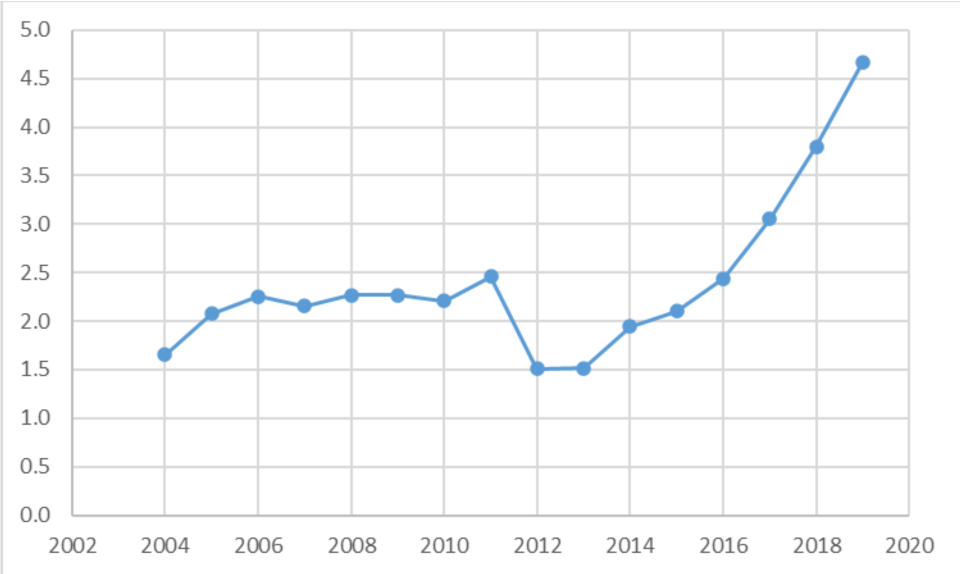

Figure 10. Yearly average of passengers carried in air route ES06 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [28].

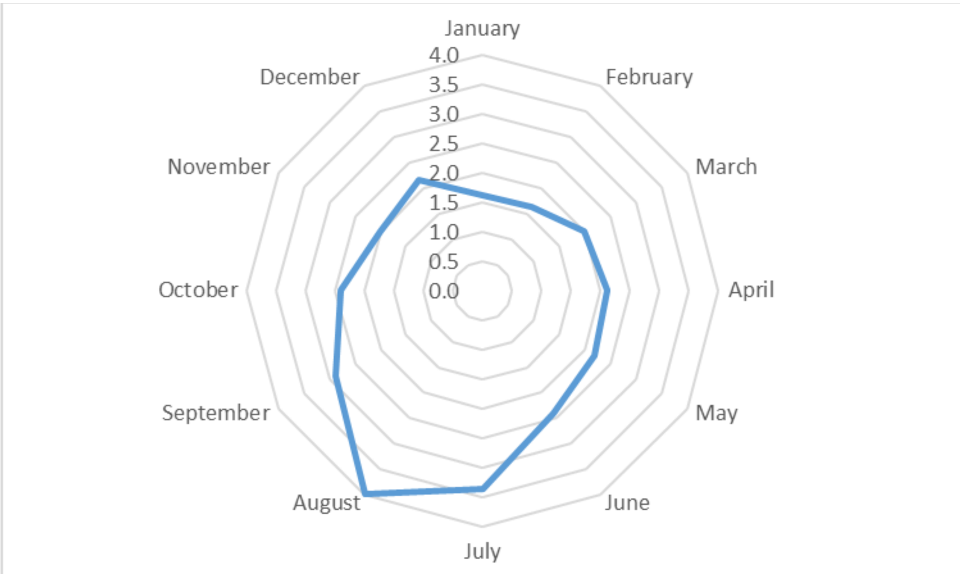

Figure 11. Monthly average of passengers carried in air route ES06 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [28].

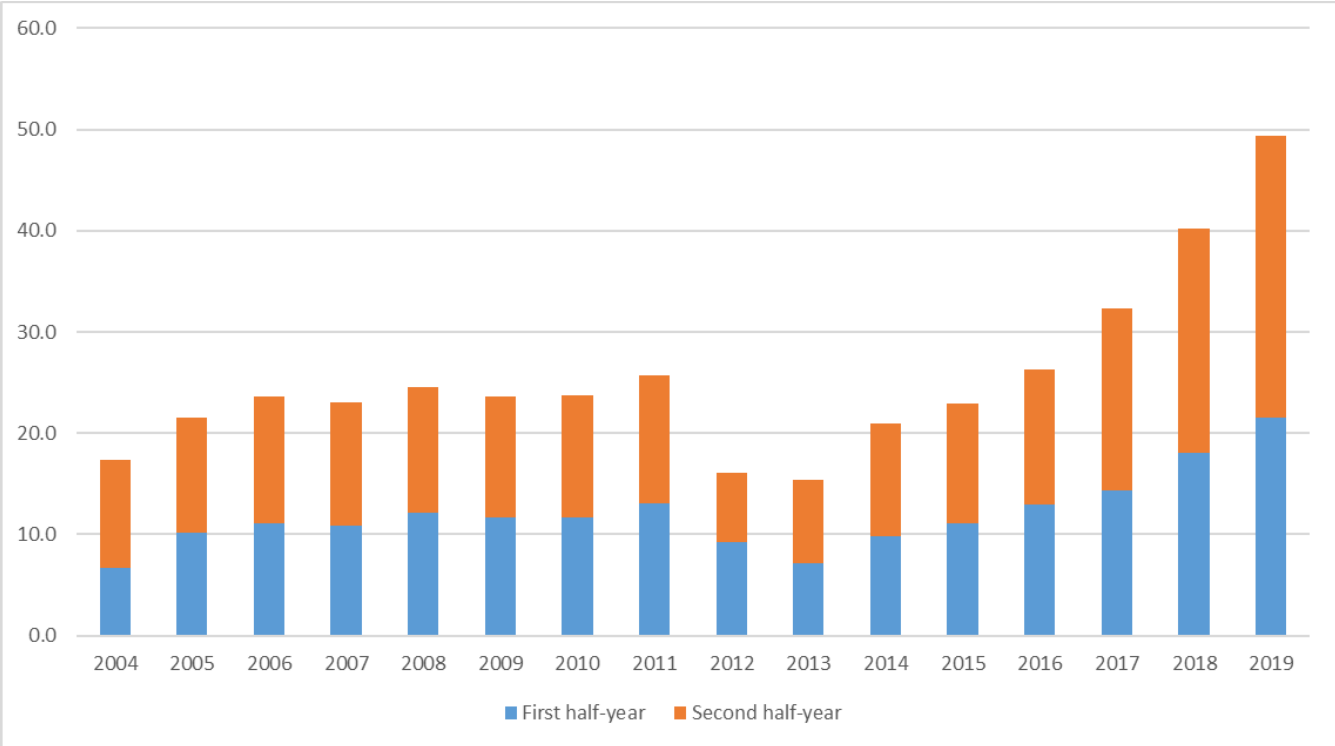

Figure 12. Thousands of passengers carried per half-year on air route ES06. Source: Own work based on data collected from the official database [28].

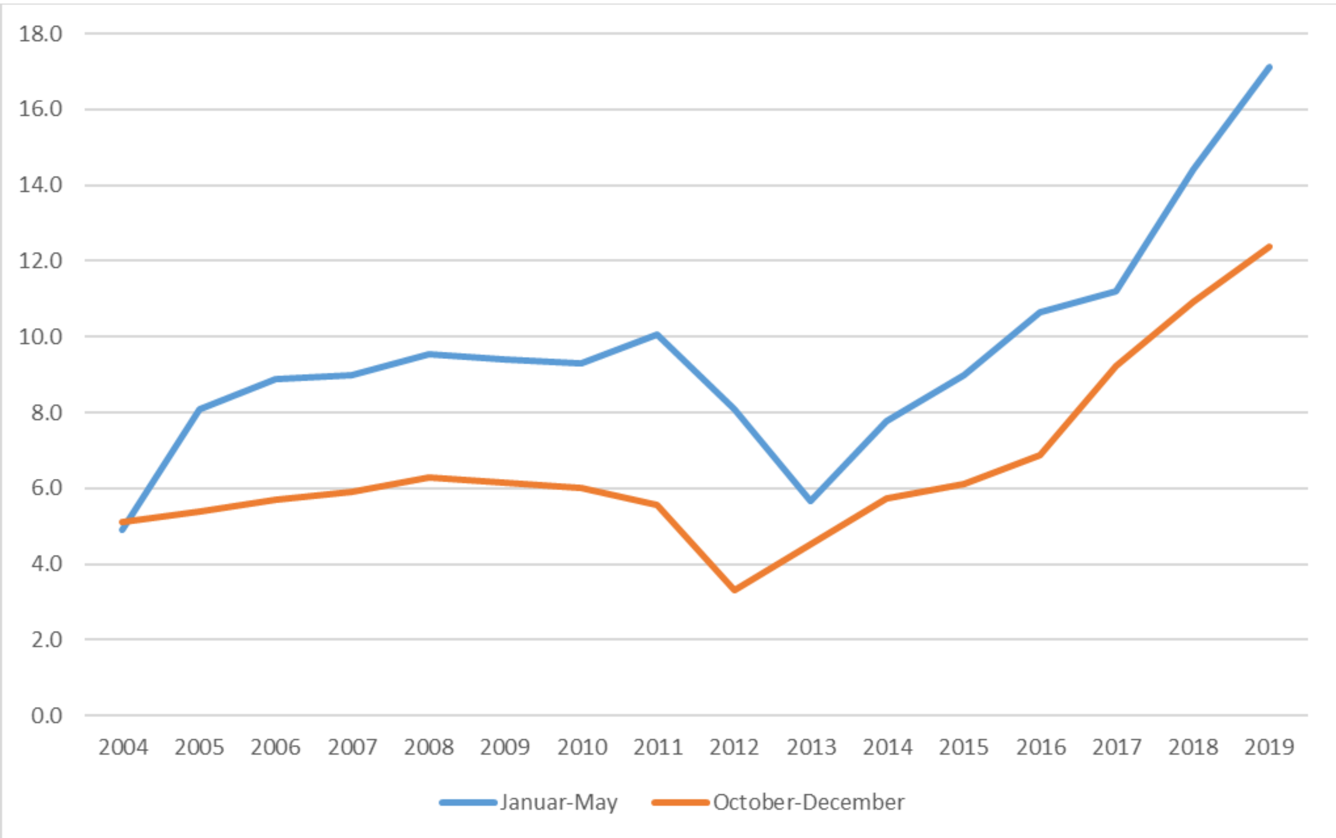

Figure 13. Thousands of passengers carried in low seasons on air route ES06. Source: Own work based on data collected from the official database [28].

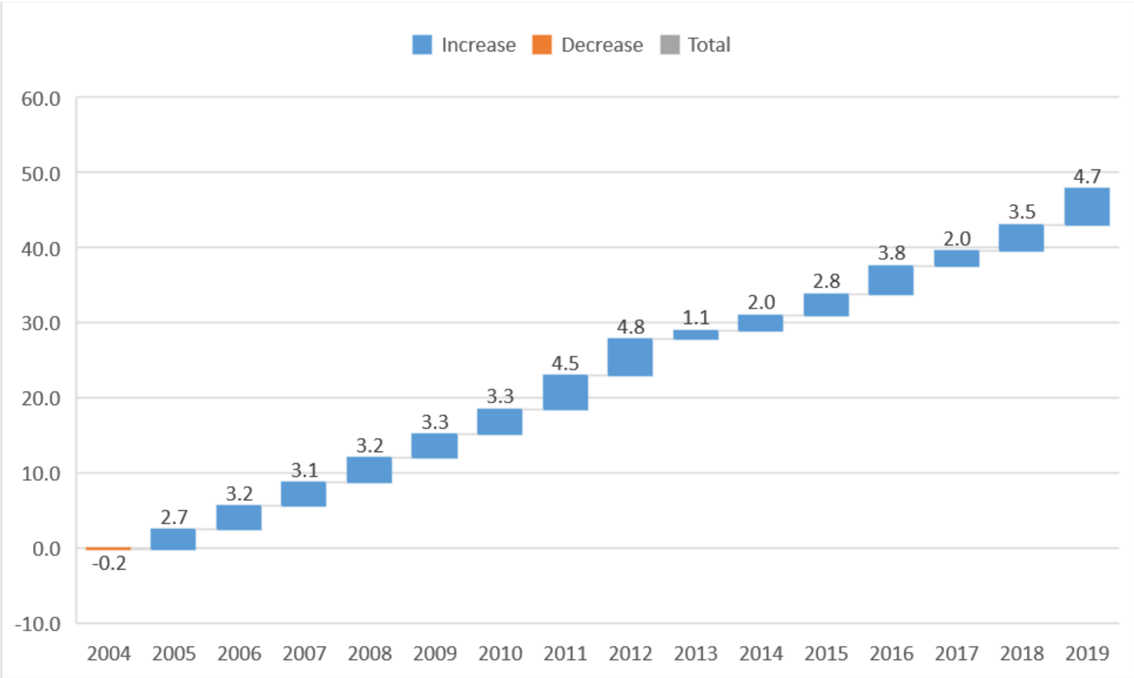

Figure 14. Difference (delta) of passengers carried on the PSO route considered between both periods of each low season per year in the period considered (2004-2019). Source: Own calculation Own work based on data collected from the official database [28].

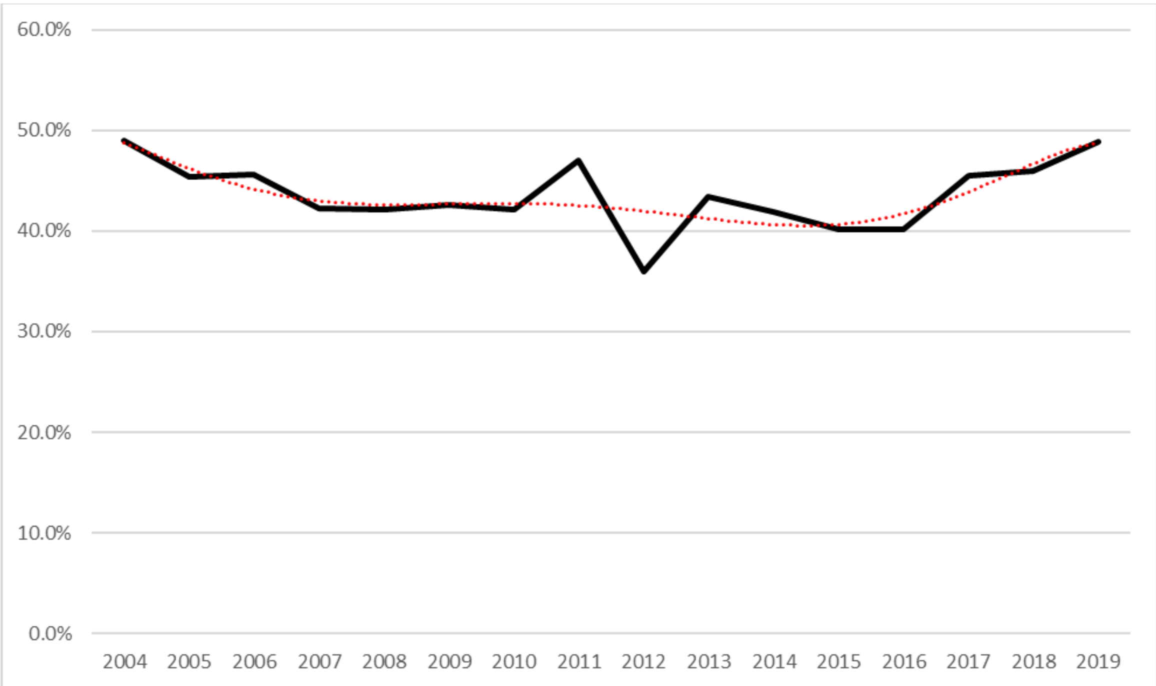

Figure 15. Seasonal trend of activity in peak seasons (June-September) as a percentage of total yearly passengers carried on air route ES06. Source: Own work based on data collected from the official database [28]. Explanatory note: 6th order polynomial trendline considered.

6.2. Evaluation of findings concerning the PSO imposition on air route ES07

The route between Gran Canaria and Tenerife South represents the one of the most important passenger air transport services among the Canary Islands in terms of passenger carried. Moreover, the route has enjoyed a considerable level of competence according to Figures 16, 18 and 19. No strong seasonality has been observed from Figure 17.

As can be seen in Figure 13, the passenger demand on this route has experienced continuous growth over past years, especially noticeable since 2014. This coincided with the extension of the resident subsidy (50 percent discount on airfares as of April 2013) to relatives of legal permanent residents as well as non-EU residents.

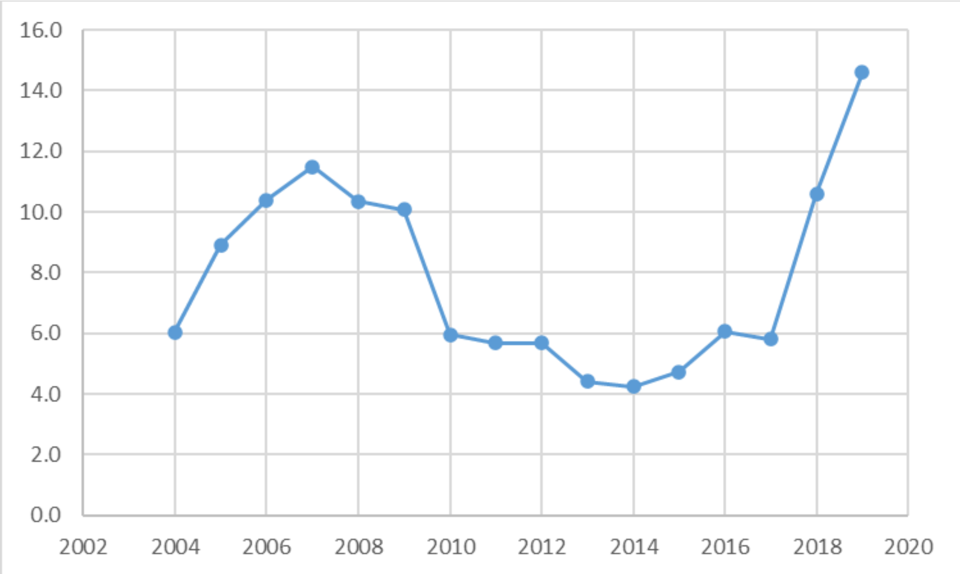

Figure 16. Yearly average of passengers carried in air route ES07 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [28].

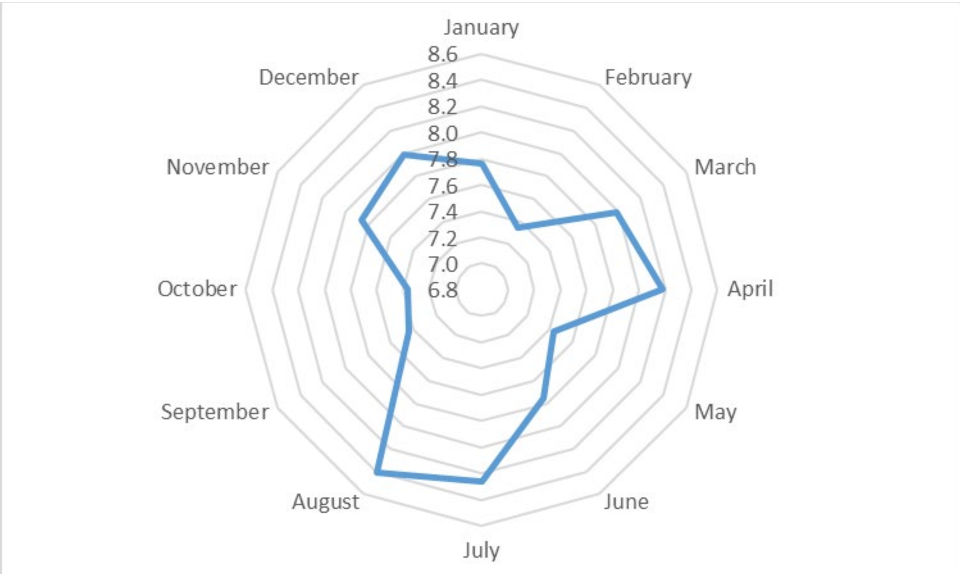

Figure 17. Monthly average of passengers carried in air route ES07 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [28].

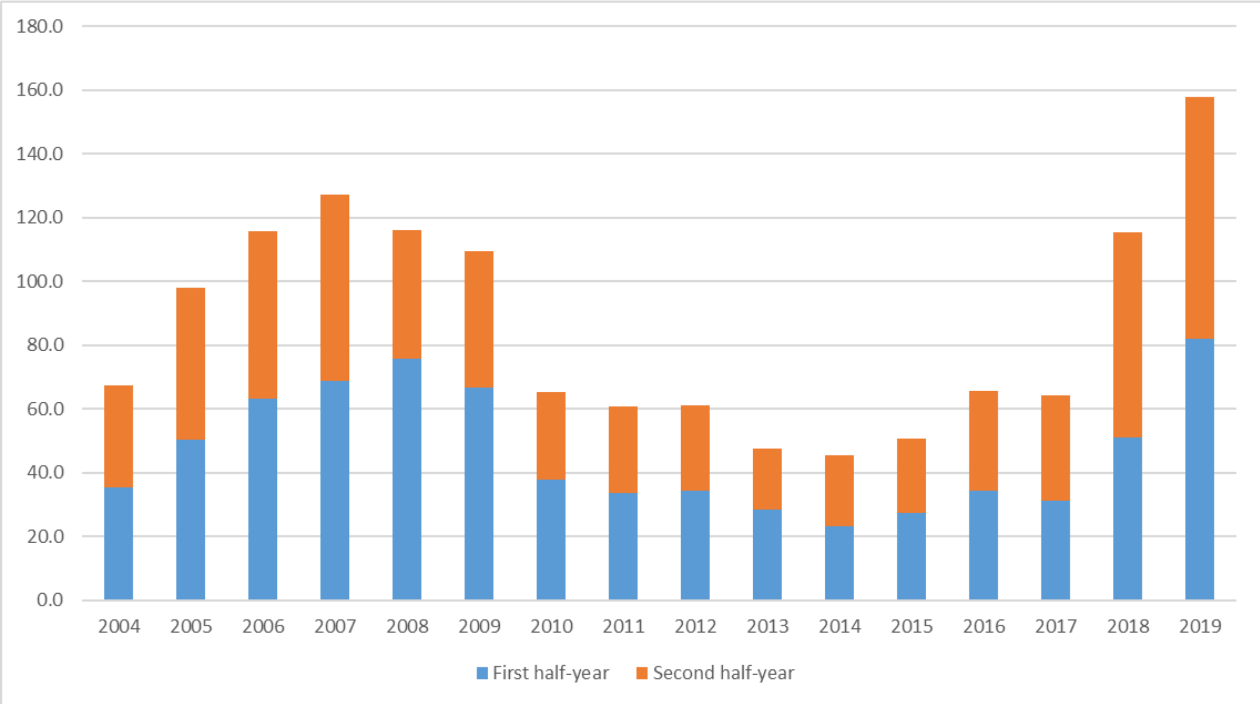

Figure 18. Thousands of passengers carried per half-year on air route ES07. Source: Own work based on data collected from the official database [28].

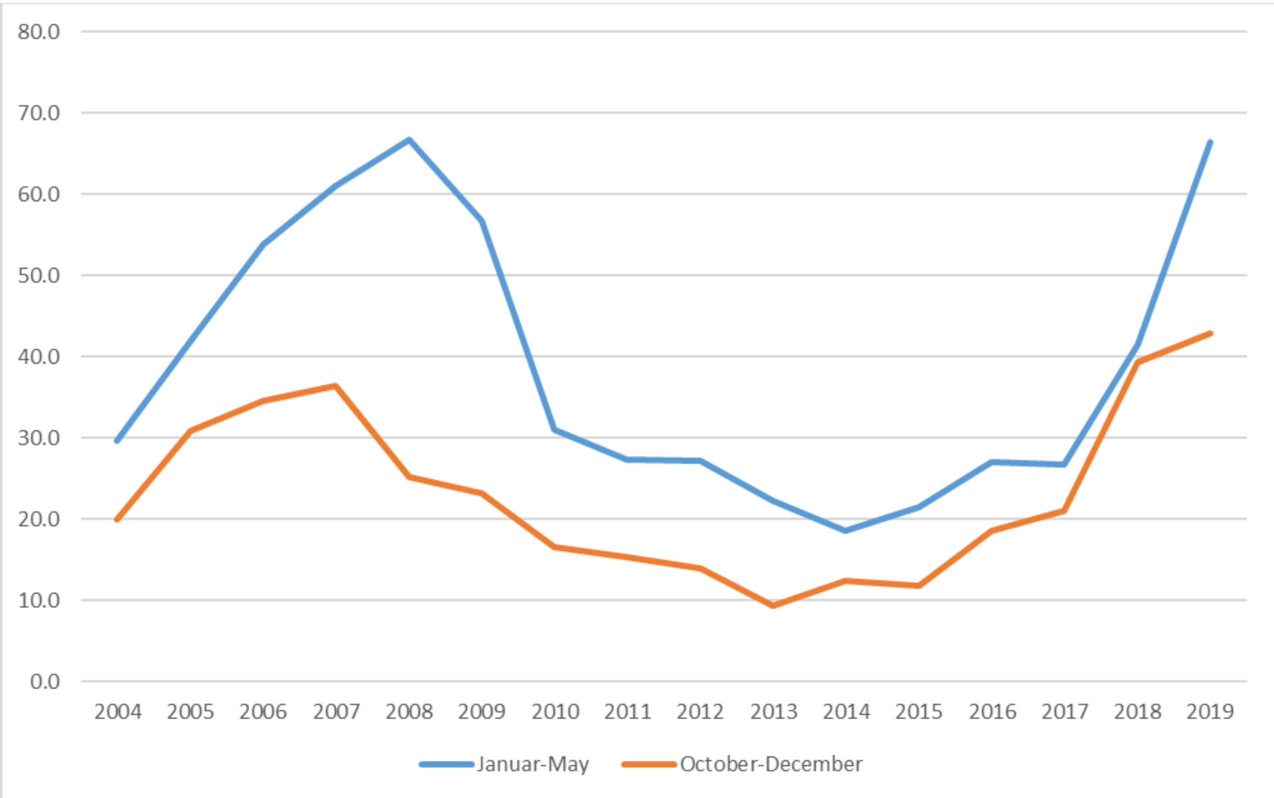

Figure 19. Thousands of passengers carried during low seasons on air route ES07. Source: Own work based on data collected from the official database [28].

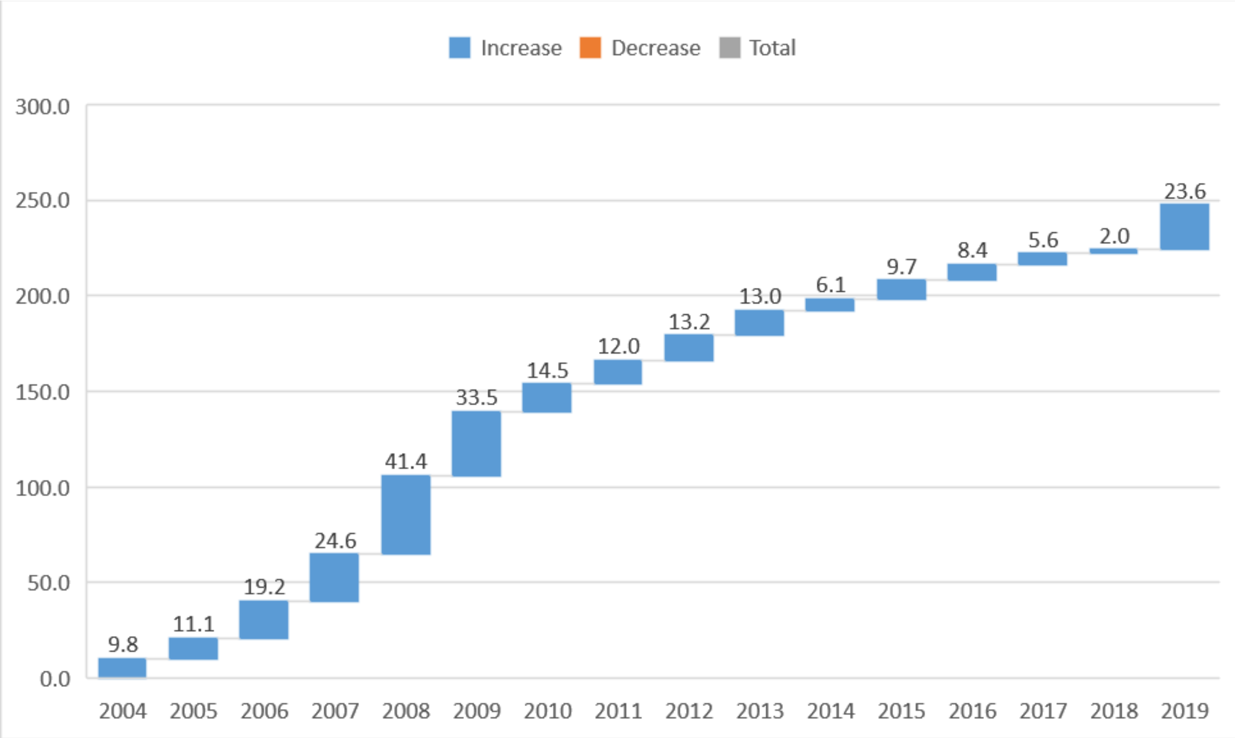

Figure 20. Difference (delta) of passengers carried on the PSO route considered between both periods of each low season per year in the period considered (2004-2019). Source: Own calculation Own work based on data collected from the official database [28].

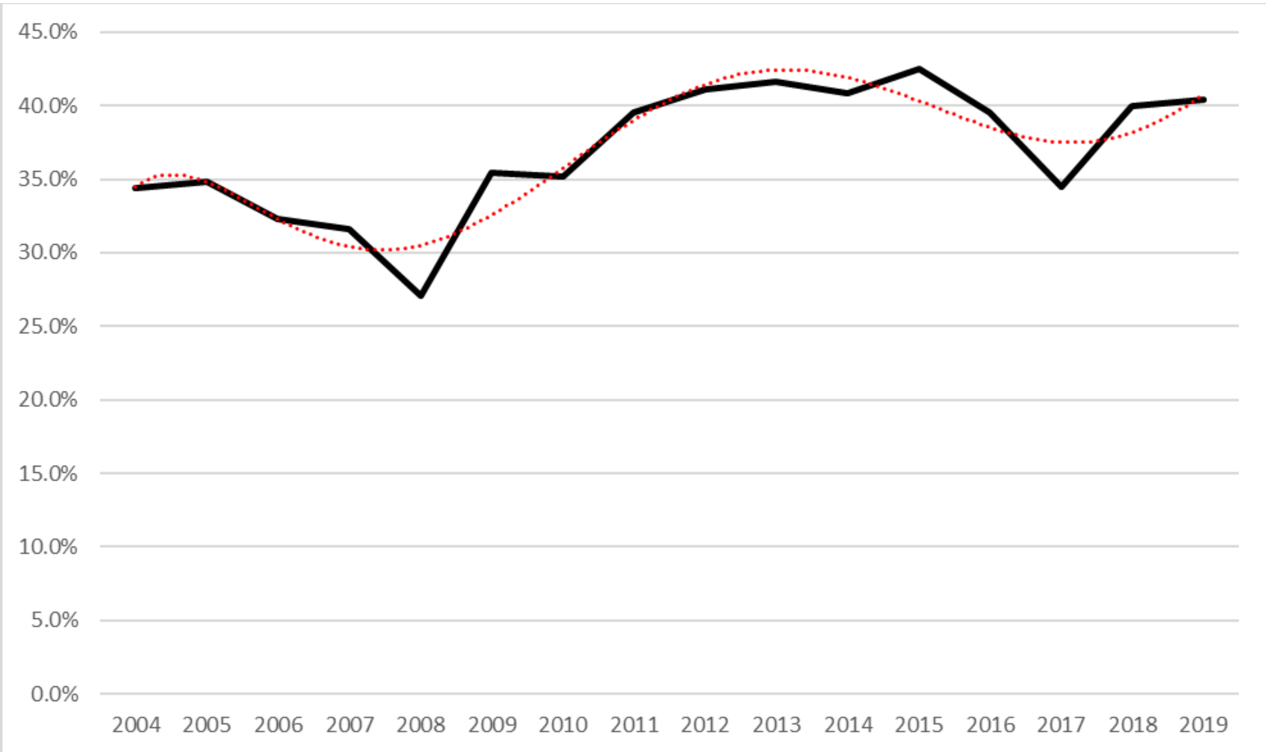

Figure 21. Seasonal trend of activity in peak seasons (June-September) as a percentage of total yearly passengers carried on air route ES07. Source: Own work based on data collected from the official database [20]. Explanatory note: 6th order polynomial trendline considered.

6.3. Evaluation of findings concerning the PSO imposition on air route ES08

The interisland air transport services between Gran Canaria and Fuerteventura is a key route in the regional air transport network concerning territorial cohesion in the Canaries.

Based on Figure 23, it is observed that the route has been habitually operated during the whole year. But without a doubt, In the case of results from Figure 20, no significant seasonality has been noted, indicating that the demand is set to remain practically constant in the 2004 to 2019 period.

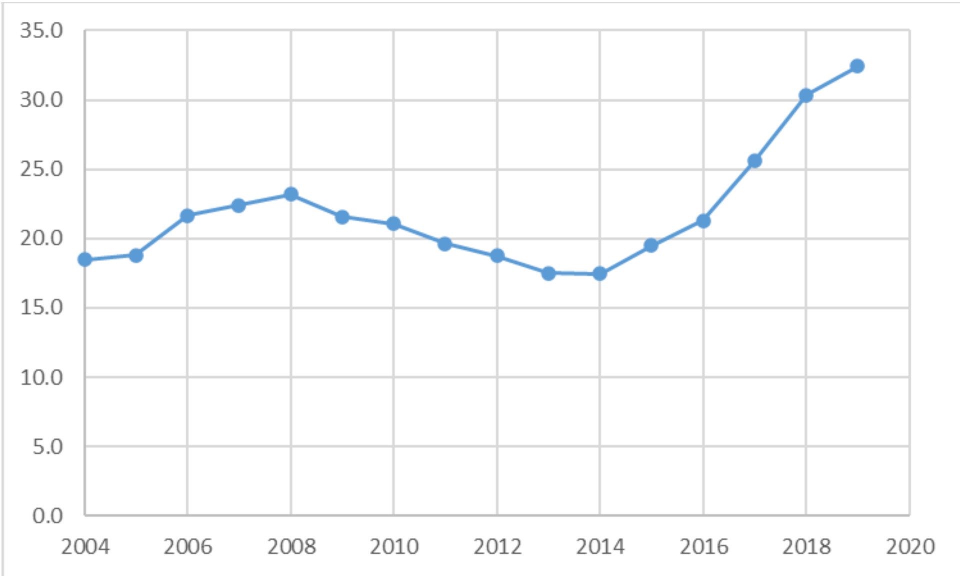

Figure 22. Yearly average of passengers carried in air route ES08 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [20].

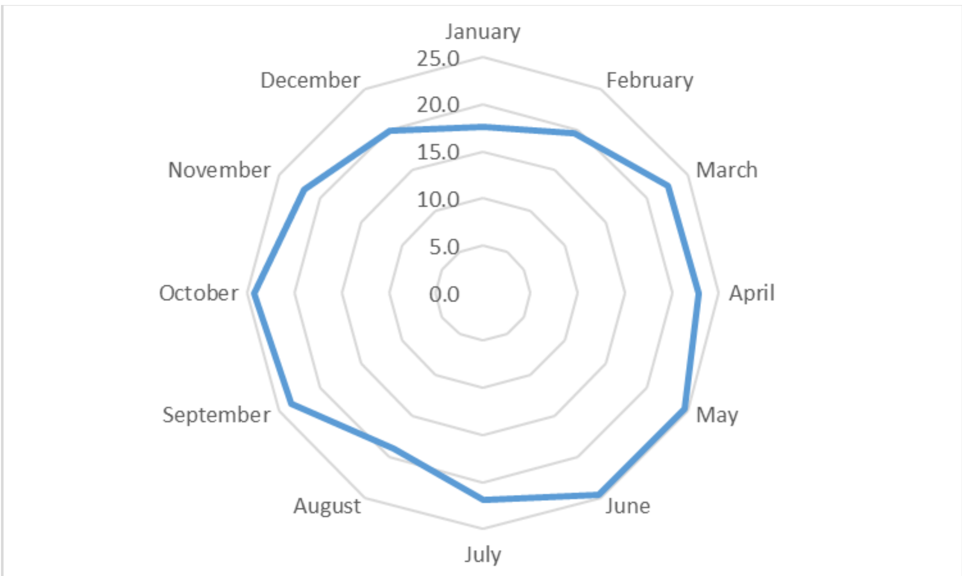

Figure 23. Monthly average of passengers carried in air route ES08 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [20].

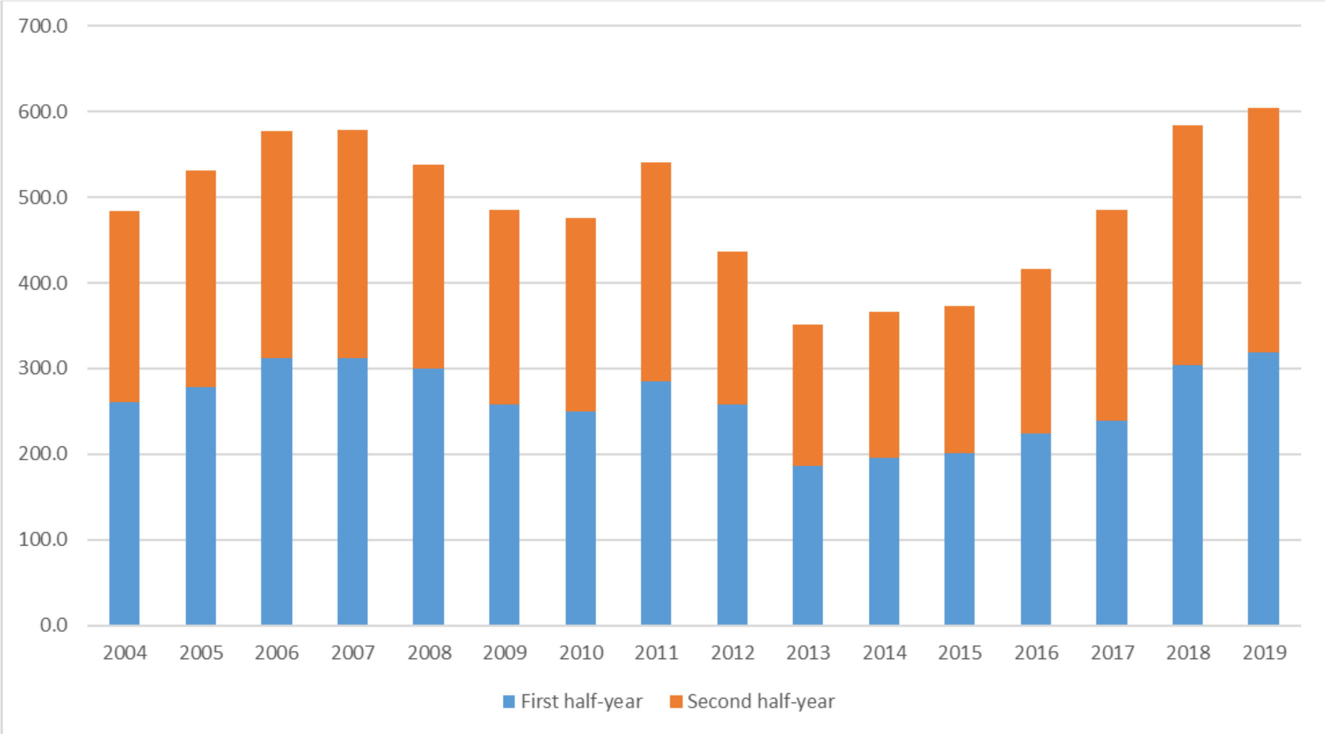

Figure 24. Thousands of passengers carried per half-year on air route ES08. Source: Own work based on data collected from the official database [28].

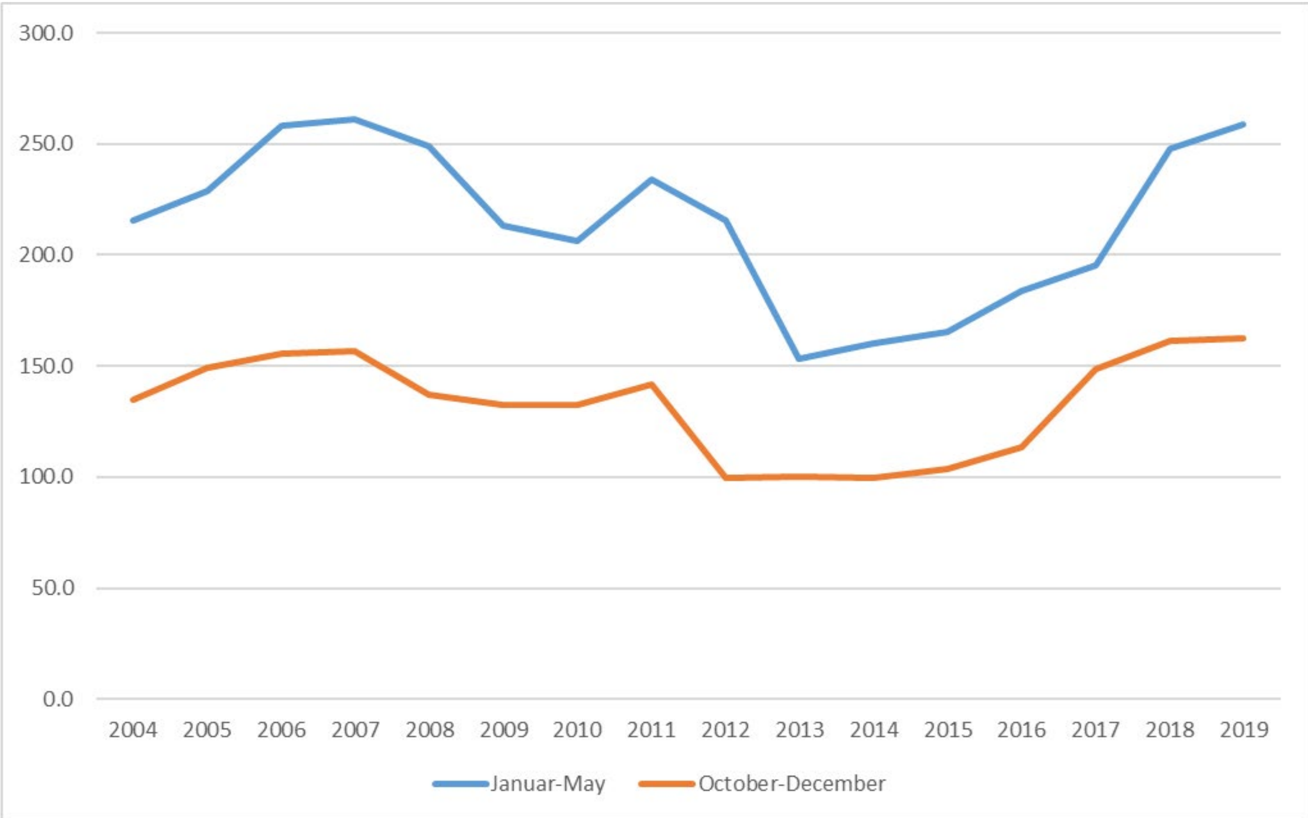

Figure 25. Thousands of passengers carried during low seasons on air route ES08. Source: Own work based on data collected from the official database [28].

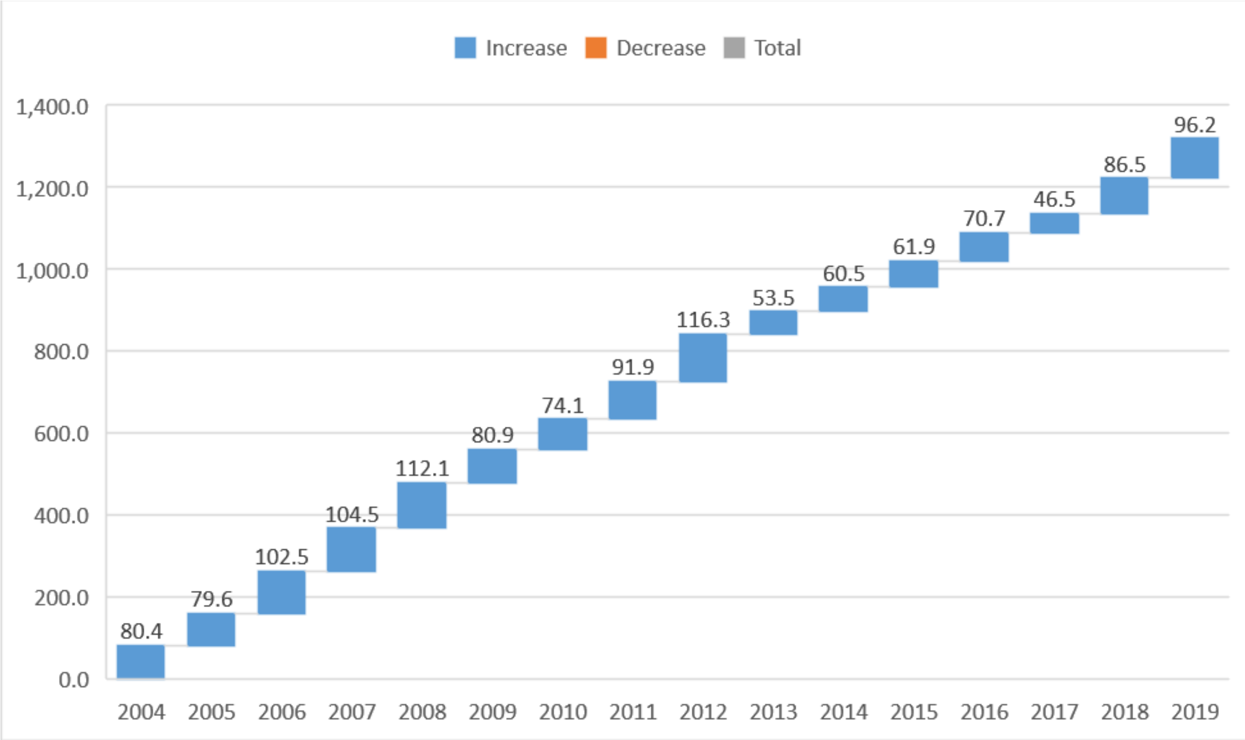

Figure 26. Difference (delta) of passengers carried on the PSO route considered between both periods of each low season per year in the period considered (2004-2019). Source: Own calculation Own work based on data collected from the official database [28].

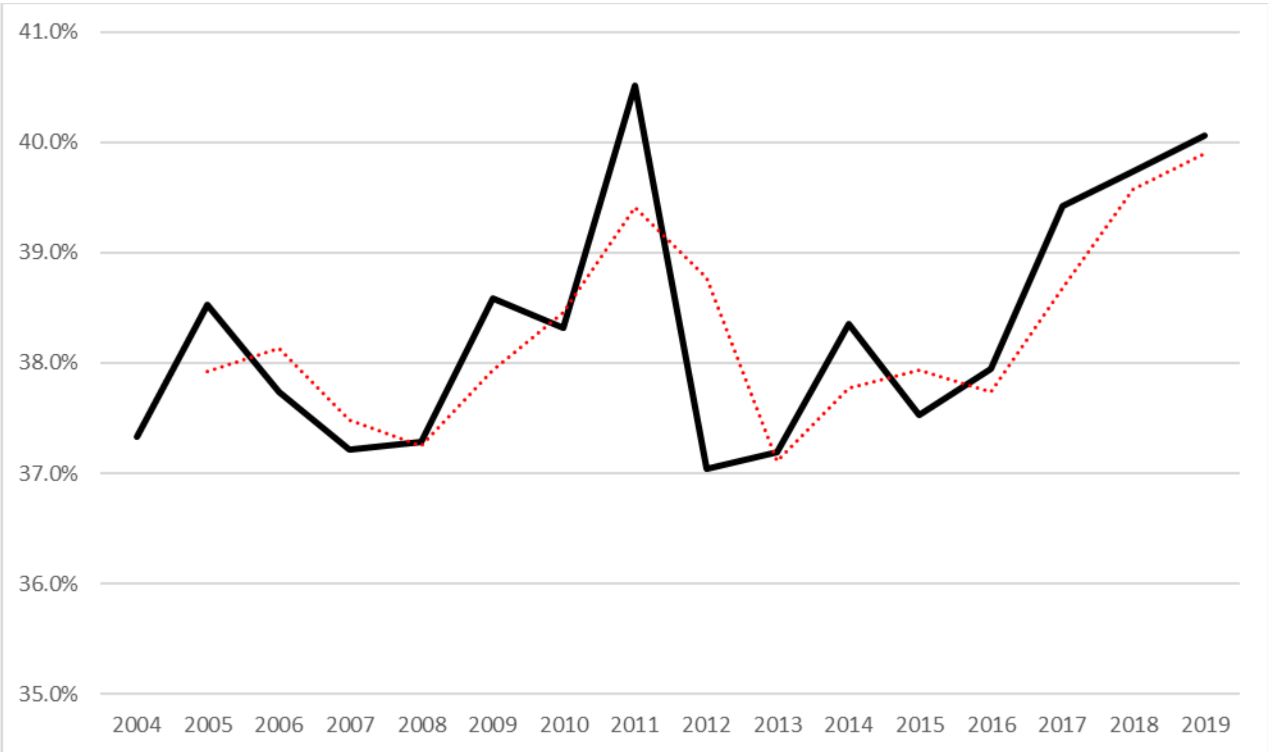

Figure 27. Seasonal trend of activity in peak seasons (June-September) as a percentage of total yearly passengers carried on air route ES08. Source: Own work based on data collected from the official database [28]. Explanatory note: Moving average with 2-period trendline considered.

6.4. Evaluation of findings concerning the PSO imposition on air route ES09

The interisland air transport services between Gran Canaria and Lanzarote is a key route in the regional air transport network concerning territorial cohesion in the Canaries. A significant increase of passenger carried has been identified since 2014 (Figure 28). No seasonality has been observed from Figure 29. As can be seen in Figure 30-31-32-33, the route has a very stable demand during each year.

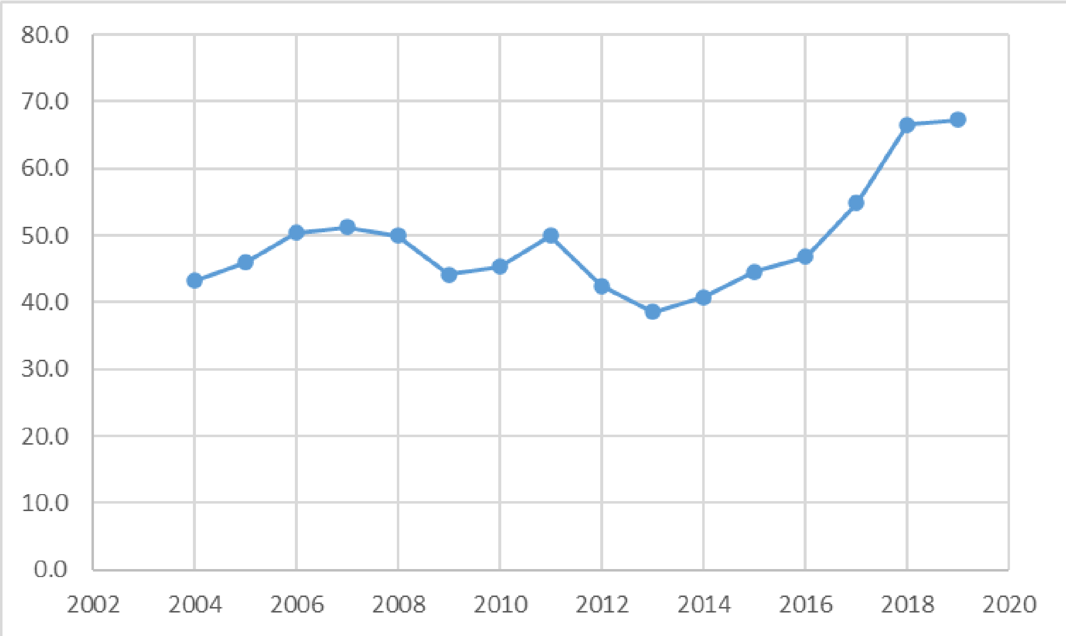

Figure 28. Yearly average of passengers carried in air route ES09 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [28].

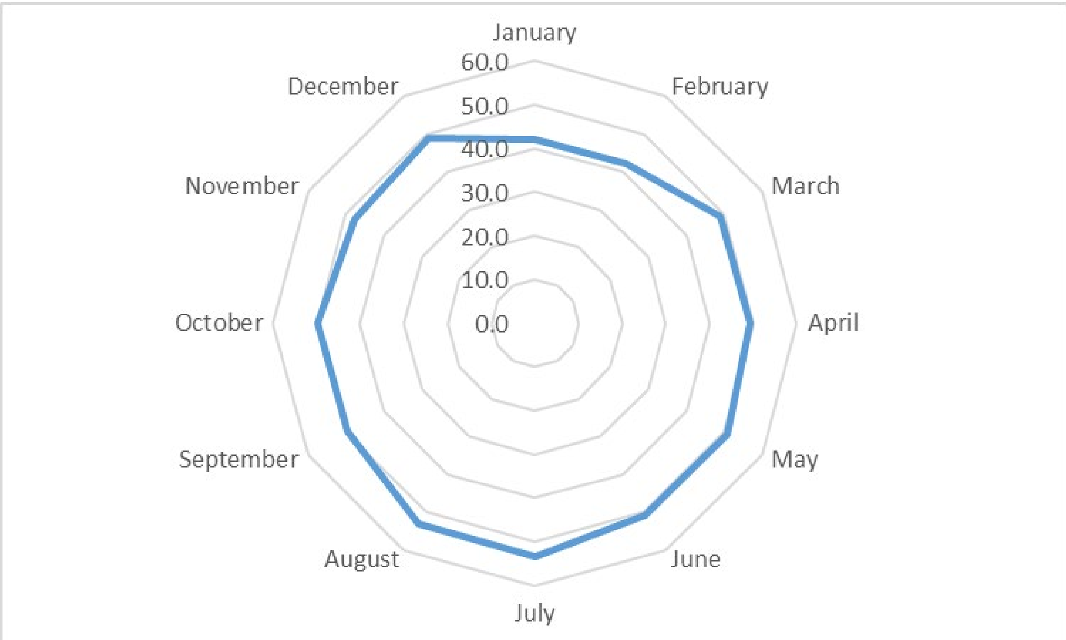

Figure 29. Monthly average of passengers carried in air route ES09 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [28].

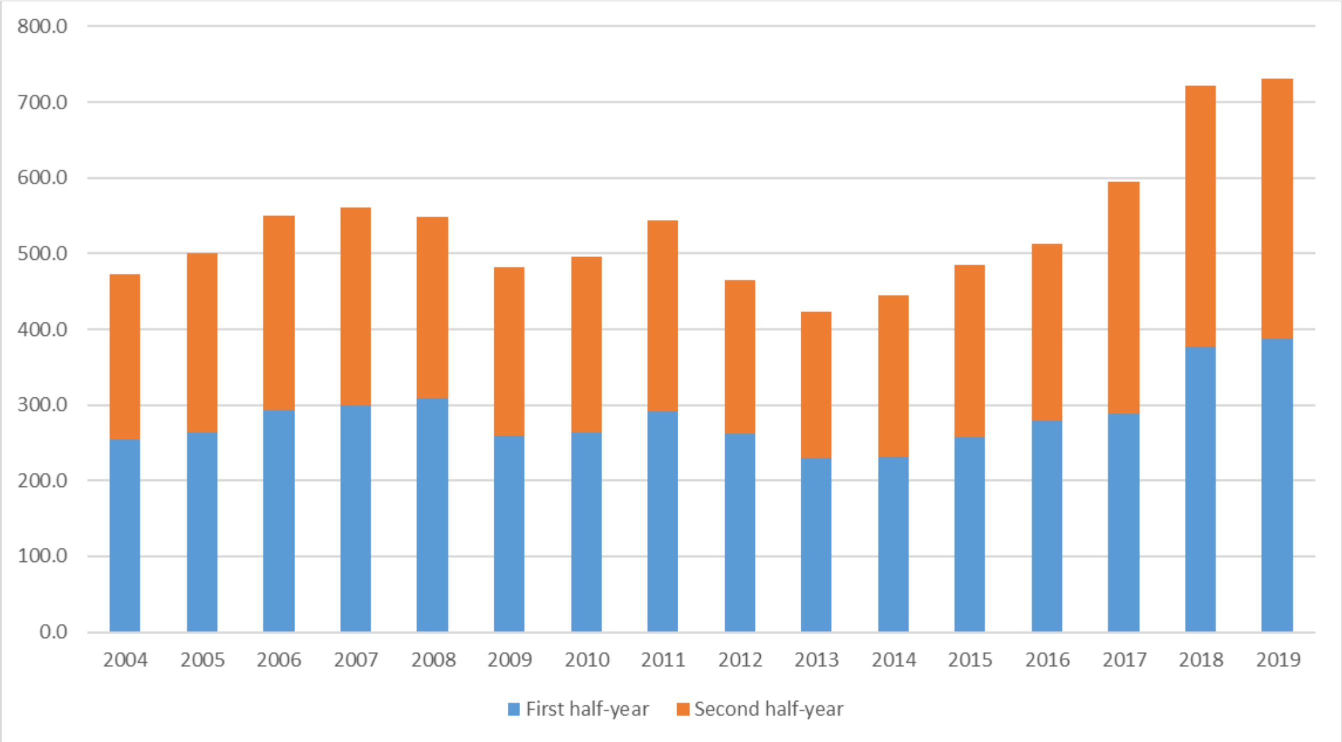

Figure 30. Thousands of passengers carried per half-year on air route ES09. Source: Own work based on data collected from the official database [28].

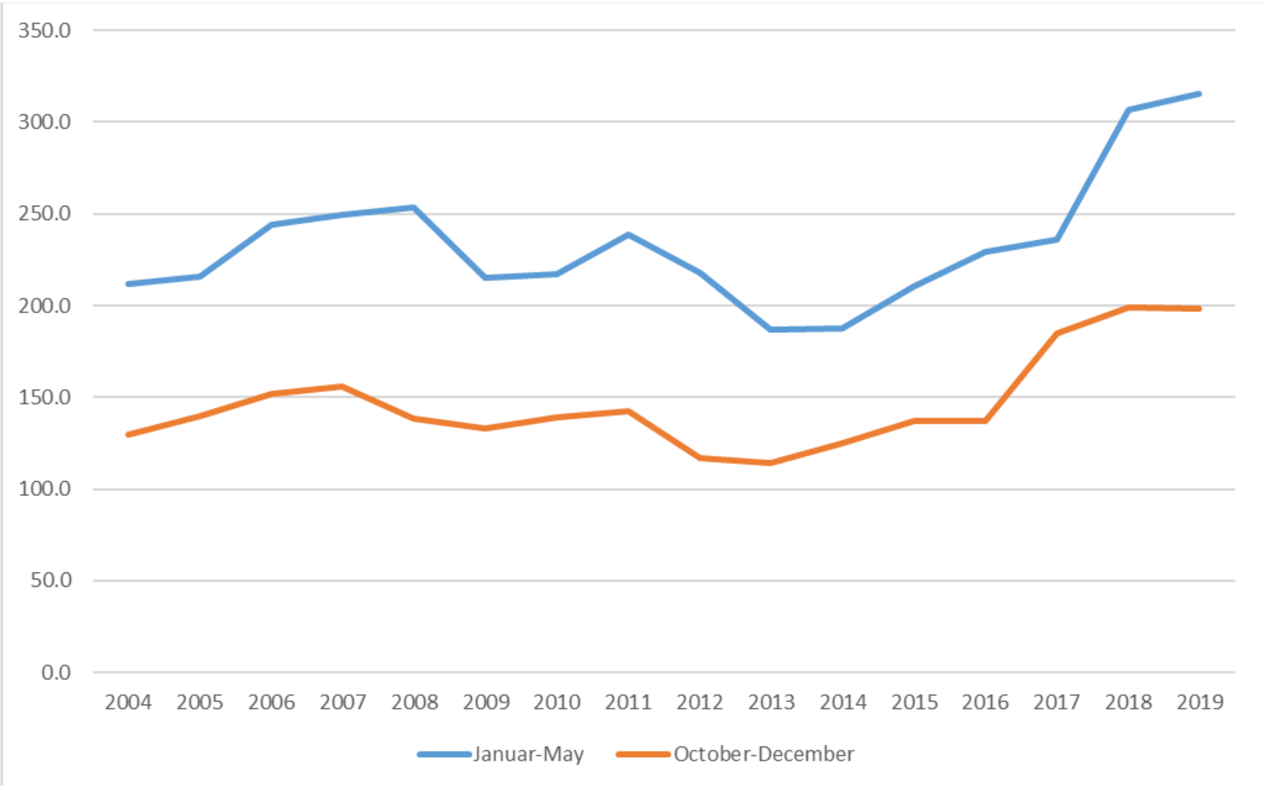

Figure 31. Thousands of passengers carried during low seasons on air route ES09. Source: Own work based on data collected from the official database [28].

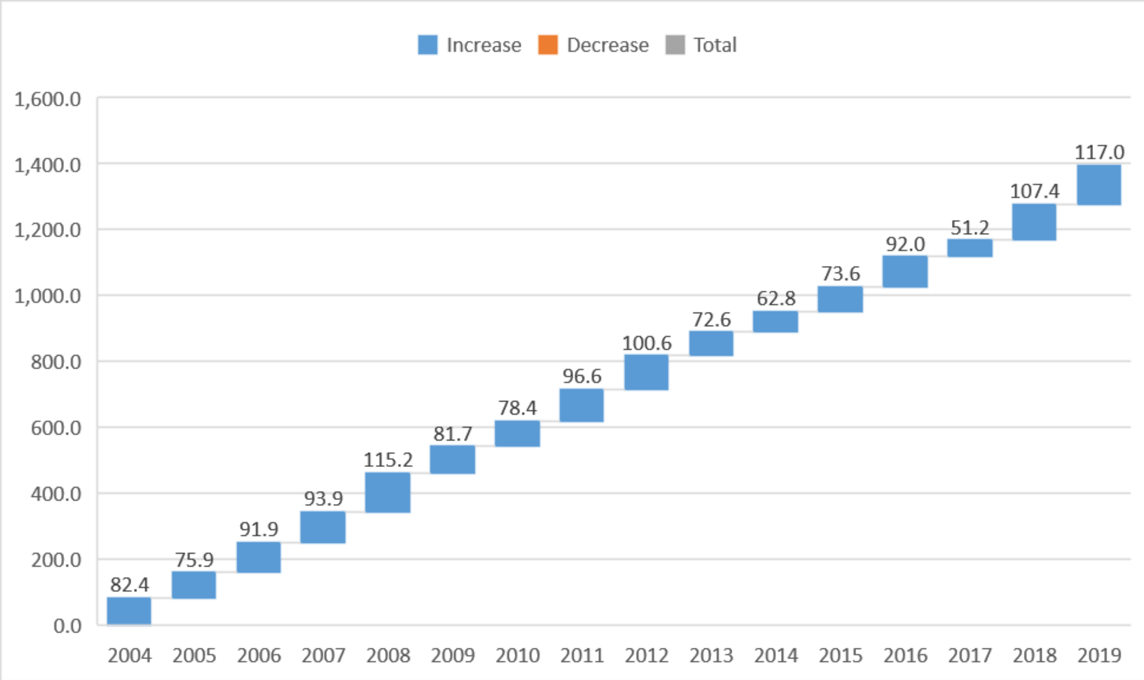

Figure 32. Difference (delta) of passengers carried on the PSO route considered between both periods of each low season per year in the period considered (2004-2019). Source: Own calculation Own work based on data collected from the official database [28].

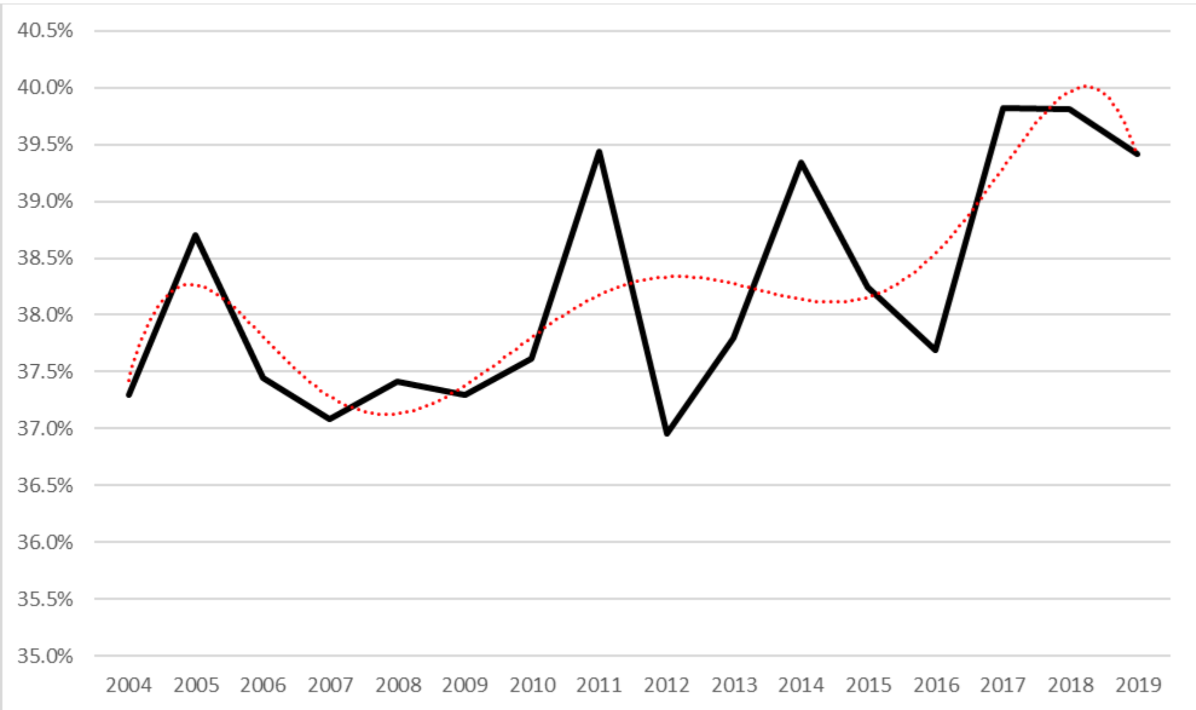

Figure 33. Seasonal trend of activity in peak seasons (June-September) as a percentage of total yearly passengers carried on air route ES09. Source: Own work based on data collected from the official database [28]. Explanatory note: 6th order polynomial trendline considered.

6.5. Evaluation of findings concerning the PSO imposition on air route ES10

The interisland air transport services between Gran Canaria and Tenerife North is a fundamental route in the regional air transport network concerning territorial cohesion in the Canaries (seen Figure 34). No seasonality has been observed from neither Figure 35 nor 36.

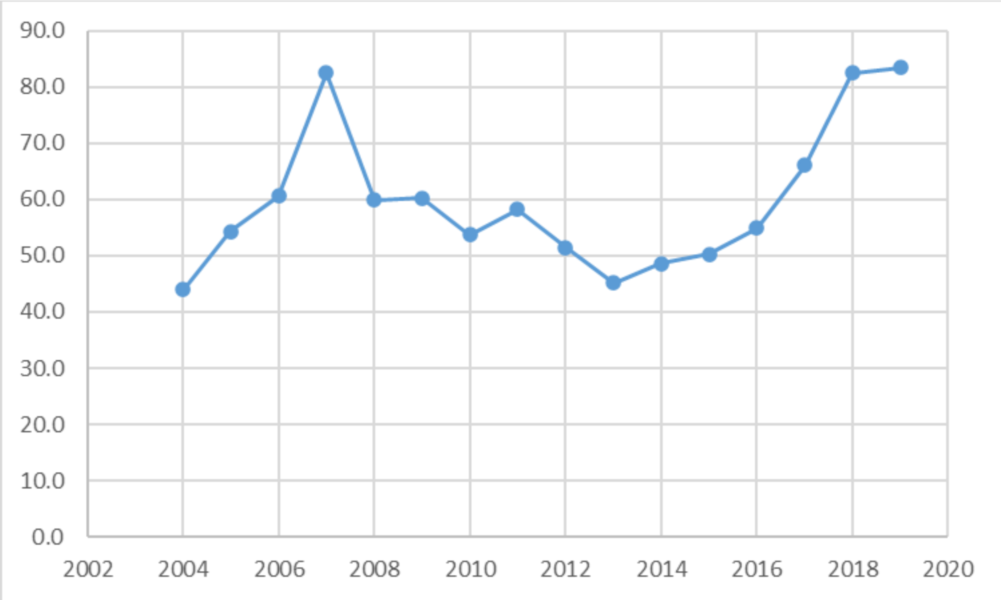

Figure 34. Yearly average of passengers carried in air route ES10 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [28].

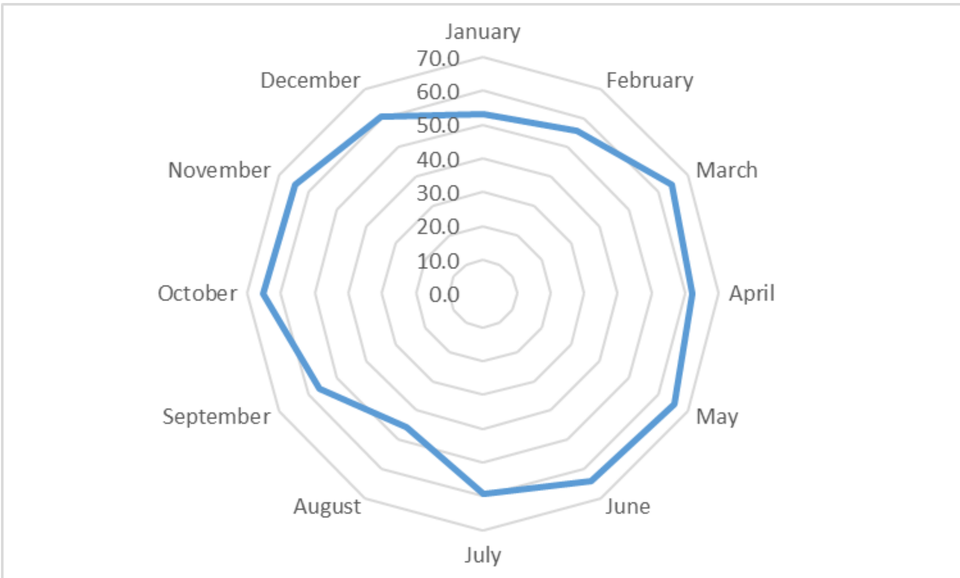

Figure 35. Monthly average of passengers carried in air route ES10 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [28].

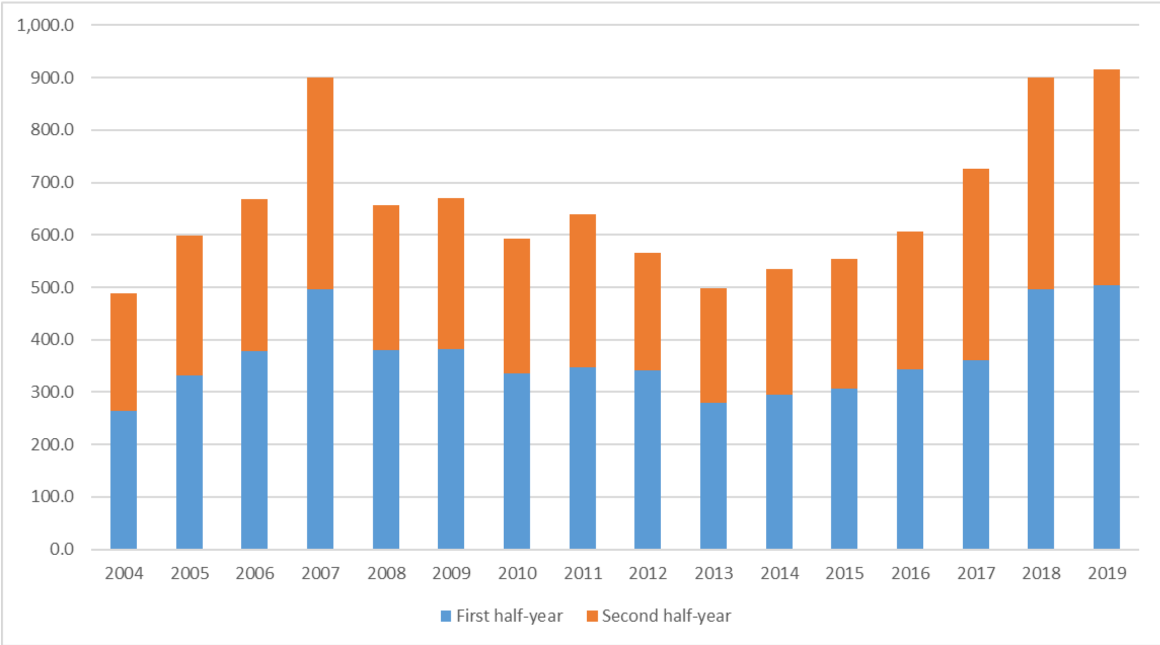

Figure 36. Thousands of passengers carried per half-year on air route ES10. Source: Own work based on data collected from the official database [28].

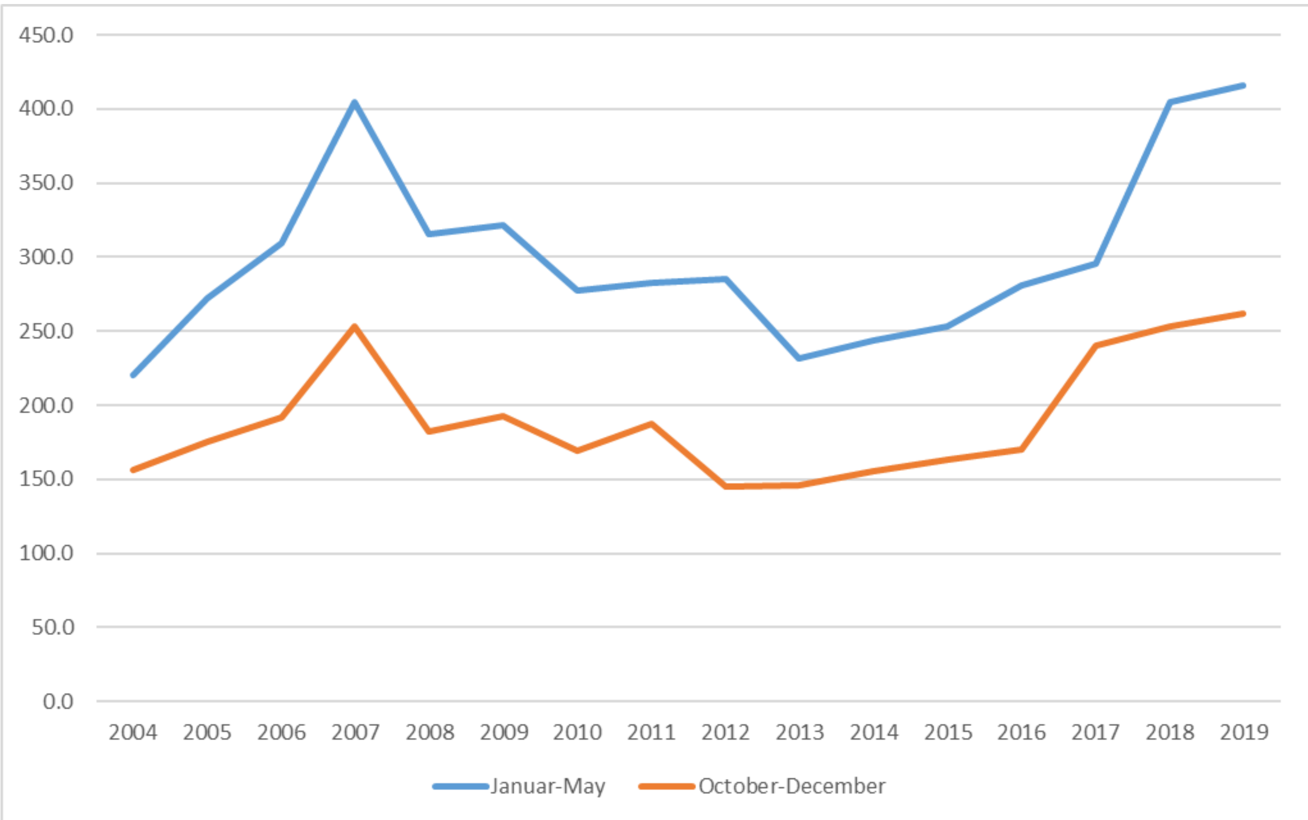

Figure 37. Thousands of passengers carried during low seasons on air route ES10. Source: Own work based on data collected from the official database [28].

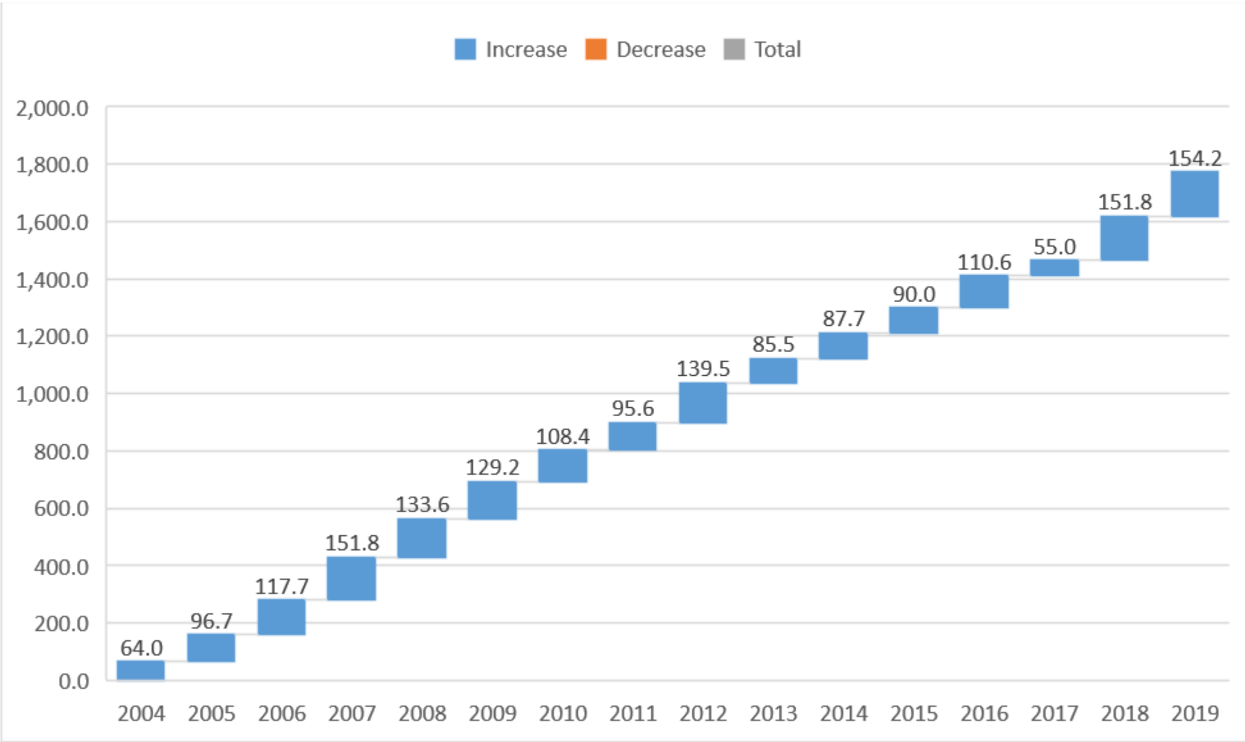

Figure 38. Difference (delta) of passengers carried on the PSO route considered between both periods of each low season per year in the period considered (2004-2019). Source: Own calculation Own work based on data collected from the official database [28].

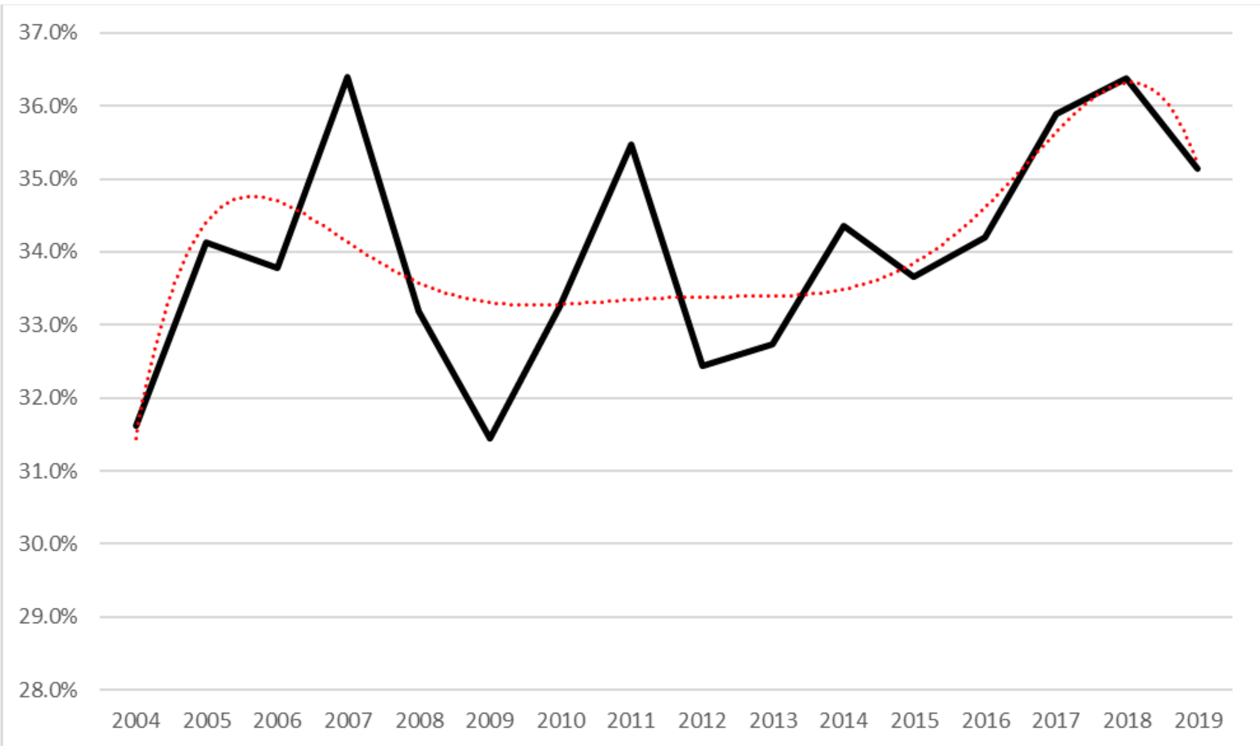

Figure 39. Seasonal trend of activity in peak seasons (June-September) as a percentage of total yearly passengers carried on air route ES10. Source: Own work based on data collected from the official database [28]. Explanatory note: 6th order polynomial trendline considered.

6.6. Evaluation of findings concerning the PSO imposition on air route ES11

The interisland air transport services between Gran Canaria and La Palma, though with slight touristic component, is a route with a significant growth since 2012, as shown in Figure 40 and Figure 41. There is almost no seasonal demand (see Figure 42 and 43).

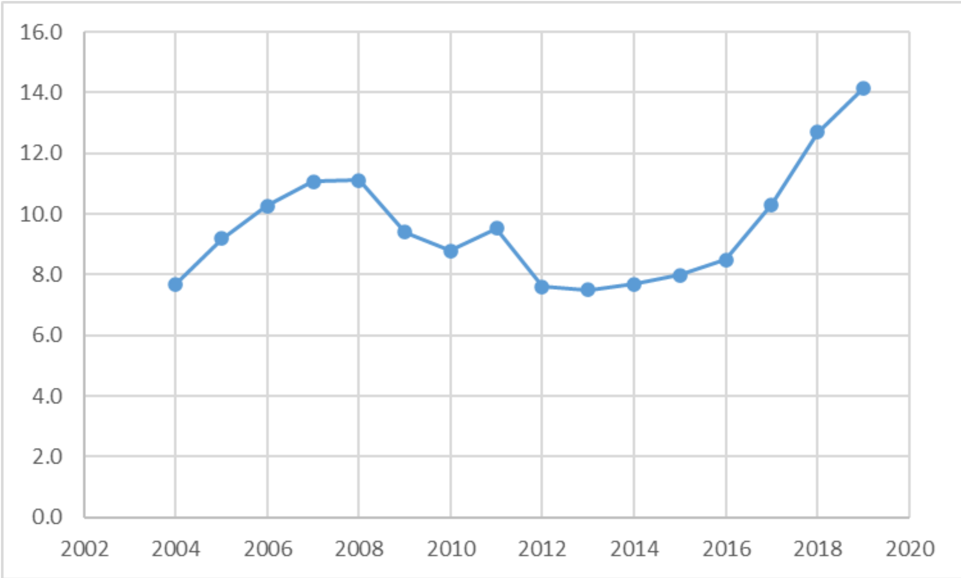

Figure 40. Yearly average of passengers carried in air route ES11 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [28].

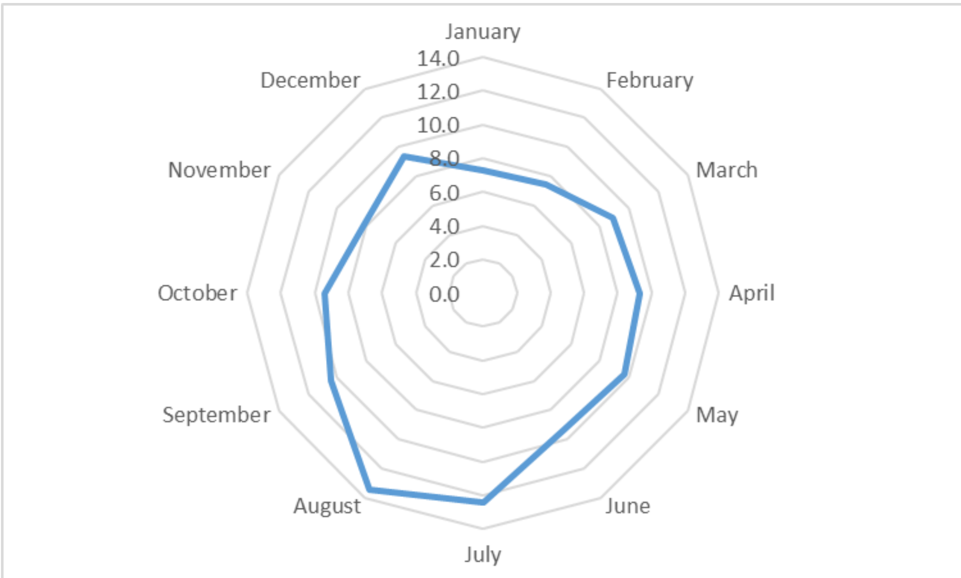

Figure 41. Monthly average of passengers carried in air route ES11 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [28].

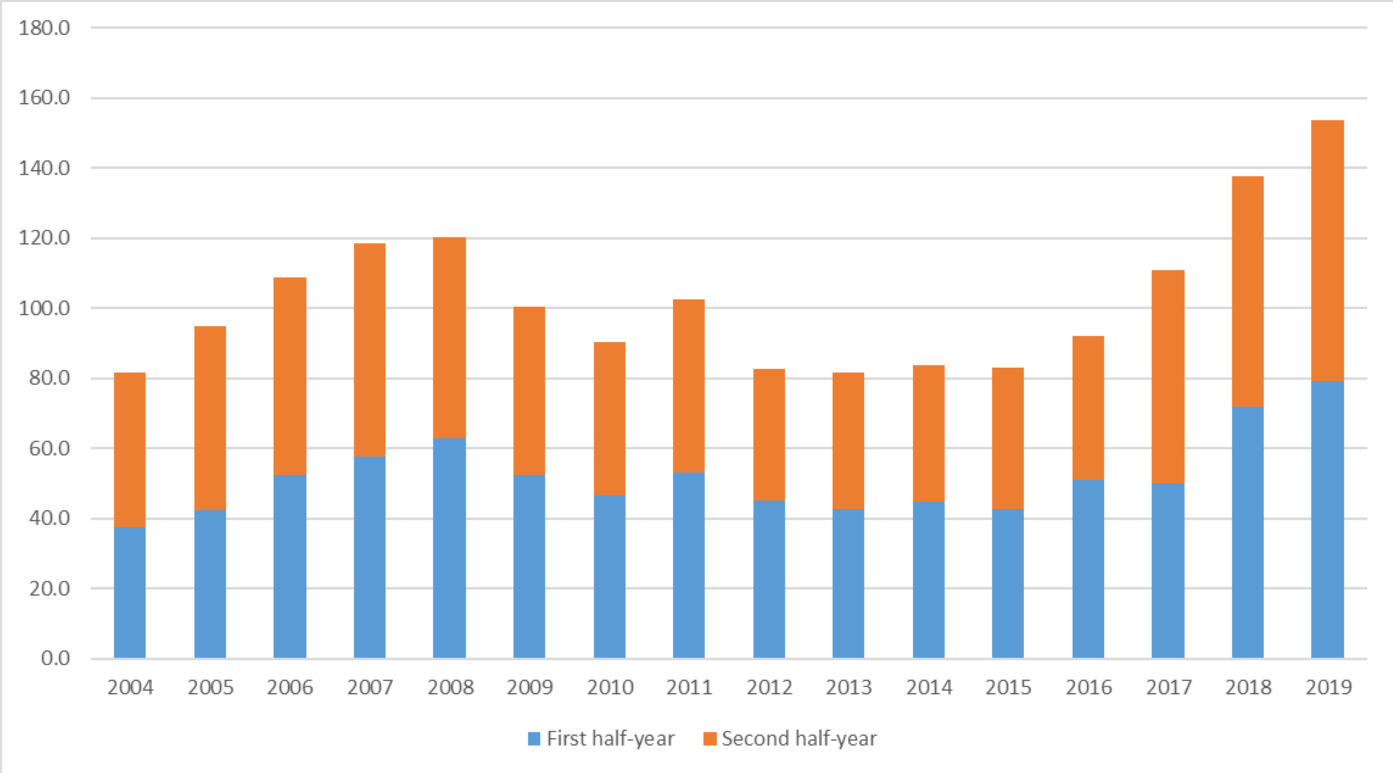

Figure 42. Thousands of passengers carried per half-year on air route ES11. Source: Own work based on data collected from the official database [28].

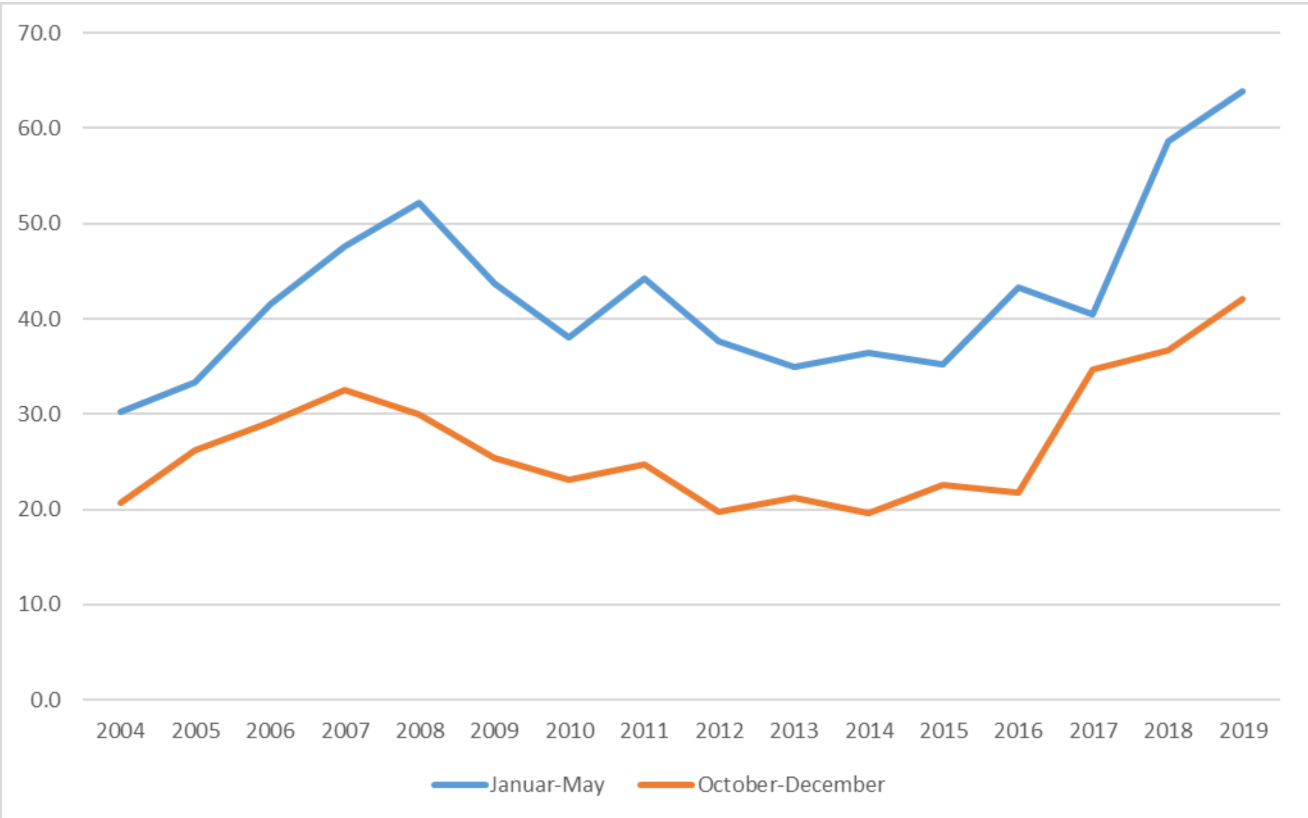

Figure 43. Thousands of passengers carried during low seasons on air route ES11. Source: Own work based on data collected from the official database [28].

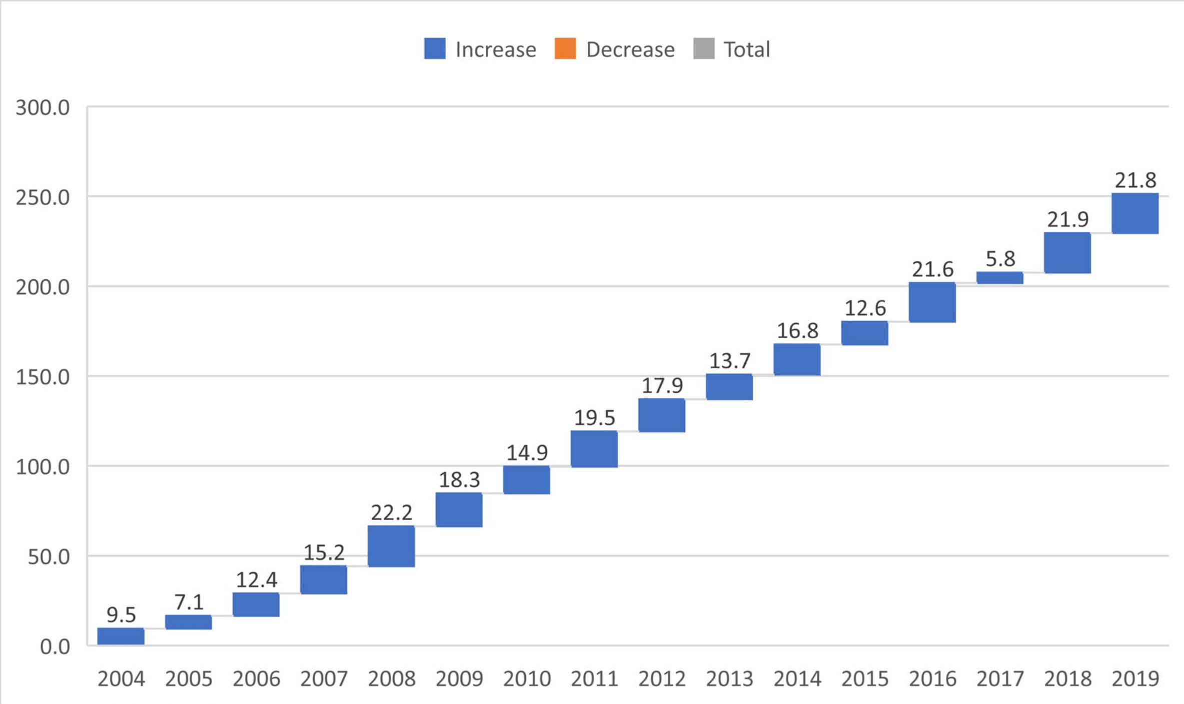

Figure 44. Difference (delta) of passengers carried on the PSO route considered between both periods of each low season per year in the period considered (2004-2019). Source: Own calculation Own work based on data collected from the official database [28].

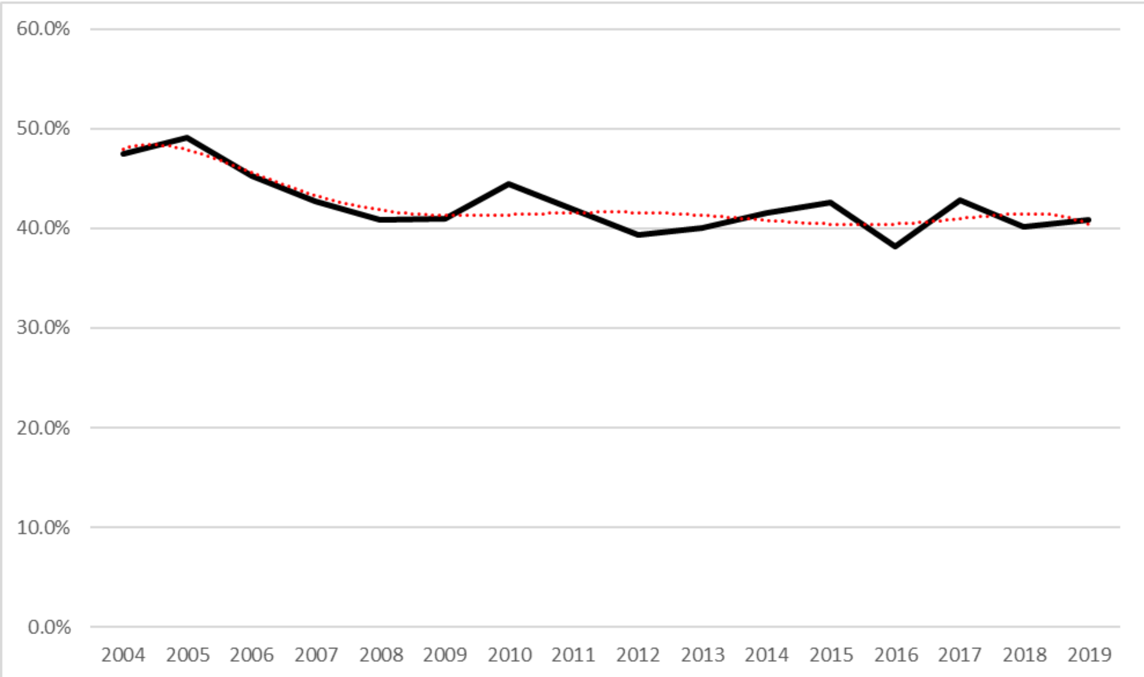

Figure 45. Seasonal trend of activity in peak seasons (June-September) as a percentage of total yearly passengers carried on air route ES11. Source: Own work based on data collected from the official database [28]. Explanatory note: 6th order polynomial trendline considered.

6.7. Evaluation of findings concerning the PSO imposition on air route ES12

The interisland air transport services between La Gomera and Gran Canaria is a secondary route in the regional air transport network of the Canary Islands. This is a very seasonal route, and thus scarcely operated point-to-point, as can be seen from figures below.

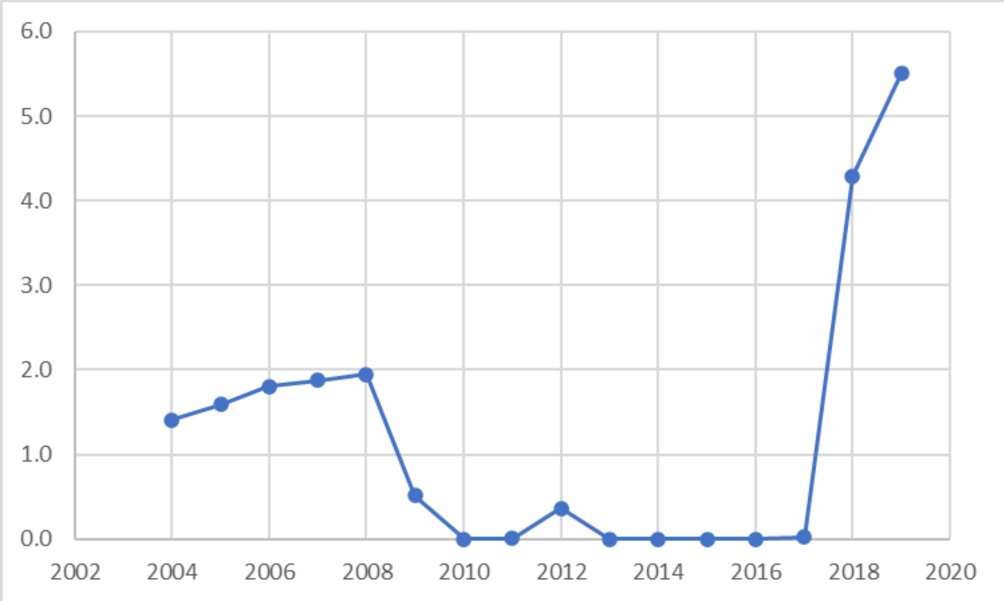

Figure 46. Yearly average of passengers carried in air route ES12 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [28].

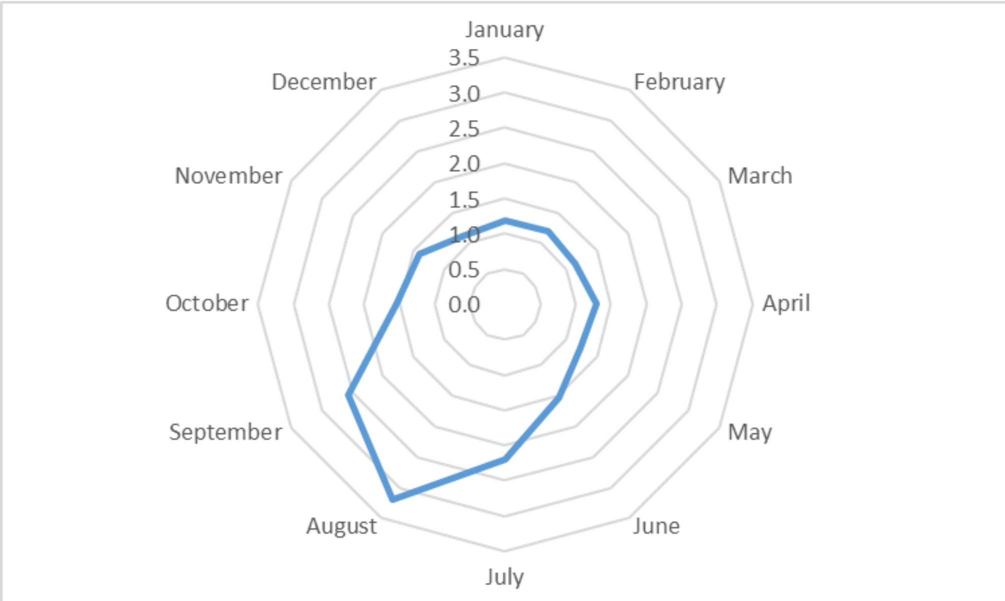

Figure 47. Monthly average of passengers carried in air route ES12 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [28].

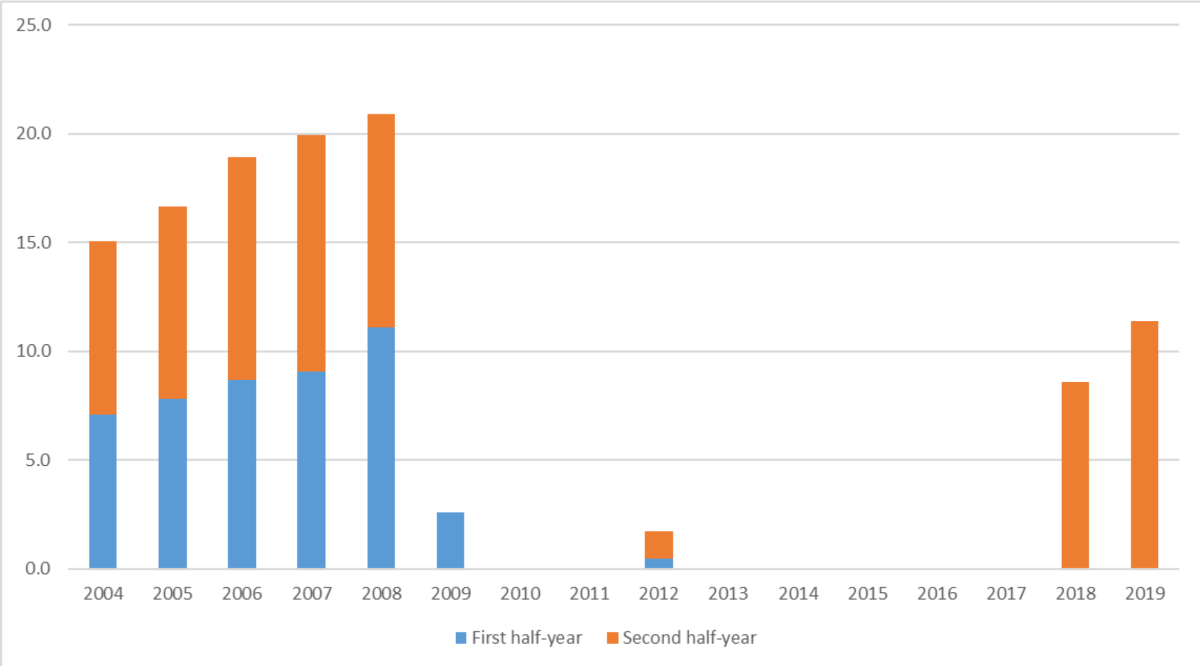

Figure 48. Thousands of passengers carried during low seasons on air route ES12. Source: Own work based on data collected from the official database [28].

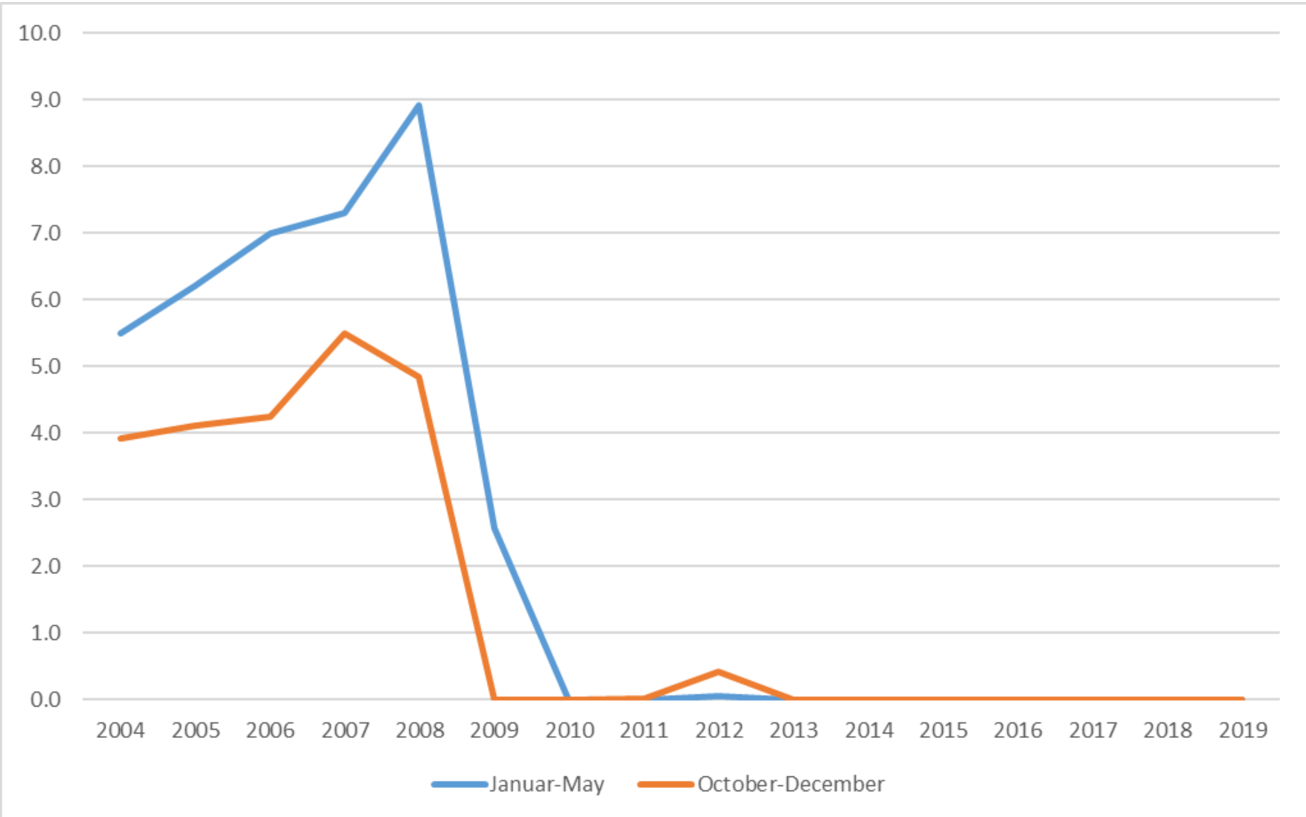

Figure 49. Thousands of passengers carried during low seasons on air route ES12. Source: Own work based on data collected from the official database [28].

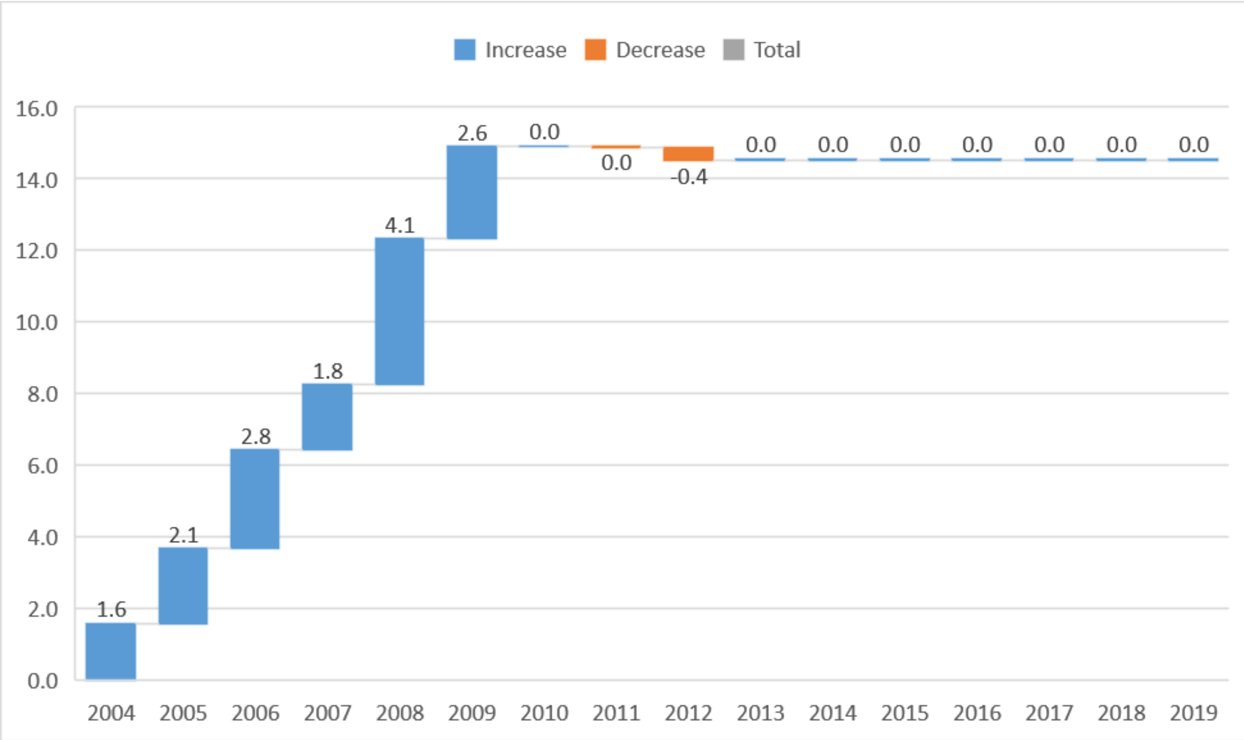

Figure 50. Difference (delta) of passengers carried on the PSO route considered between both periods of each low season per year in the period considered (2004-2019). Source: Own calculation Own work based on data collected from the official database [28].

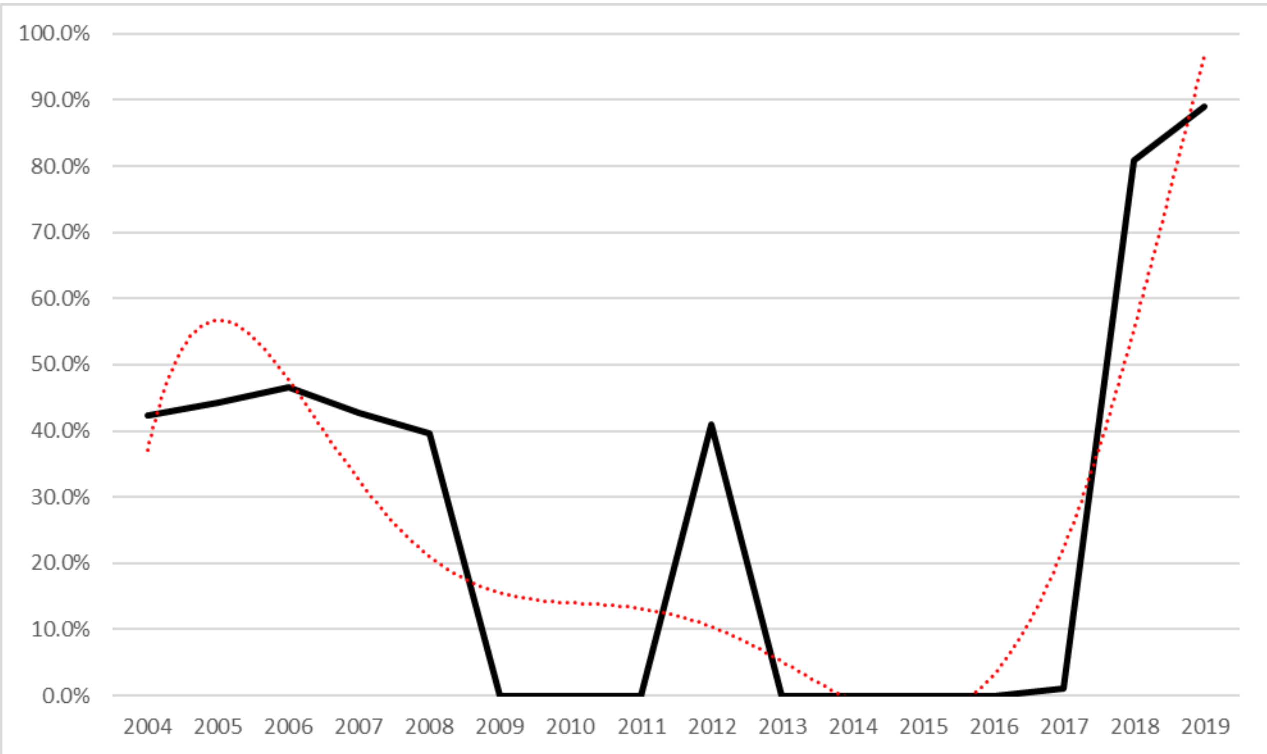

Figure 51. Seasonal trend of activity in peak seasons (June-September) as a percentage of total yearly passengers carried on air route ES11. Source: Own work based on data collected from the official database [28]. Explanatory note: 6th order polynomial trendline considered.

6.8. Evaluation of findings concerning the PSO imposition on air route ES13

The interisland air transport services between La Palma and Lanzarote is a peripheral route in the regional air transport network in the Canaries, since this does not connect with one of the two capitals of the archipelago. However, no seasonality has been observed from Figures 52 and 53. This seems this route has not strongly been influenced by tourism effect.

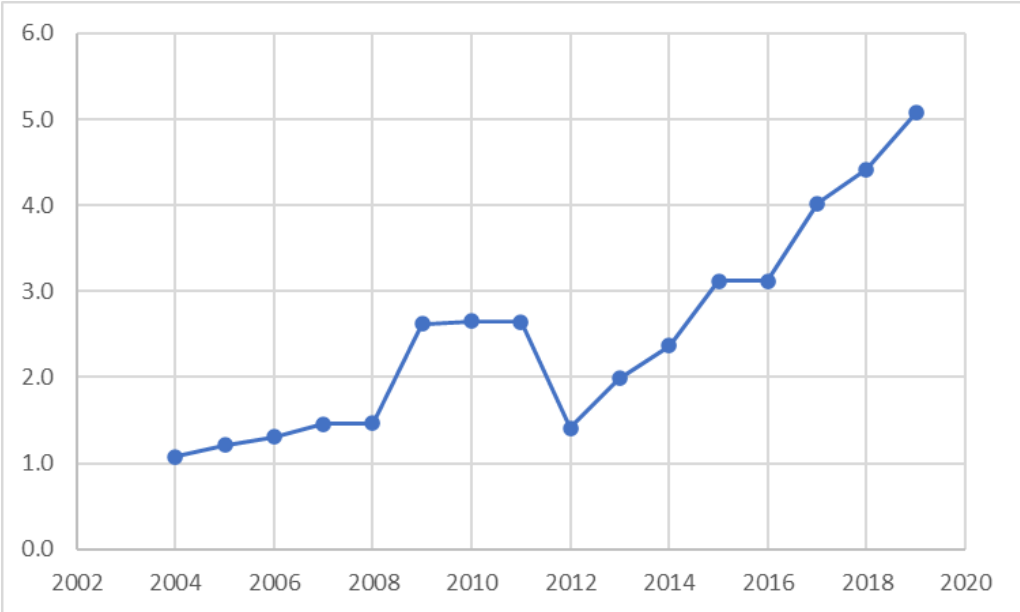

Figure 52. Yearly average of passengers carried in air route ES13 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [28].

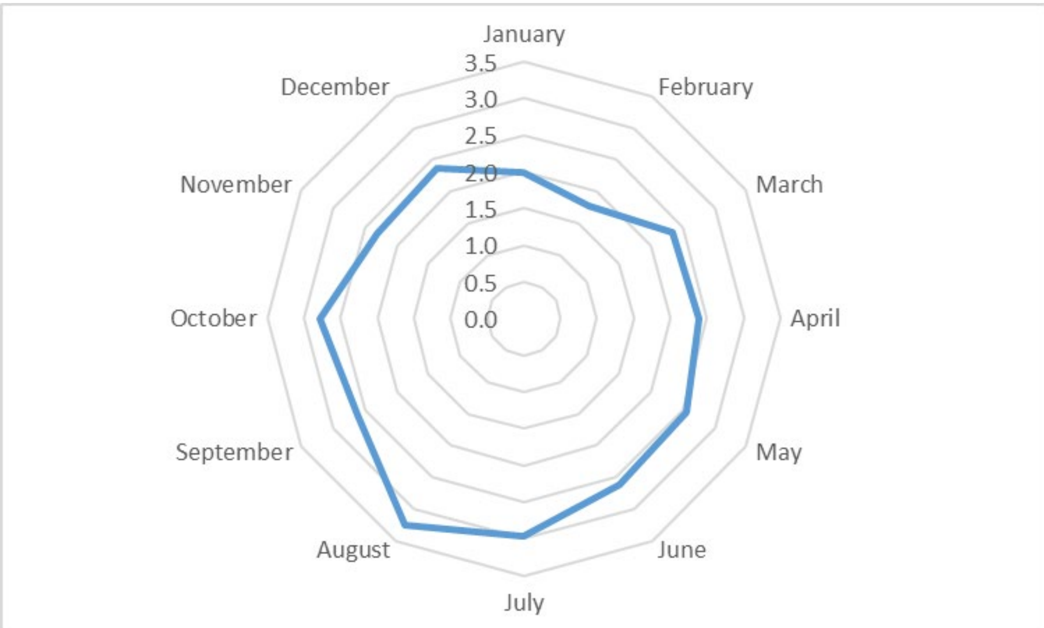

Figure 53. Monthly average of passengers carried in air route ES13 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [28].

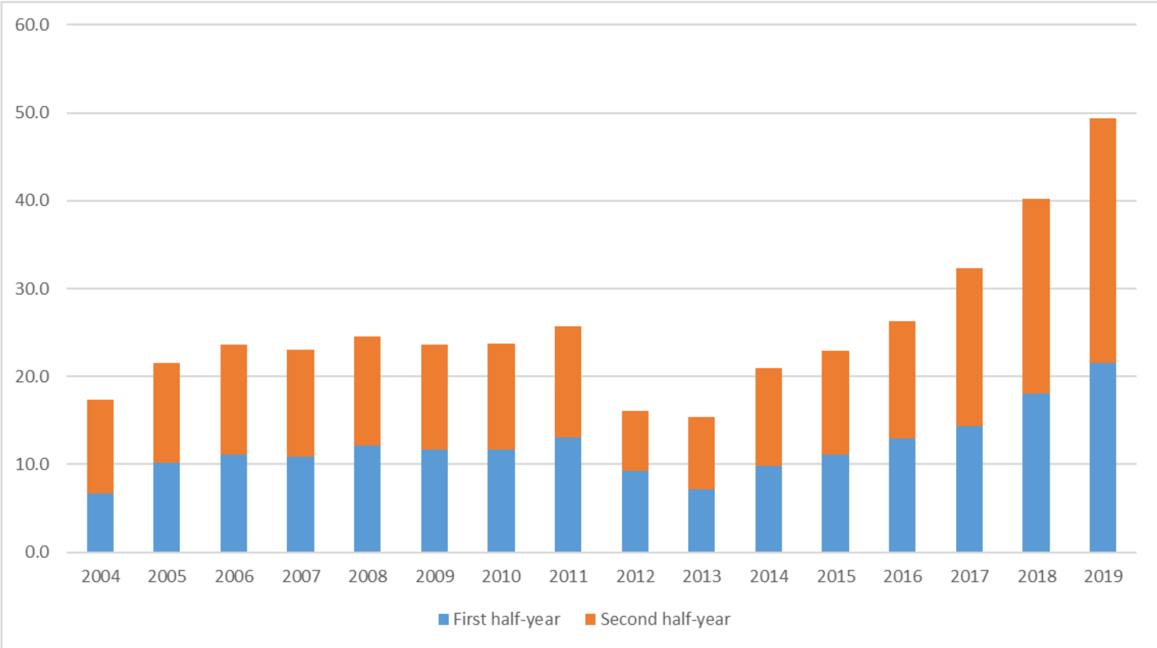

Figure 54. Thousands of passengers carried during low seasons on air route ES13. Source: Own work based on data collected from the official database [28].

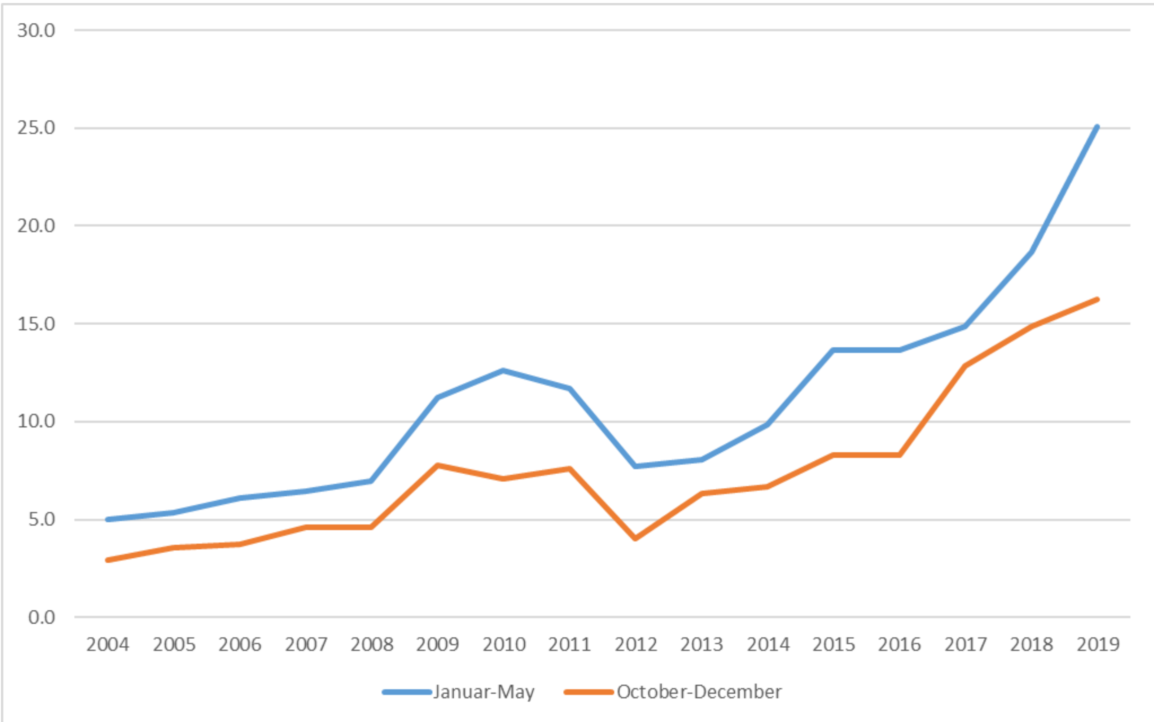

Figure 55. Thousands of passengers carried during low seasons on air route ES13. Source: Own work based on data collected from the official database [28].

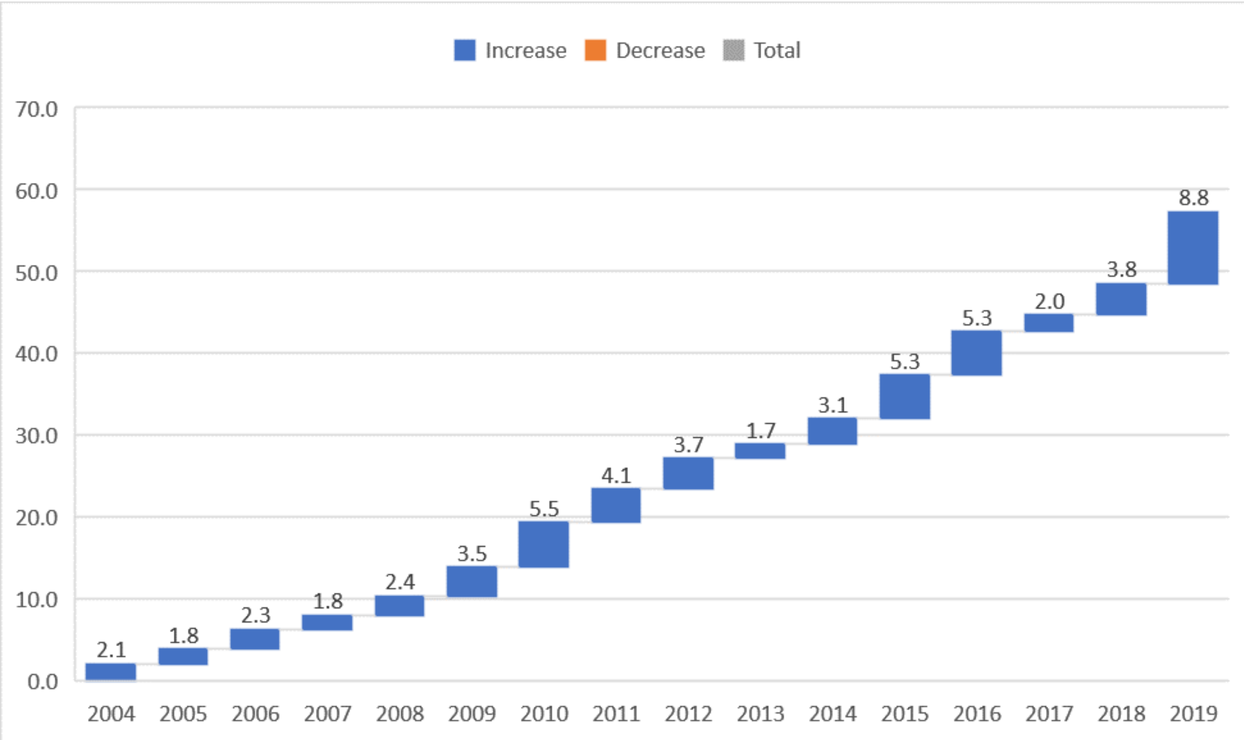

Figure 56. Difference (delta) of passengers carried on the PSO route considered between both periods of each low season per year in the period considered (2004-2019). Source: Own calculation Own work based on data collected from the official database [28].

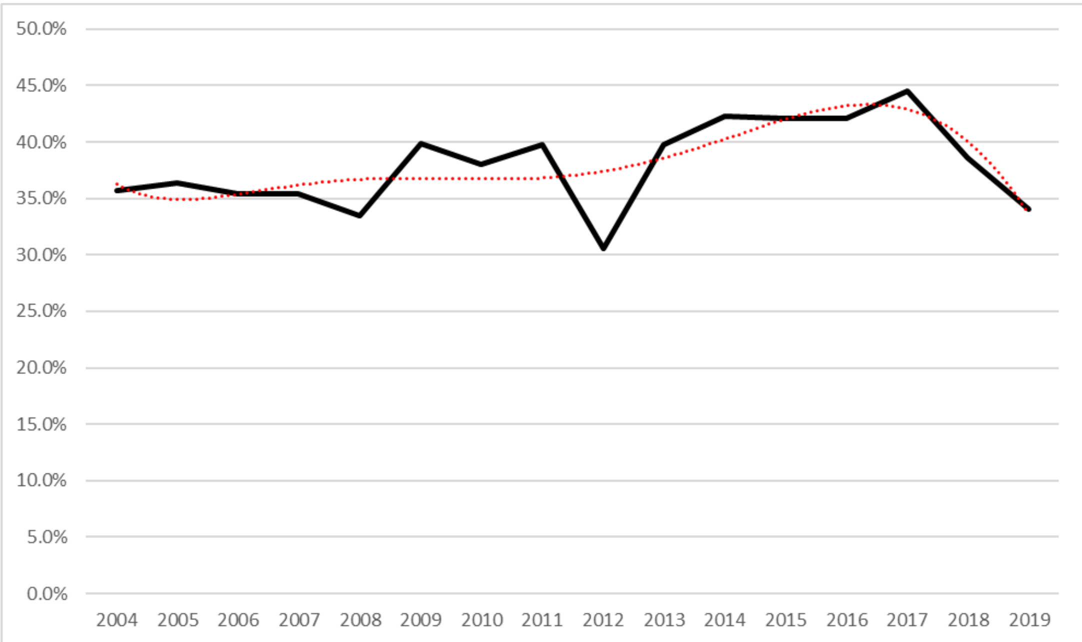

Figure 57. Seasonal trend of activity in peak seasons (June-September) as a percentage of total yearly passengers carried on air route ES13. Source: Own work based on data collected from the official database [28]. Explanatory note: 6th order polynomial trendline considered.

6.9. Evaluation of findings concerning the PSO imposition on air route ES14

The interisland air transport services between La Palma and Lanzarote is peripheral route in the regional air transport network of the Canaries. This demand has a strong effect due to tourism impact, as can be seen in Figures below.

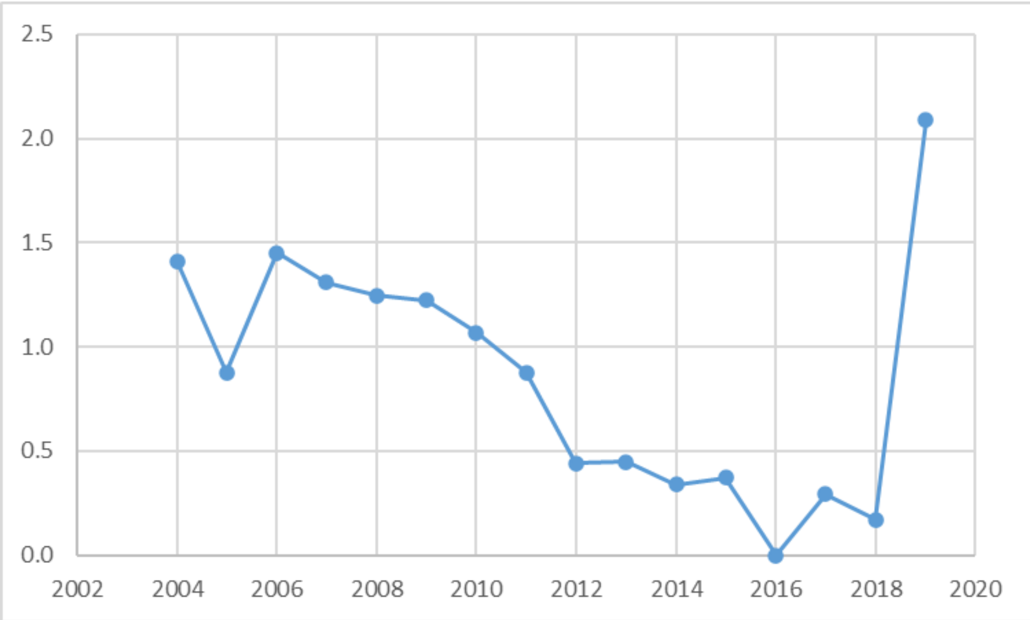

Figure 58. Yearly average of passengers carried in air route ES14 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [28].

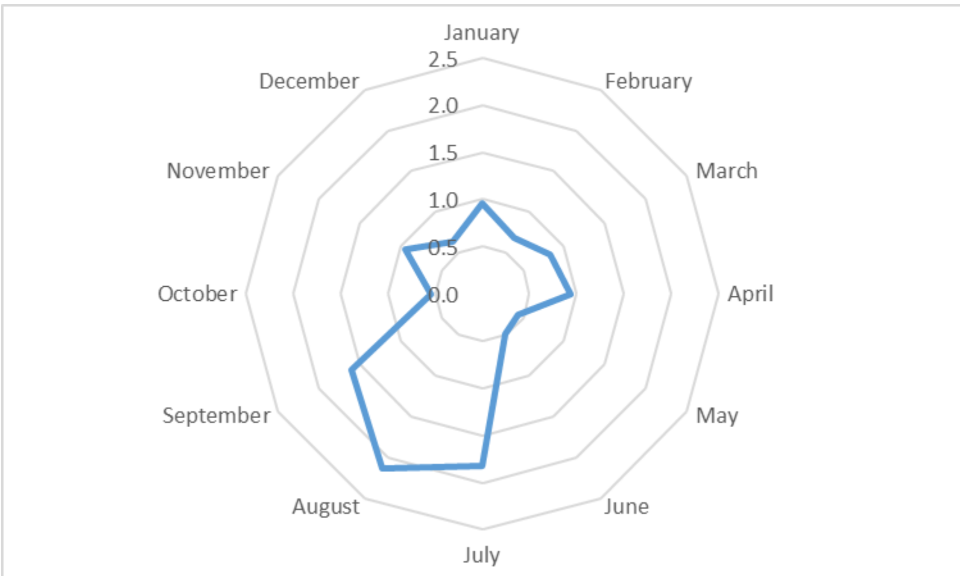

Figure 59. Monthly average of passengers carried in air route ES14 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [28].

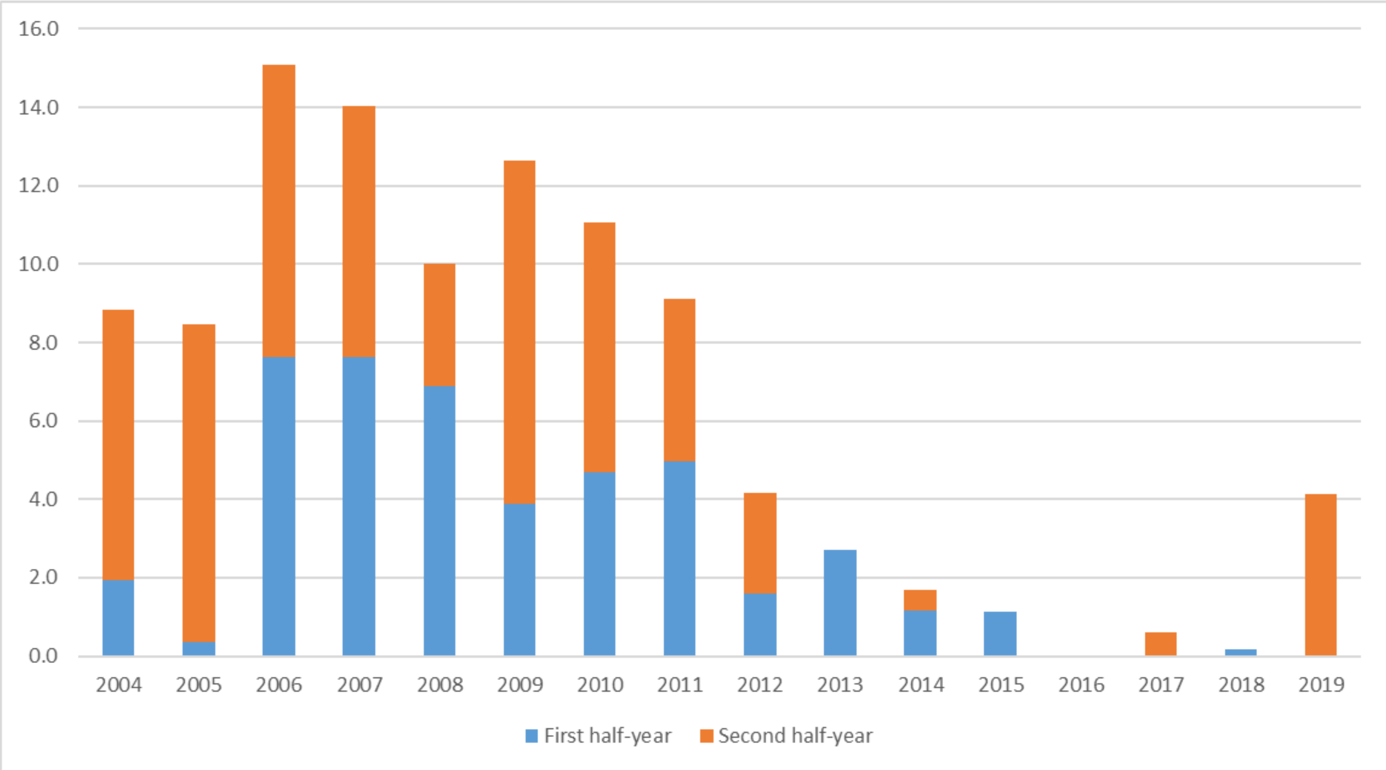

Figure 60. Thousands of passengers carried during low seasons on air route ES14. Source: Own work based on data collected from the official database [28].

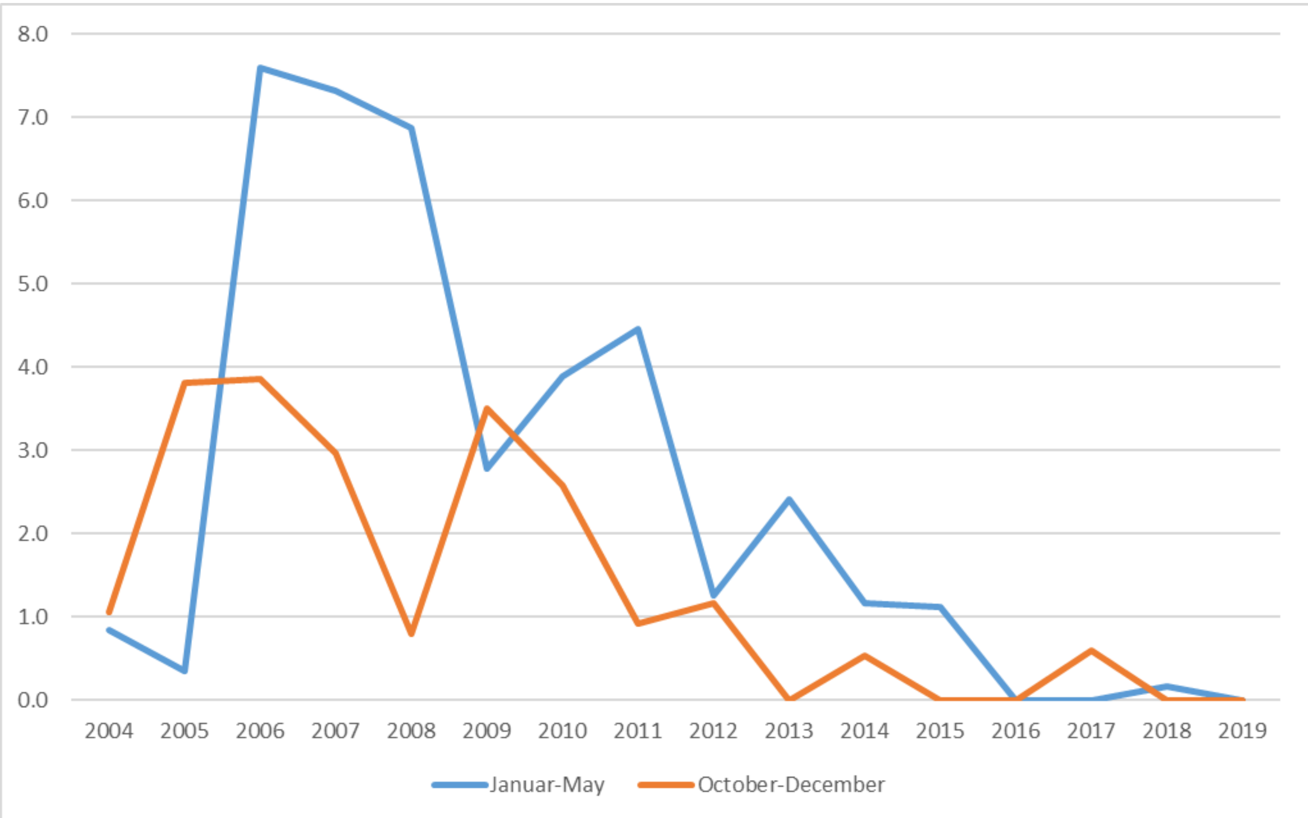

Figure 61. Thousands of passengers carried during low seasons on air route ES14. Source: Own work based on data collected from the official database [28].

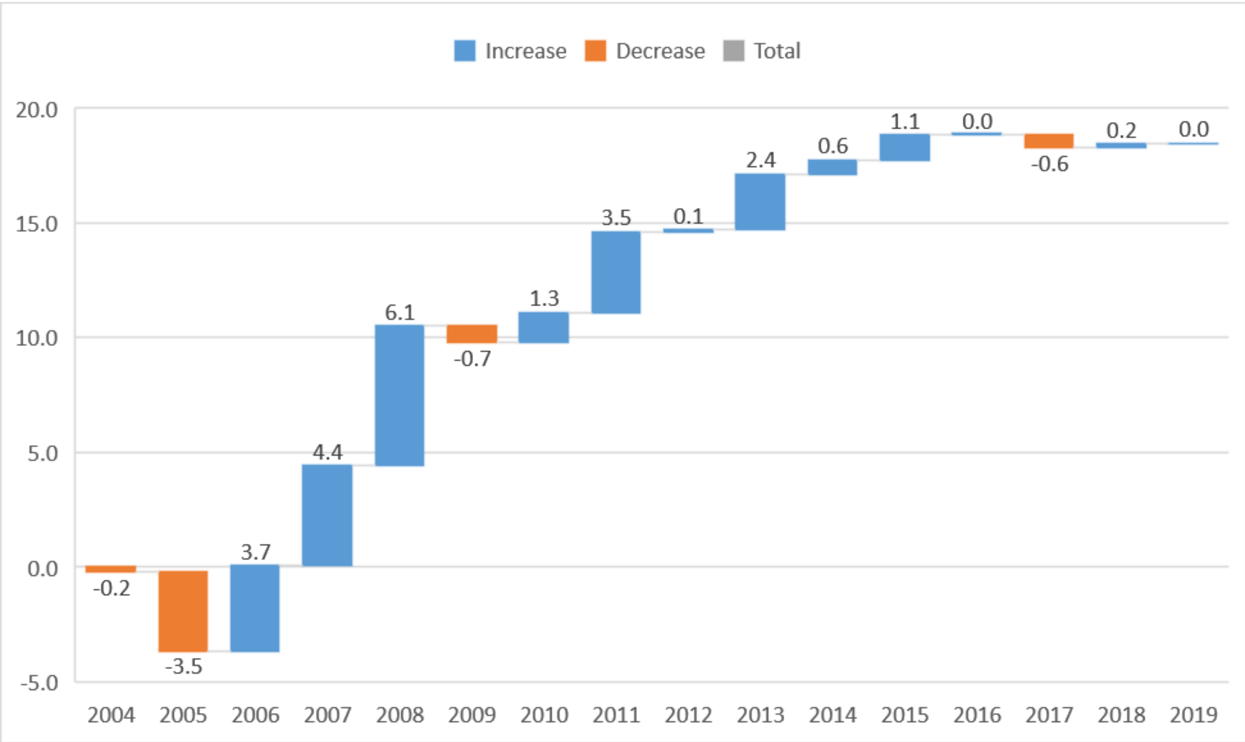

Figure 62. Difference (delta) of passengers carried on the PSO route considered between both periods of each low season per year in the period considered (2004-2019). Source: Own calculation Own work based on data collected from the official database [28].

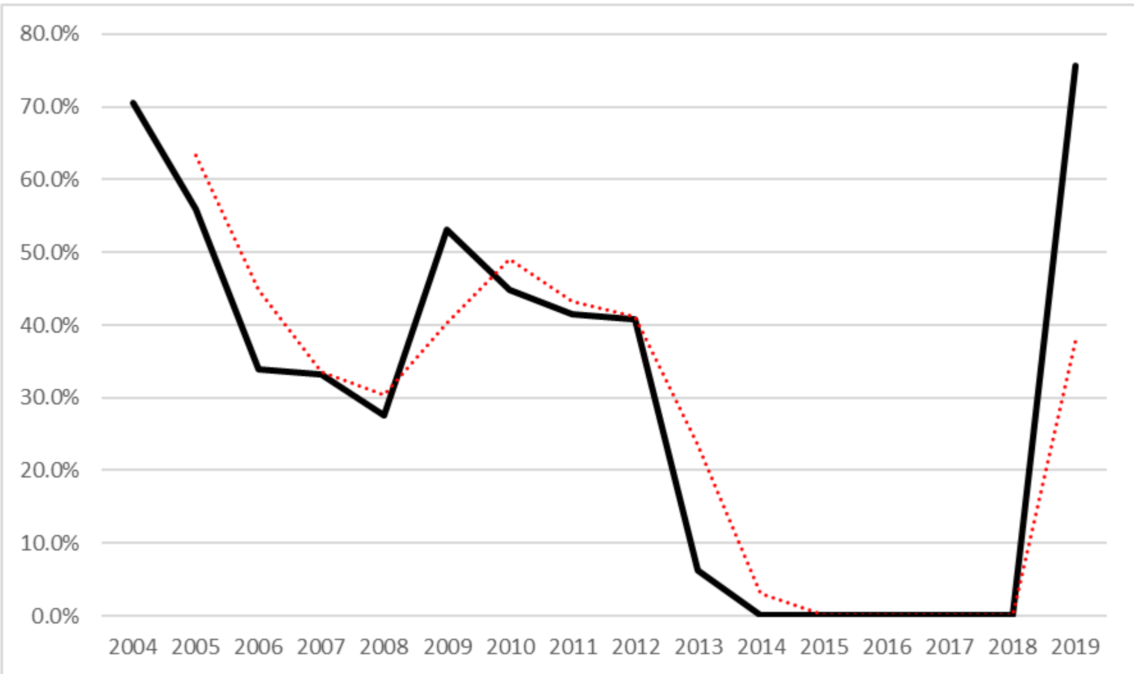

Figure 63. Seasonal trend of activity in peak seasons (June-September) as a percentage of total yearly passengers carried on air route ES14. Source: Own work based on data collected from the official database [28]. Explanatory note: Moving average with 2-period considered

6.10. Evaluation of findings concerning the PSO imposition on air route ES15

The interisland air transport services between Tenerife and El Hierro is a thin route in the regional air transport network in the Canaries. No seasonality has been observed from figures below. The route has led to an significant increase in demand since 2013.

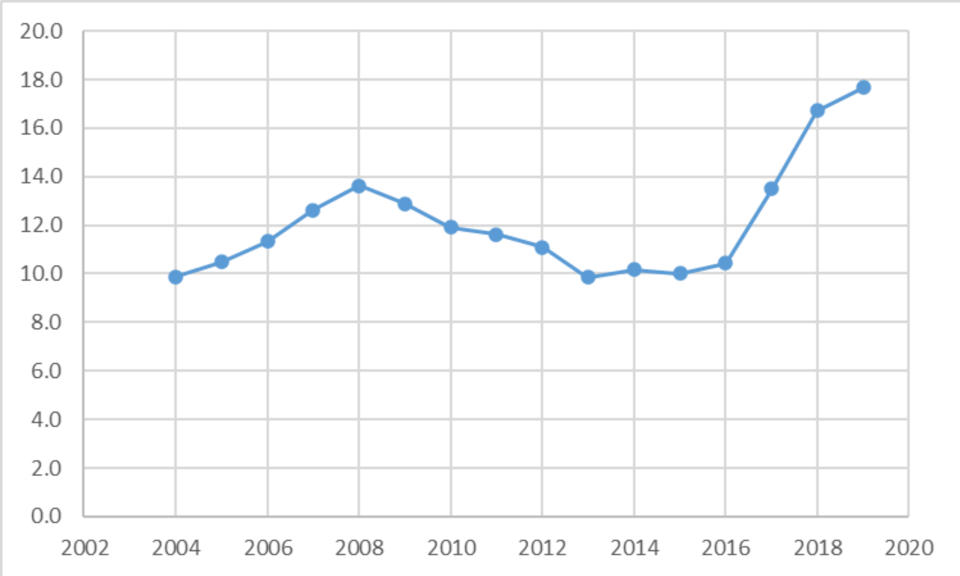

Figure 64. Yearly average of passengers carried in air route ES15 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [28].

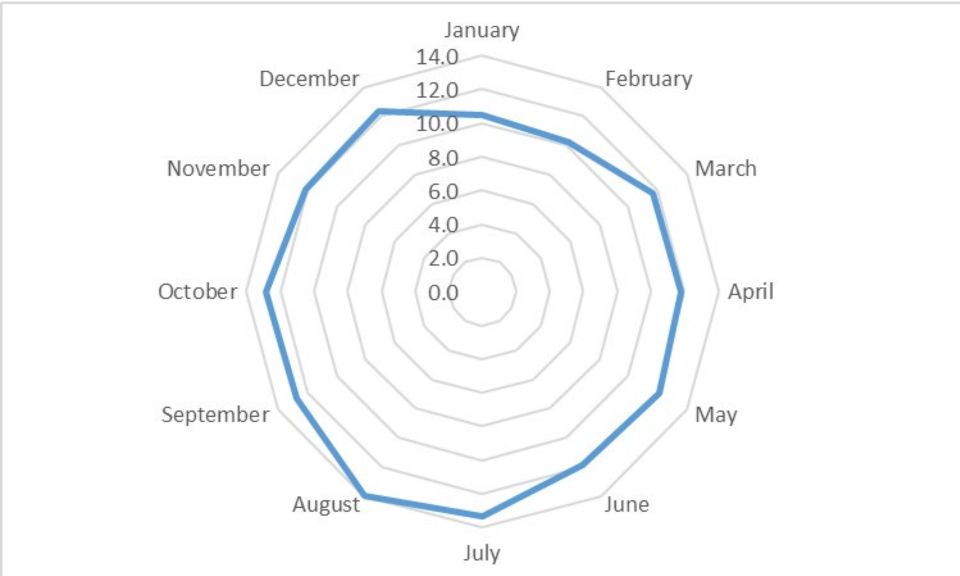

Figure 65. Monthly average of passengers carried in air route ES15 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [28].

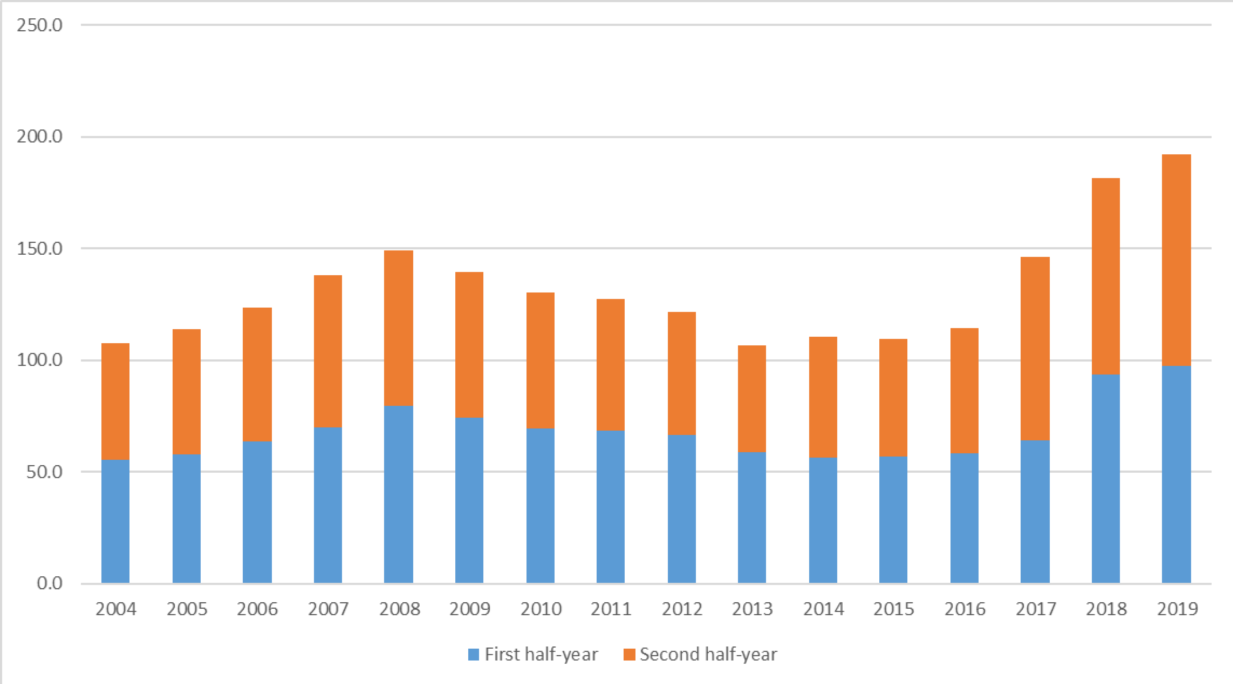

Figure 66. Thousands of passengers carried during low seasons on air route ES15. Source: Own work based on data collected from the official database [28].

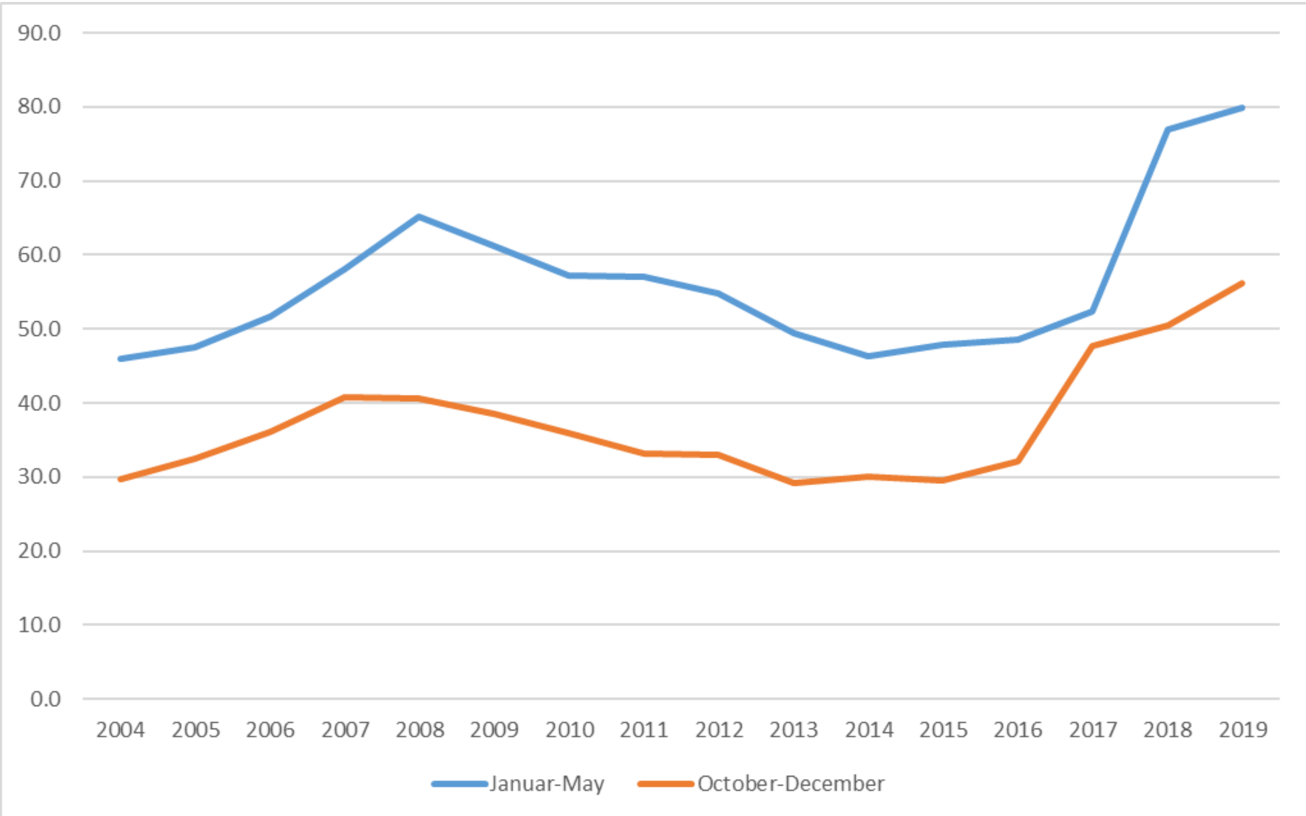

Figure 67. Thousands of passengers carried during low seasons on air route ES15. Source: Own work based on data collected from the official database [28].

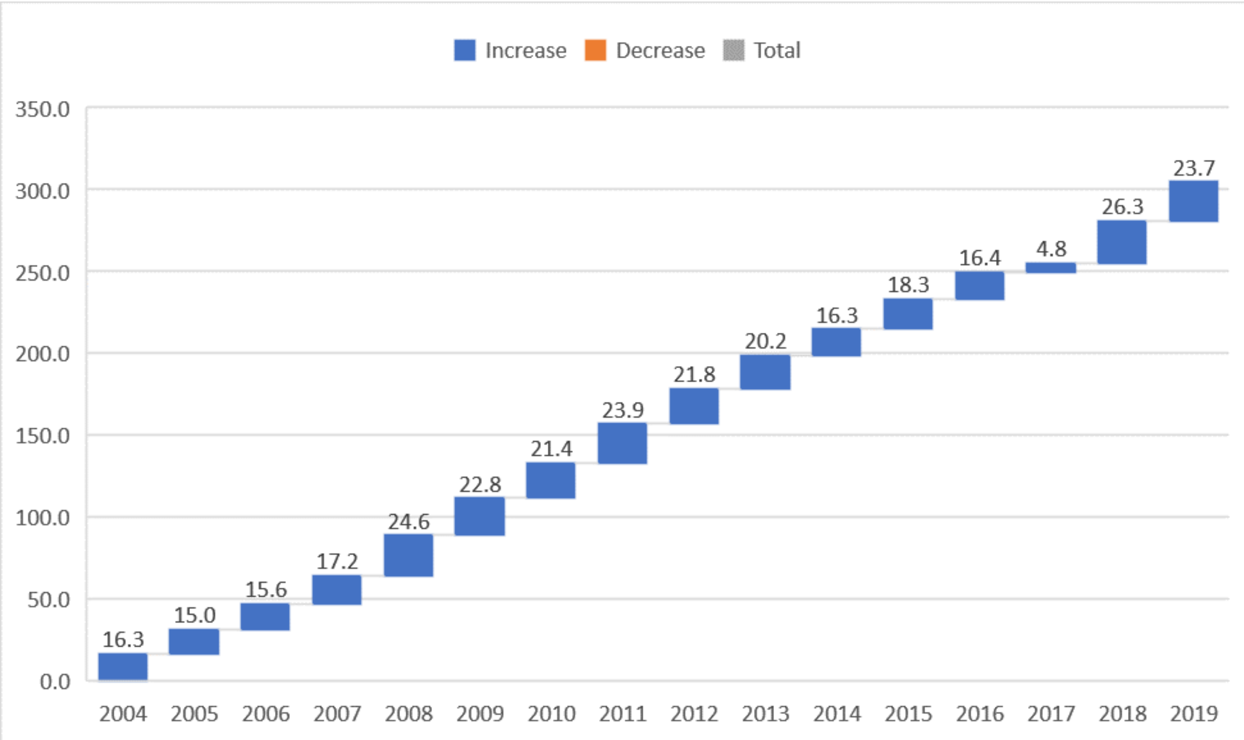

Figure 68. Difference (delta) of passengers carried on the PSO route considered between both periods of each low season per year in the period considered (2004-2019). Source: Own calculation Own work based on data collected from the official database [28].

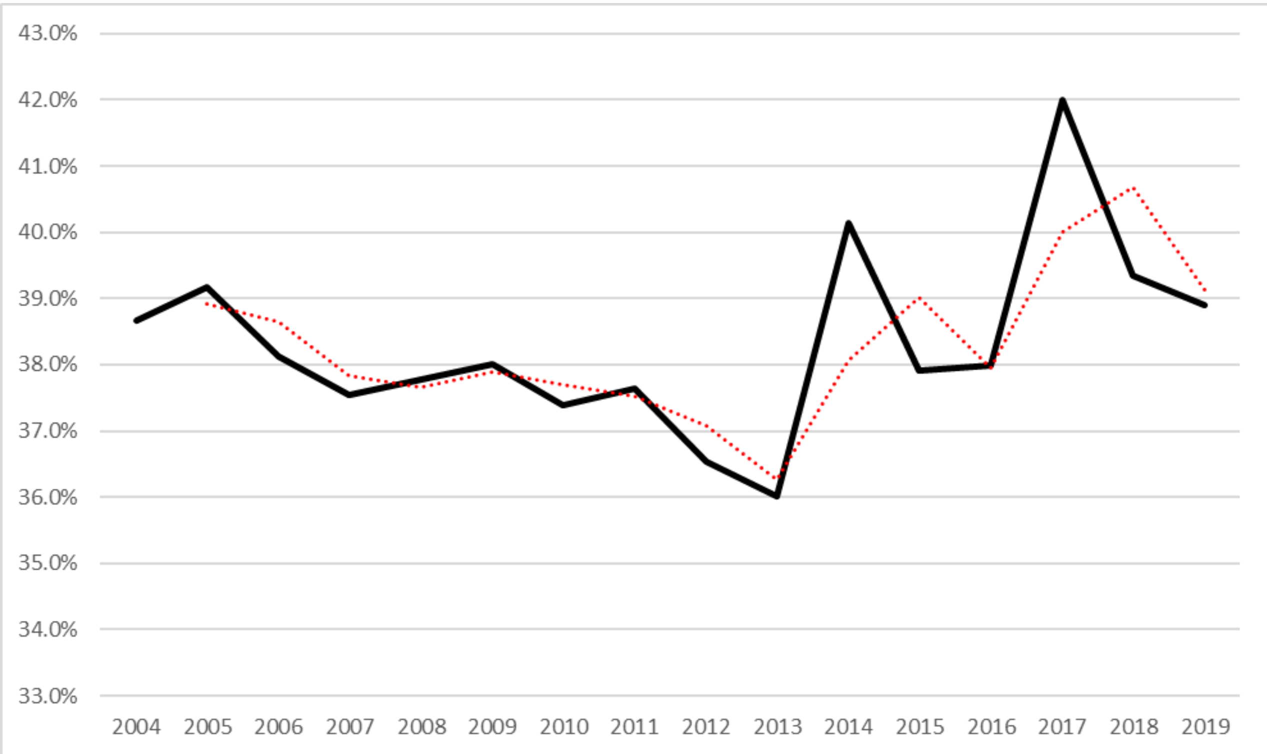

Figure 69. Seasonal trend of activity in peak seasons (June-September) as a percentage of total yearly passengers carried on air route ES15. Source: Own work based on data collected from the official database [20]. Explanatory note: Moving average with 2-period trendline considered.

6.11. Evaluation of findings concerning the PSO imposition on air route ES16

The interisland air transport services between Tenerife and Fuerteventura is a secondary route in the Canaries whose demand in passengers carried is slight seasonal, as can be seen below.

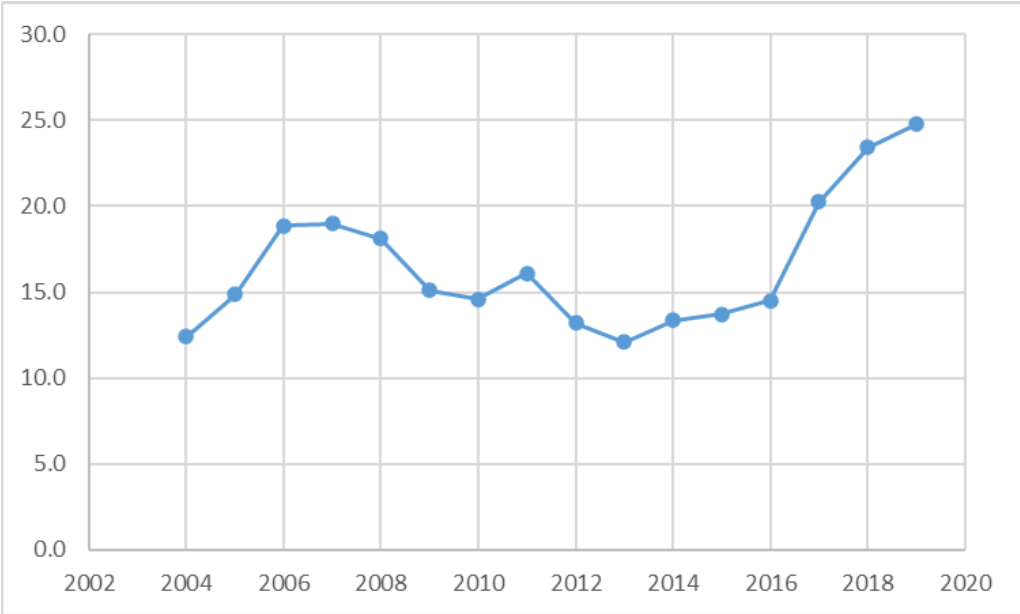

Figure 70. Yearly average of passengers carried in air route ES16 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [28].

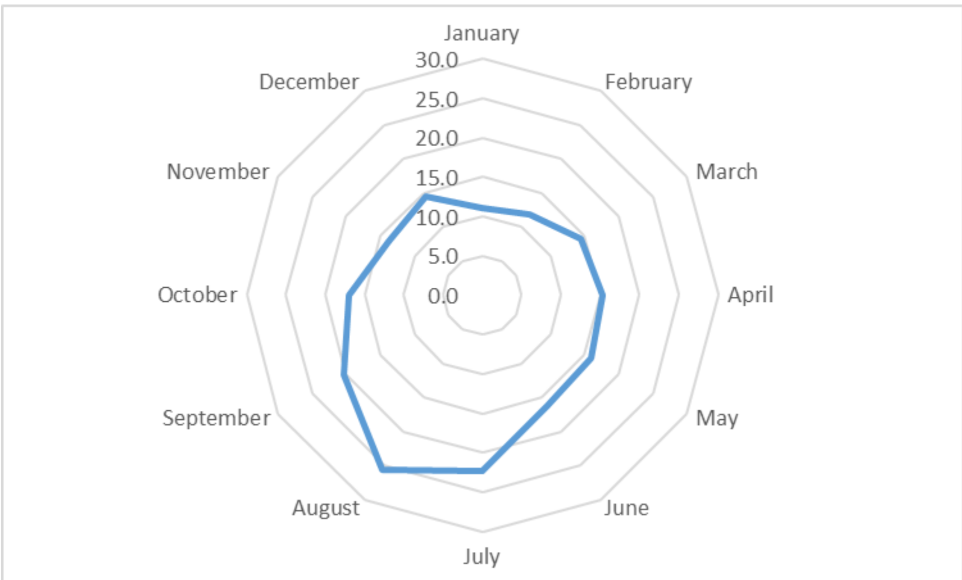

Figure 71. Monthly average of passengers carried in air route ES16 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [28].

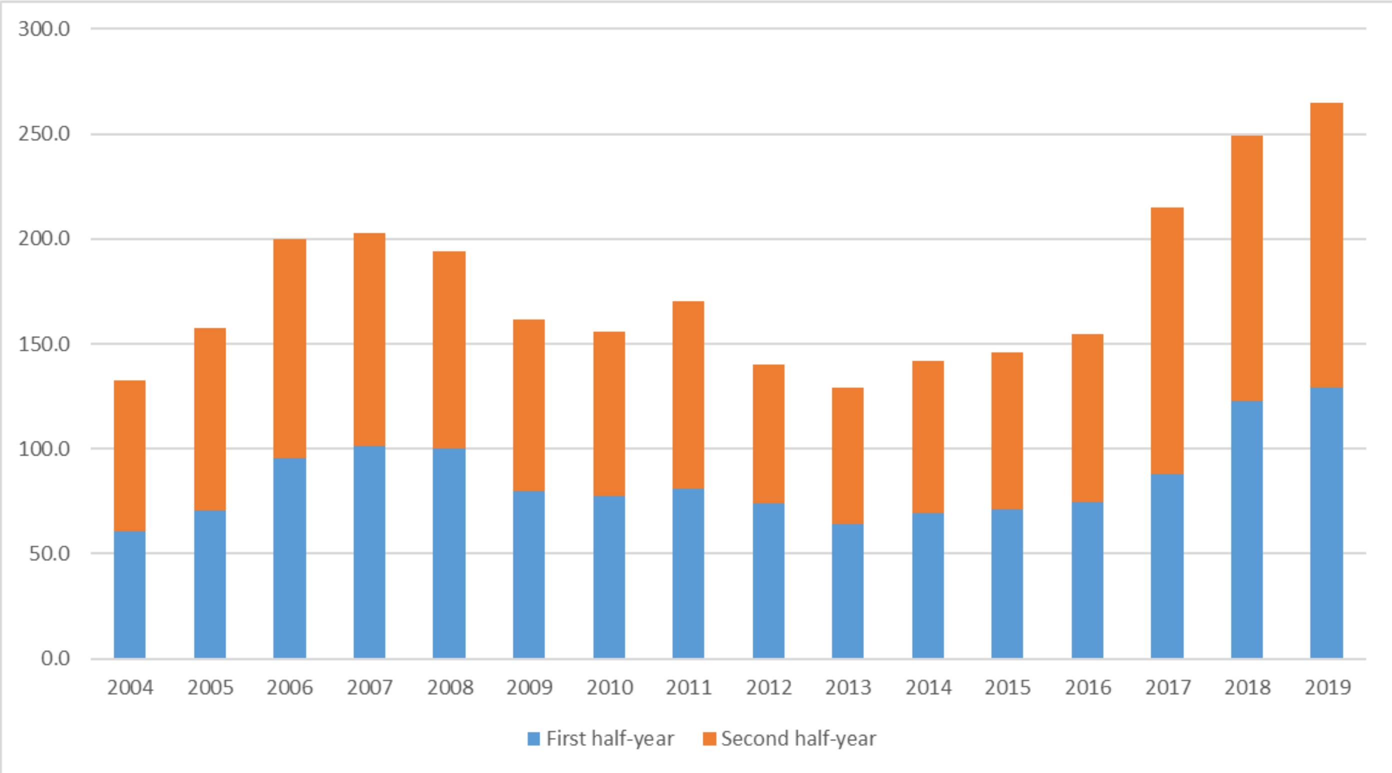

Figure 72. Thousands of passengers carried during low seasons on air route ES16. Source: Own work based on data collected from the official database [28].

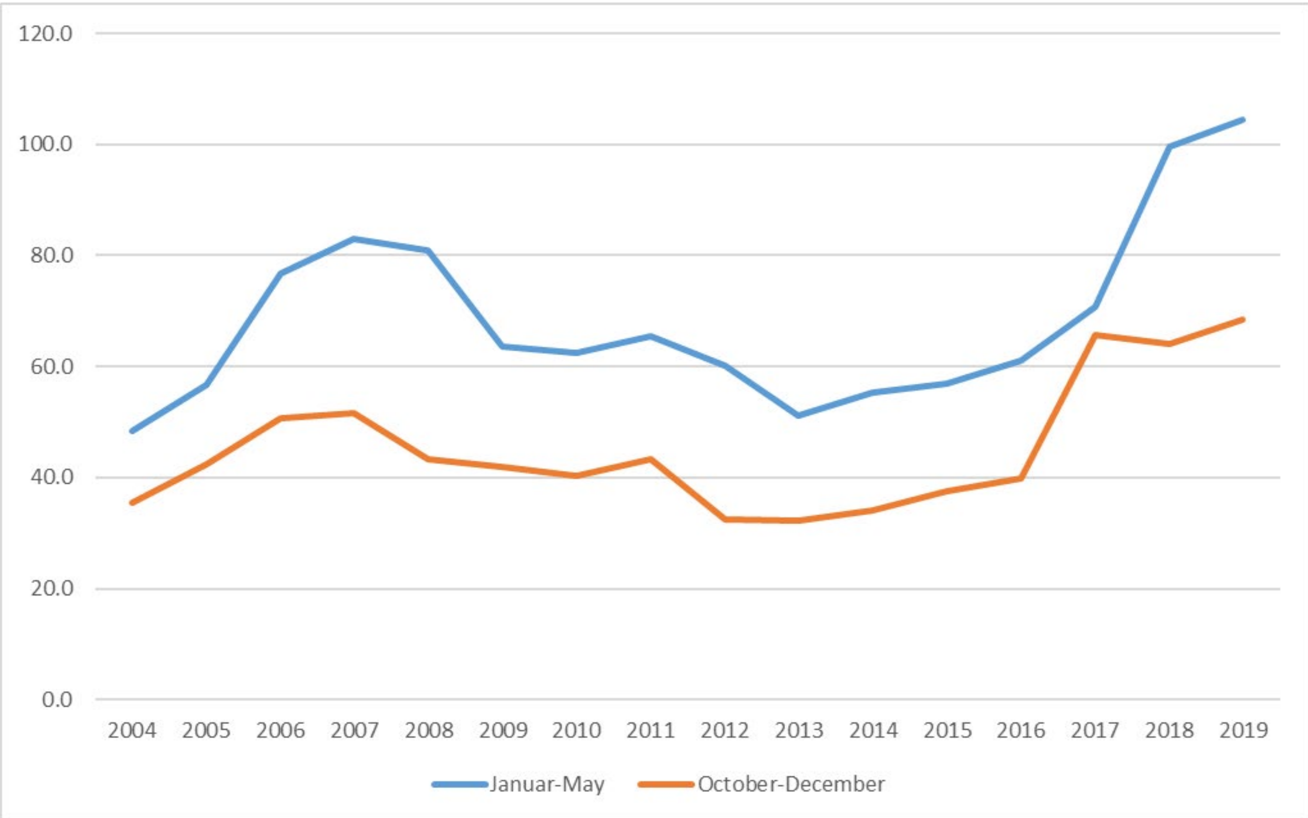

Figure 73. Thousands of passengers carried during low seasons on air route ES16. Source: Own work based on data collected from the official database [28].

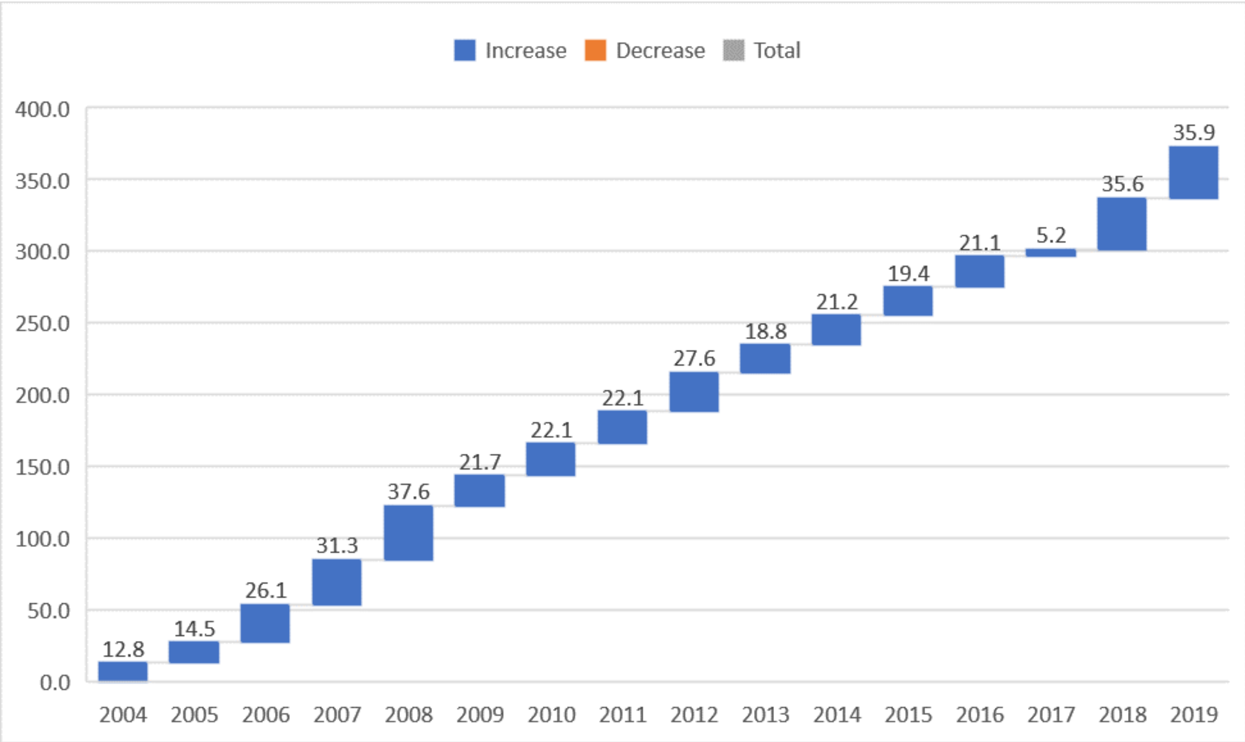

Figure 74. Difference (delta) of passengers carried on the PSO route considered between both periods of each low season per year in the period considered (2004-2019). Source: Own calculation Own work based on data collected from the official database [28].

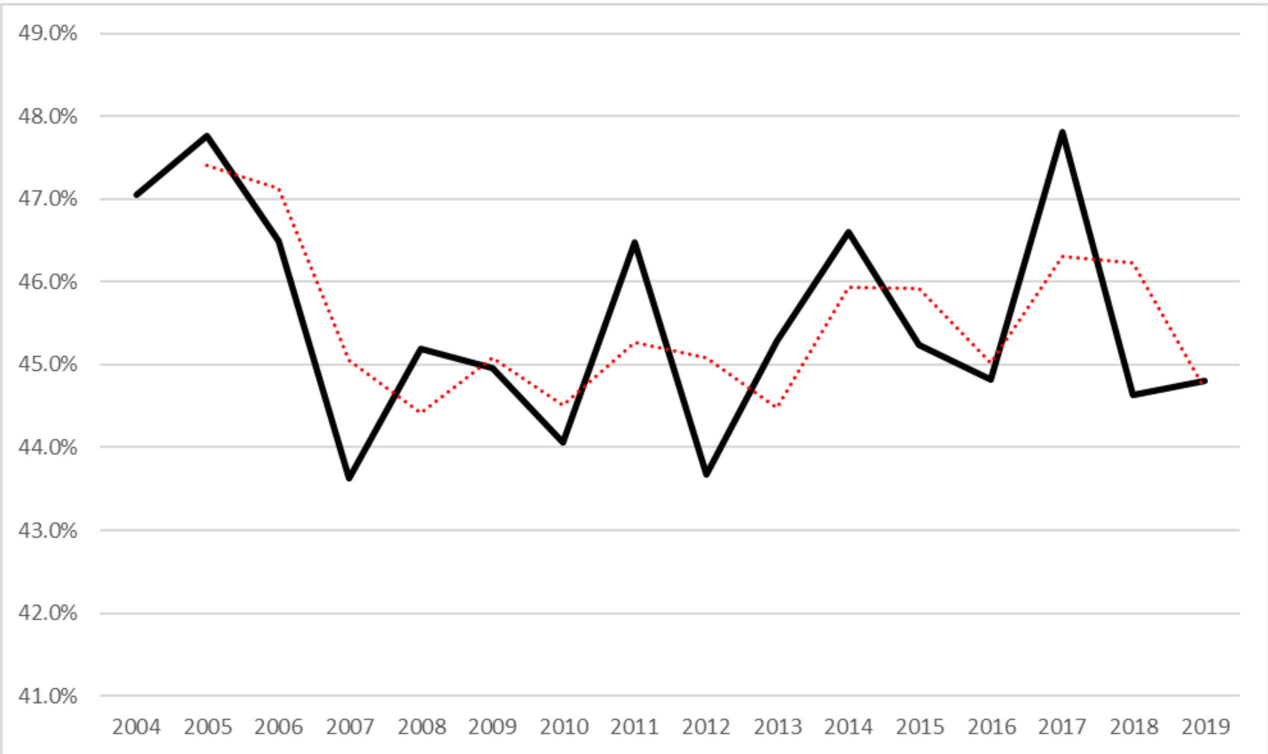

Figure 75. Seasonal trend of activity in peak seasons (June-September) as a percentage of total yearly passengers carried on air route ES16. Source: Own work based on data collected from the official database [20]. Explanatory note: Moving average with 2-period trendline considered.

6.12. Evaluation of findings concerning the PSO imposition on air route ES17

The interisland air transport services between Tenerife North and Lanzarote is a secondary route in the regional air transport network with strong impact on territorial cohesion in the Canaries. No seasonal behavior has been observed second one in terms of passenger carried, as shown in figures below.

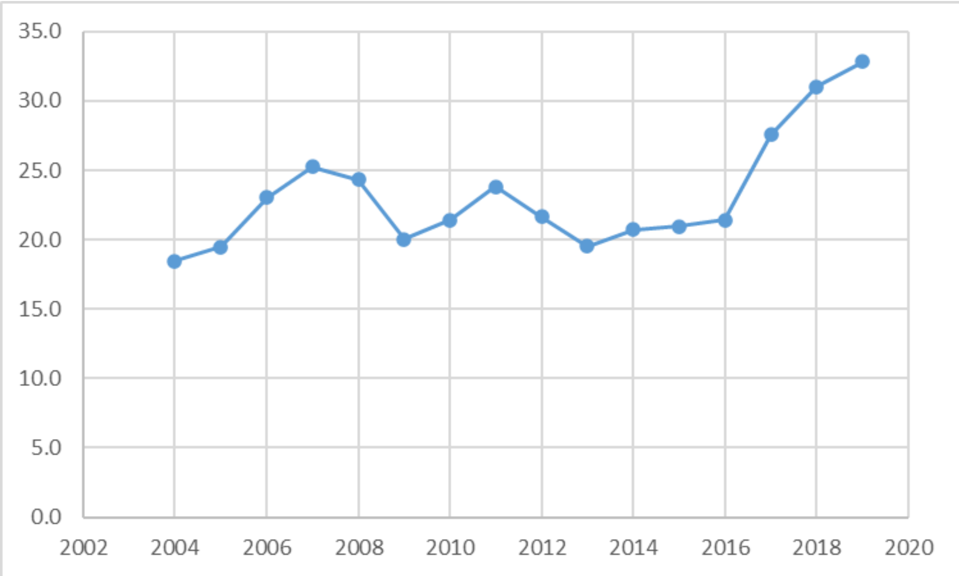

Figure 76. Yearly average of passengers carried in air route ES17 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [28].

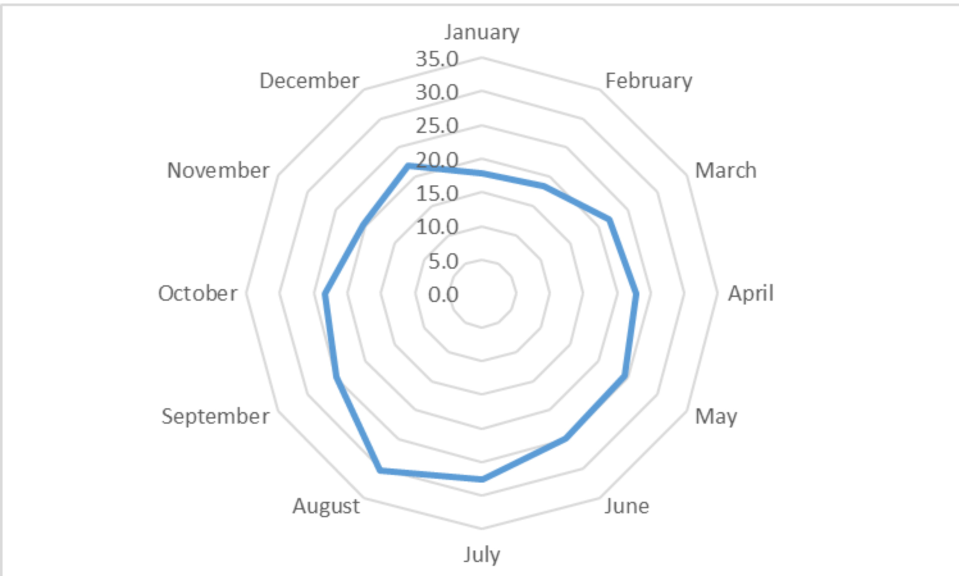

Figure 77. Monthly average of passengers carried in air route ES17 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [28].

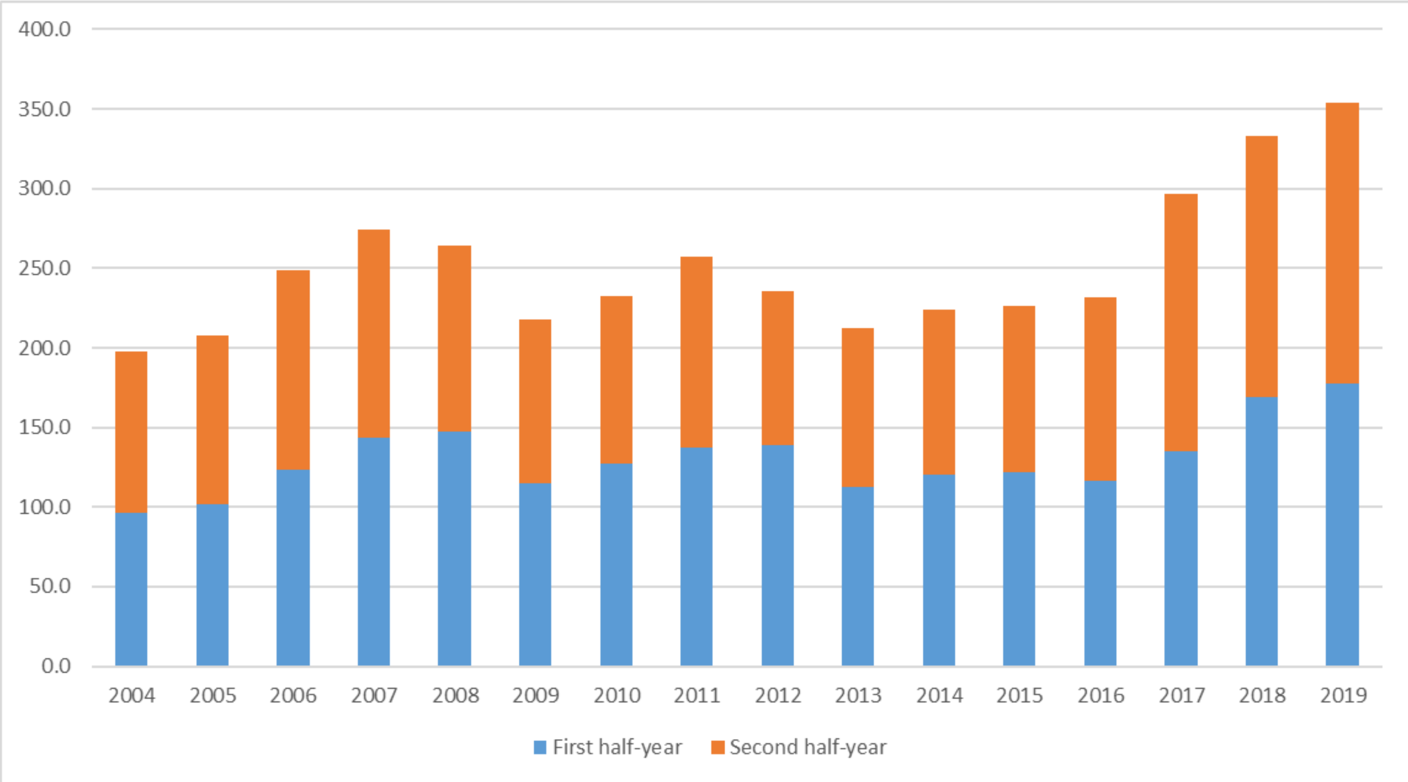

Figure 78. Thousands of passengers carried during low seasons on air route ES17. Source: Own work based on data collected from the official database [28].

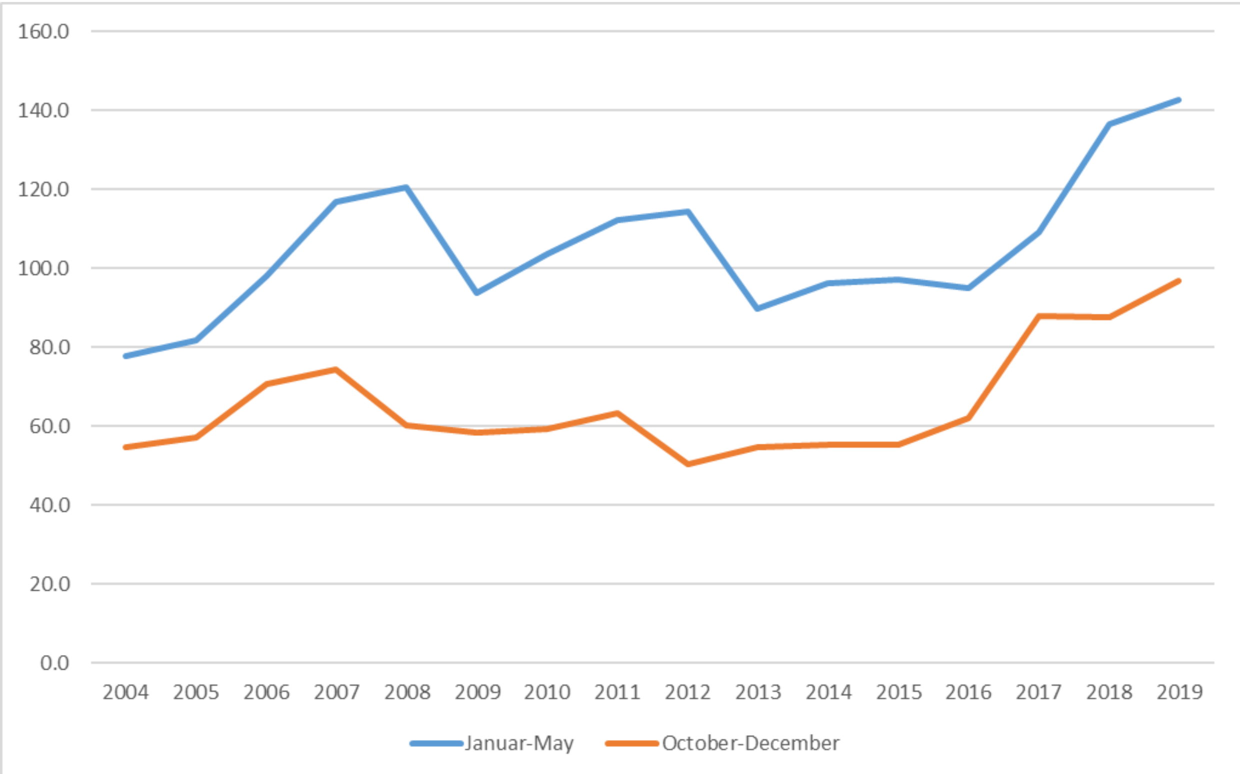

Figure 79. Thousands of passengers carried during low seasons on air route ES17. Source: Own work based on data collected from the official database [28].

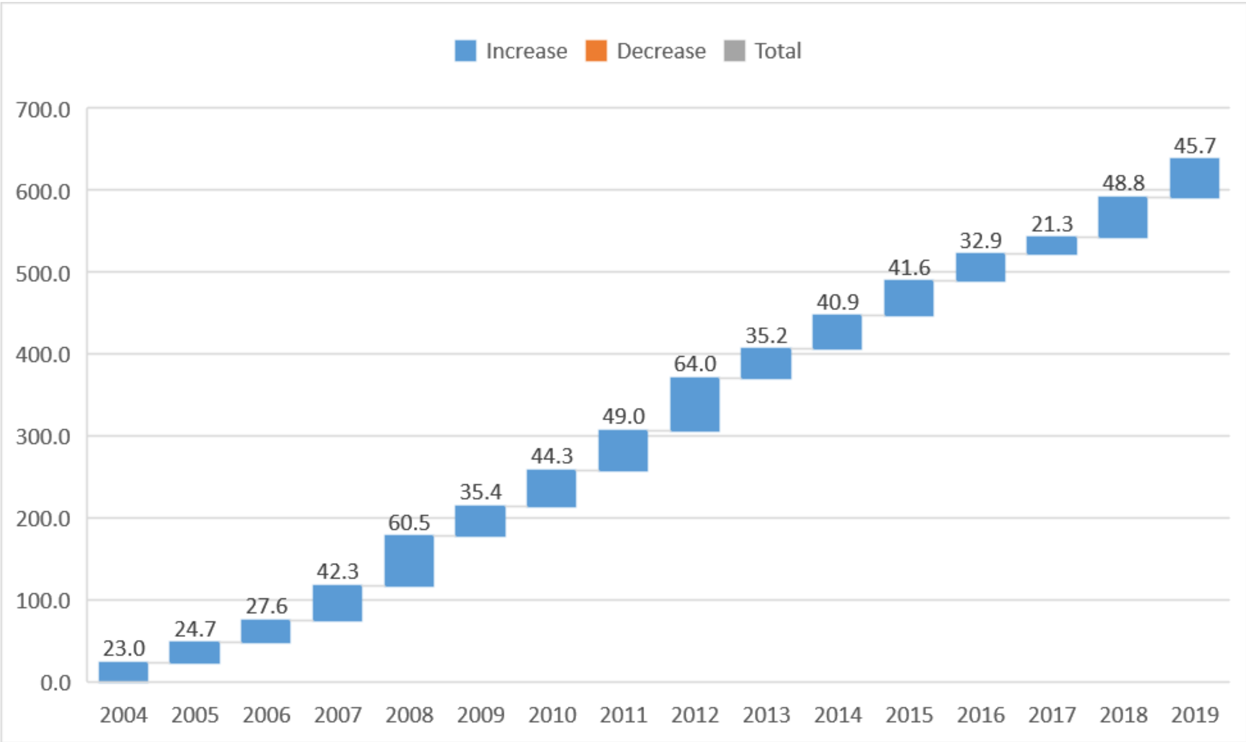

Figure 80. Difference (delta) of passengers carried on the PSO route considered between both periods of each low season per year in the period considered (2004-2019). Source: Own calculation Own work based on data collected from the official database [28].

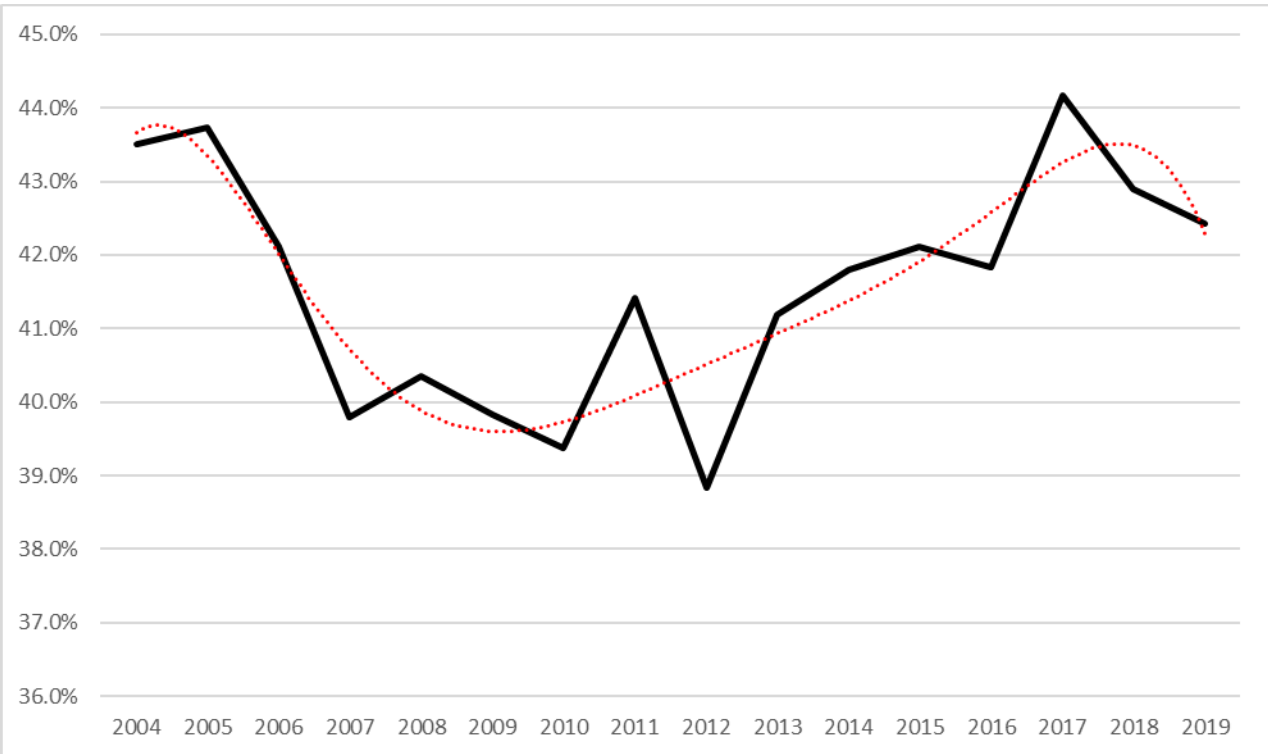

Figure 81. Seasonal trend of activity in peak seasons (June-September) as a percentage of total yearly passengers carried on air route ES17. Source: Own work based on data collected from the official database [20]. Explanatory note: 6th order polynomial trendline considered.

6.13. Evaluation of findings concerning the PSO imposition on air route ES18

The interisland air transport services between Tenerife North and La Palma is a secondary route in the regional air transport network whose impact on territorial cohesion in the Canaries is very important. Neither seasonality nor drop in demand has been observer from related figures below.

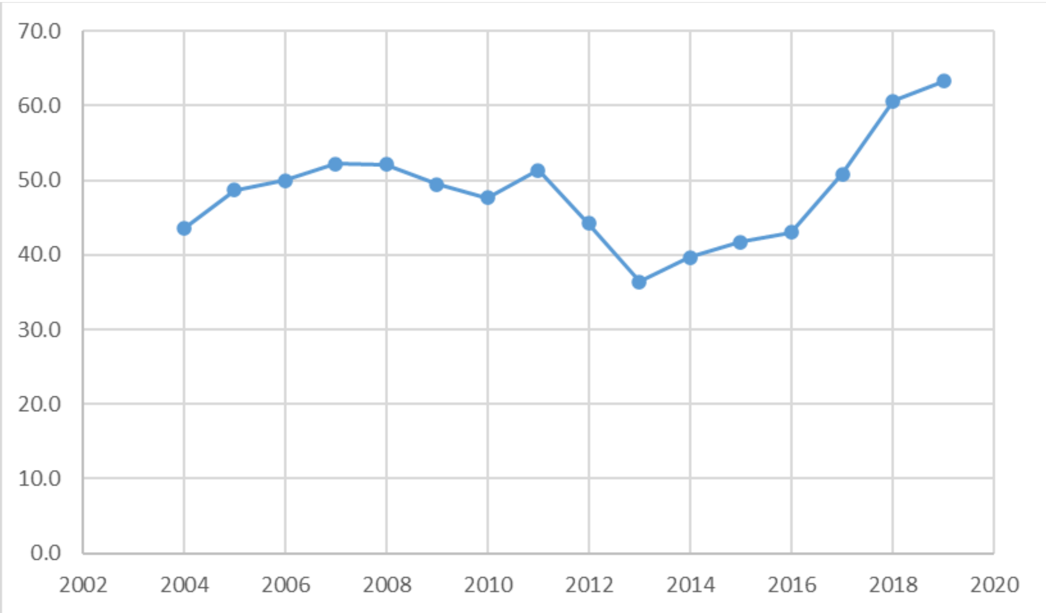

Figure 82. Yearly average of passengers carried in air route ES18 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [28].

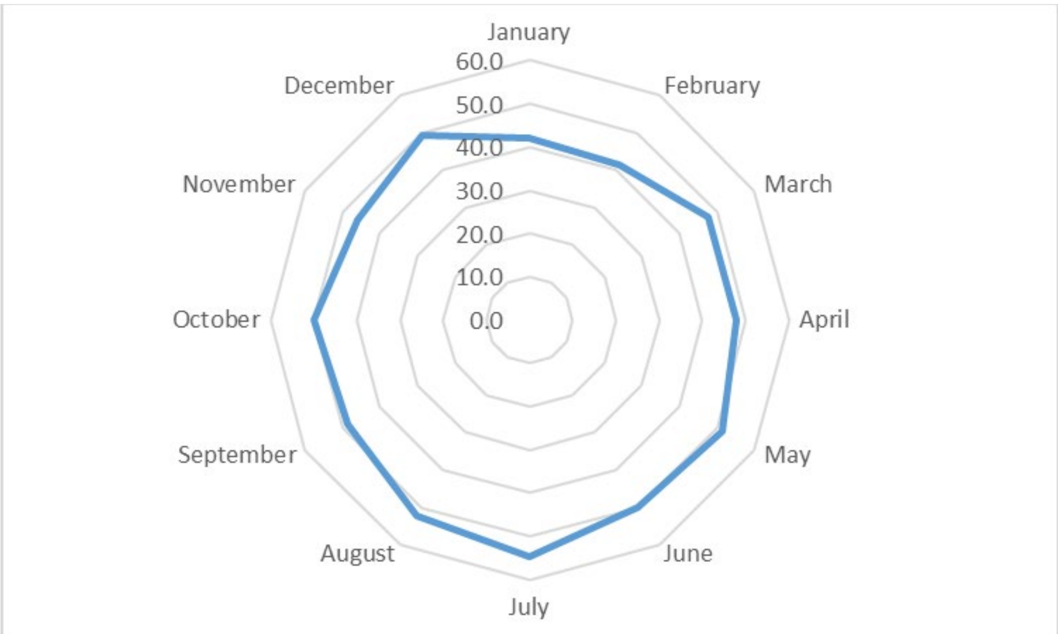

Figure 83. Monthly average of passengers carried in air route ES18 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [28].

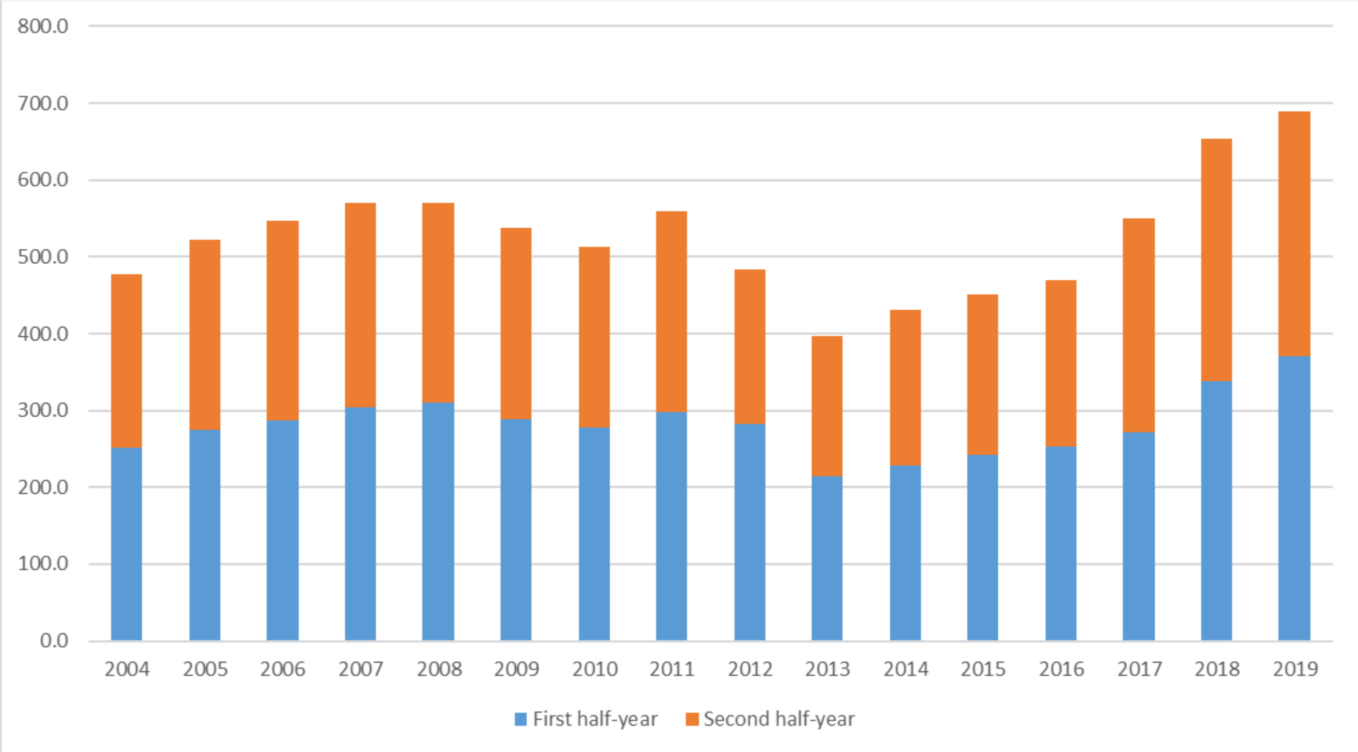

Figure 84. Thousands of passengers carried during low seasons on air route ES18. Source: Own work based on data collected from the official database [28].

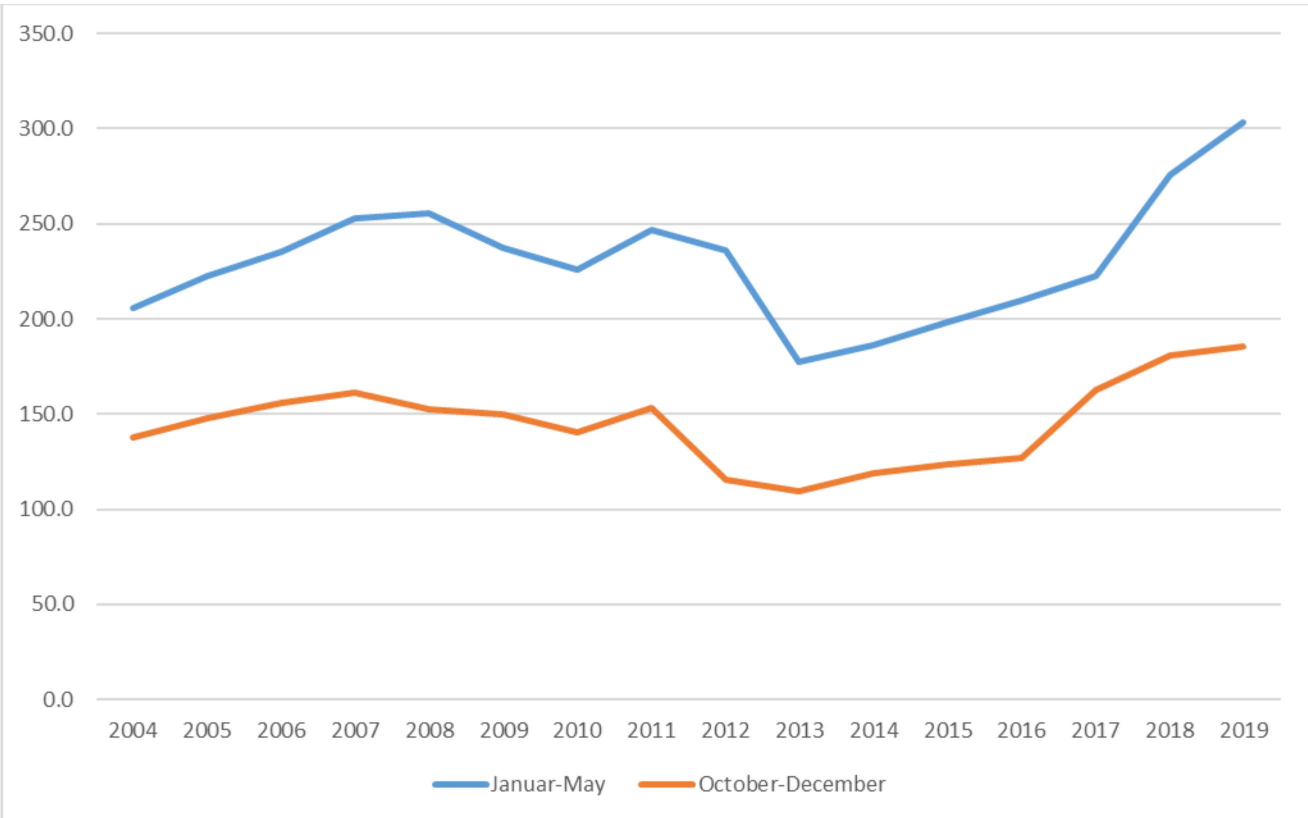

Figure 85. Thousands of passengers carried during low seasons on air route ES18. Source: Own work based on data collected from the official database [28].

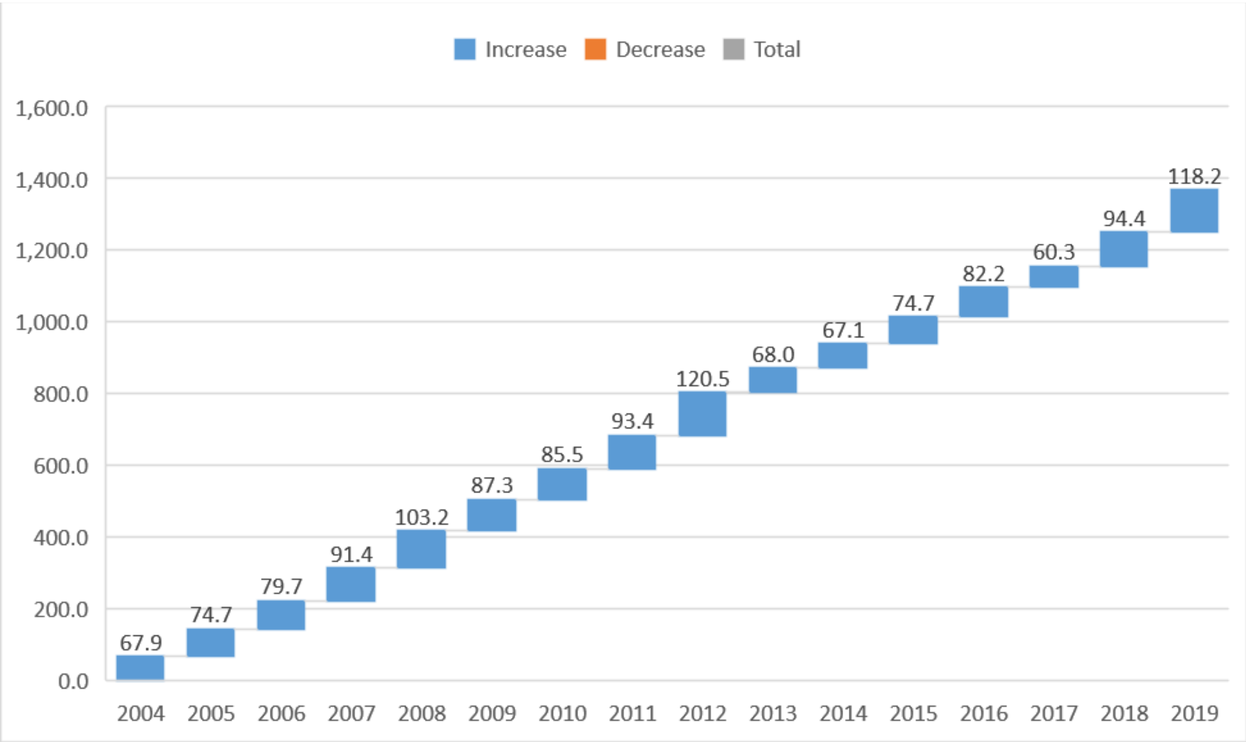

Figure 86. Difference (delta) of passengers carried on the PSO route considered between both periods of each low season per year in the period considered (2004-2019). Source: Own calculation Own work based on data collected from the official database [28].

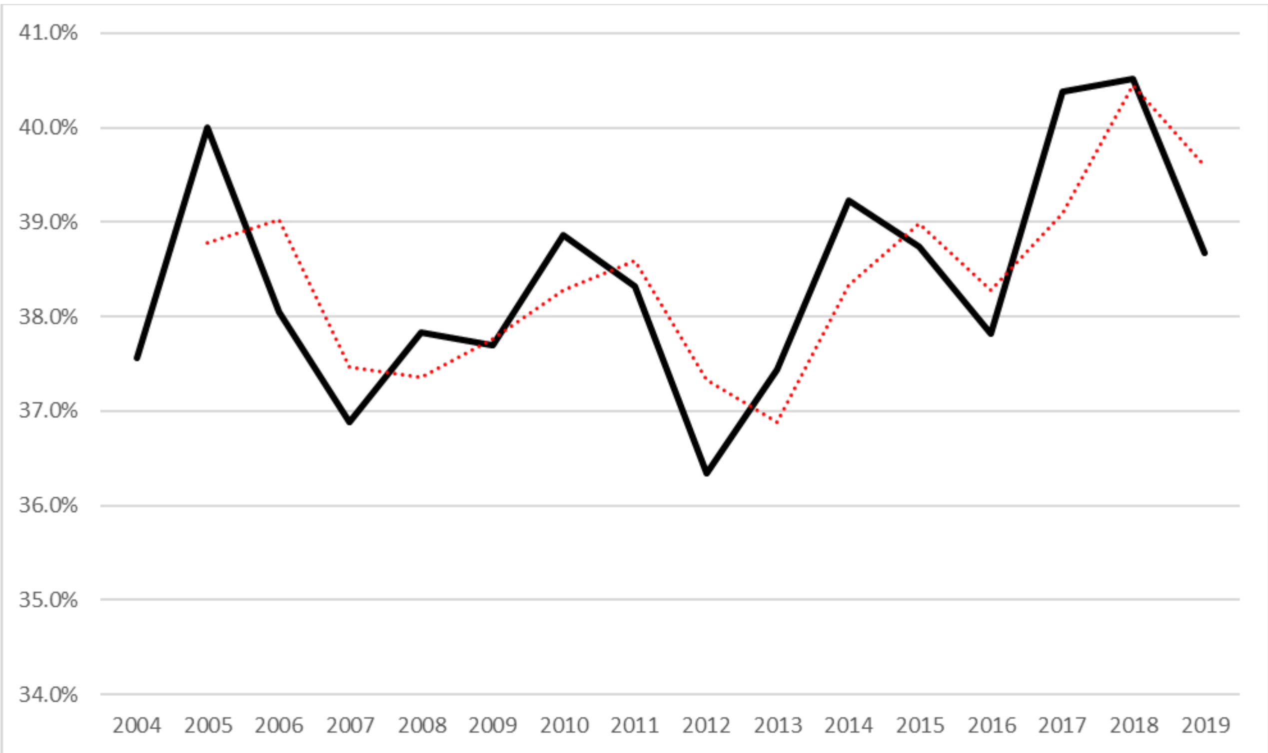

Figure 87. Seasonal trend of activity in peak seasons (June-September) as a percentage of total yearly passengers carried on air route ES18. Source: Own work based on data collected from the official database [20]. Explanatory note: Moving average with 2-period trendline considered.

7. Conclusions

This study aimed to provide an empirical approach to the PSO schema applied in island territories within the EU single air transport market by analyzing the interisland routes serving the o Islands. This research also should shed some light on how the PSO schema non-mainland territories can be useful to enhance the regional public transport market. Since the related EU regulation [14] only covers the internal market for carrying, either freights or individuals, the research has been focused on the particular study of 13 interisland air routes operated under a PSO imposition, but not all of them carried out with a public contract for the provision of scheduled air services. Thus, in this study case and departing from the complexity of the research topic as expressed previously, it has been attempted to stress in the paper that it is not possible to approach this rarely studied area from earlier studies concerning public efficiency and socioeconomic sustainability, since the preview literature is almost inexistent on this matter. Moreover, the complexity of the PSO schema applied within the EU single market in aviation forces to study each imposition of a PSO on air routes by comprehensively analyzing the domestic transportation market concerned. That is precisely the main problem with this issue and its originality at the same time within the scope of sustainable transportation.

Since air transport services have traditionally been regarded as general economic interest according to EU law [36], the imposition of a PSO should be applied carefully in avoiding market distortions. This raises the question of whether air transport could be a necessity for social inclusion and economic development [37]. This is particularly important in the case of ultraperipheral regions with a high degree of dependence on tourism outbound markets, especially considering that the air transport industry and tourism sector are linked towards strategic competition [38]. Throughout the paper, the analysis of the legal framework of the PSO system at the EU level, as well as the way of implementing it at the national level, has not only identified some of its strengths but some of its weaknesses. For instance, common assessment criteria based on socioeconomic needs (thin, peripheral, or development transport services) in designing PSO routes.

In the case of PSO contracts for the provision for air transport services analyzed in this study, including those relating to emergency procedures (ζ, η, θ, ι), related tenders have been carried out from a single electronic platform at the national level, and since 2018 all of them carried out with a full e-procurement process [39]. This has led a simplicity and agility in awarding the related contracts for such transport services, and thus with good practices for public transparency.

The study findings show that all PSO routes considered have been operated at least by the dominant operator (NT), since this market player has the largest regional fleet in the Canary Islands, operating the proper aircraft type for these short-haul flights. Then there is the question of the appropriateness of a public system based on subsidies for resident passengers, in the event of a leading company operating market practically alone [40]. As already discussed, prices could have raised artificially over the last few years due to the existence of a generous resident subsidy, and thus creating a market distortion. However, because of the complex nature of the issue, besides the lack of reliable price data over past years, there is not enough evidence that confirms this fact. A regulated single rate on each local route would be a solution in stabilizing airfares concerned, such has been implemented by PCAA in the Azores islands. This public measure may, however, have the disadvantage of causing substantial price imbalance in the liberalized aviation market. Another solution would be a discount schema depending on the income level of the eligible passenger. It may result in a more efficient and equitable distribution of such public subsidies from PSO impositions, thus achieving common social and regional development goals.

With regard to sustainability, apart from ES14, the PSO routes analyzed in the study have a travel distance of less than 300 km, having habitually been operated so far with turboprops. In comparison with other PSO routes with similar distances, but operated with turbofan until 2019, the differences of emissions per passenger are enormous in favor of turboprop. This is precisely the case of the route ES01 [41].

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Subsection 3.2.e

THE PSO ROUTE BETWEEN BADAJOZ AND MADRID (ES19)

How do Public Service Obligations affect long-distance transport system serving peripheral areas of the European Union: The case of scheduled air services between Badajoz and Madrid

How do Public Service Obligations affect long-distance transport system serving peripheral areas of the European Union: The case of scheduled air services between Badajoz and Madrid

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1. Introduction

Regional transport system on peripheral areas may have some disadvantages due to remoteness and geographic isolation, but other aspects, related to high levels of unemployment or low population density, must also be taken into consideration when addressing the problems associated with lack of adequate transports. With this in mind, the paper attempts to shift its research focus onto how the population of a region so depressed as Extremadura can have access to reliable and affordable transportation, linking Badajoz with the main transport hubs located in Madrid. With this matter, this research explores the socioeconomic impact on the air routes between both cities on the concerned transport network in terms of resilience and reliability, particularly when airlines in a free market regime cannot provide adequate air services. When this occurs, the national governments impose the so-called Public Service Obligations in order to overcome this market failure. Due to this, the case study attempts to shift the research focus on how this form of public intervention on transport market may help enhance the transportation of less developed regions. Finally, this paper is intended to serve as a basis for further research on those topics whose purpose is to bring a better understanding to the regional air transport.

Figure 1: Aircraft type, CRJ-200, mostly operated on the route BJZ-MAD (courtesy of Air Nostrum)

2. Background and key facts

Considering that the Spanish Autonomous Community of Extremadura has historically suffered for years from poor communication and transport infrastructure, its desirable economic development has been seriously impeded by the lack of adequate transportation. In fact, the European Commission (EC) considers Extremadura as one of its less developed regions in the European Union (EU) whose gross domestic products (GDP) per head is below 75% of EU-27 average. Moreover, a special need for this region exists to access national transport system, mainly due to its demographic dimension that is scattered over a vast territory. Hence, the lack of both adequate transportation and the widely dispersed population has not contributed to any change in this issue. Today, this region is one of the most depressed areas in Spain, but very rich in natural resources, and therefore, with a strong primary sector, such as breeding farmers and livestock breeders. Moreover, it has broaden the market and the export capacity. With this in mind, previous papers have already demonstrated that transportation is strongly linked to economic growth. For instance, Allroggen & Malina (2014) related this to economic effects from regional airports. More specifically, regarding the relationship between economic growth and air transport in regional markets, there are remarkable studies, such as Baker et al (2015) in the case of Australia, Chi & Baek (2013) in the case of United States, Hakim & Merkert (2016) in the case of South Asia, or even Marazzo et al (2010) in the case of Brazil. Furthermore, as the European air transport is carried out within a fully liberalised internal market, air carriers are not forced to operate on any route, even despite the public service nature of passenger transport. Therefore, airlines with Air Operator Certificate (AOC) provided from any State Member shall be allowed to operate among locations in the EU Single Market, as long as there is slot available at concerned airports. However, some air routes amongst regional facilities, or even linking peripheral and main airports, may not be adequately covered from private initiative. For instance, when in the absence of any airline on a particular route of significant economic and social interest, it would be impossible to establish and maintain an adequate regional transport system. That is particularly important in the case of transportation in Extremadura, whose only airport is located precisely in Badajoz, resulting from the significant loss of efficient means of transport. Together with those linked with Madrid and Barcelona, particularly compared with the alternative modes of travel, such as by coach and by train, as seen in the table below.

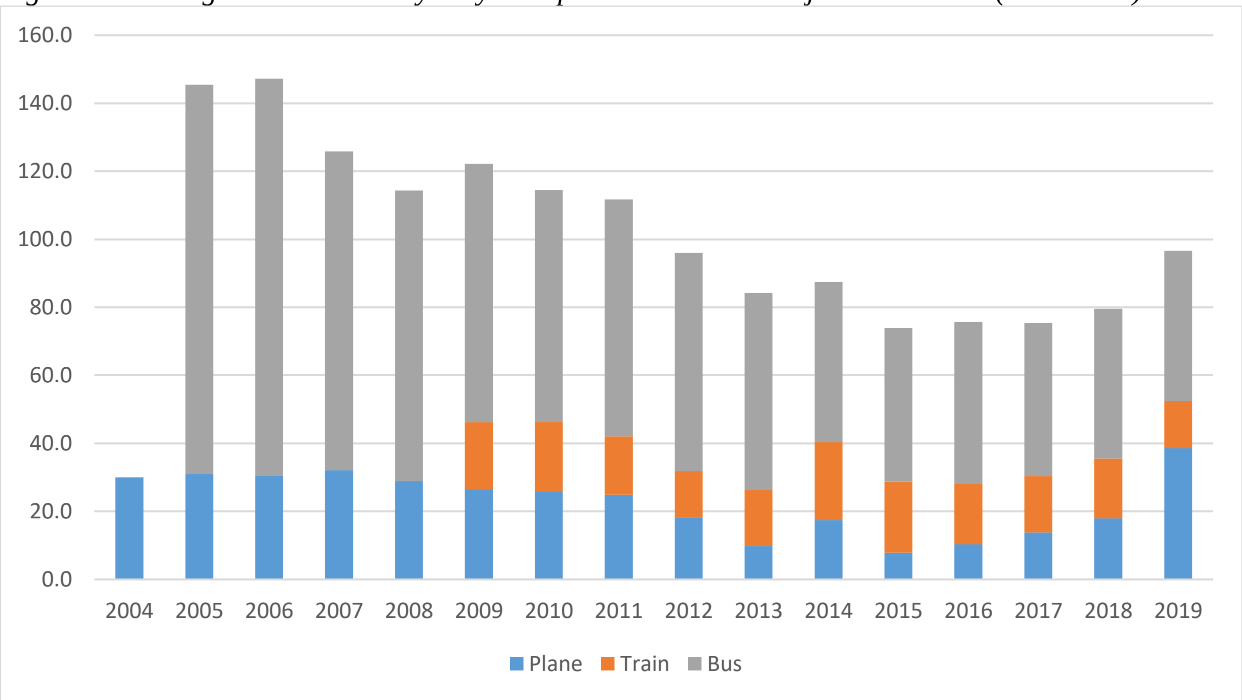
Table 1: Means of transport between Badajoz and Madrid (as of 31.12.2019)

	Airplane	Bus[c]	Train[e]
Travel distance (km)	331.5[v]	399.1	458.1
Max. time travel (h)	1:00	5:50	5:53
Min. time travel (h)	1:00	4:40	5:08
Daily frequencies/leg	2[i]	8	2[iii]
Usual equipment	CRJ200[vi]	IRIZARi6	CAF598/TALGOVI[ii]
Max. fare (€)	90	44.90	41.90
Min. fare (€)[a]	25	31.83	25.15
Seats	50[iv]	36/47[vii]	172/174[ii]
Fuel Burn (l)[b]	1,600.39 (Jet A1)	119.73 (Diesel)	1007.82 (Diesel)
CO_2 Emissions (kg)[b]	4,650	301.30	2,593.12
CO_2 Emissions (kg/pax)[b,f]	93.0	6.55	14.01
Engines	2 x GE CF34-3B1, turbofans	DAF MX-340, Euro 5	4 x MAN D2876, LUE605

Figure notes: i) two flights per leg on working days from Monday to Friday, but just one flight per leg is operated on Sundays; ii) since 1st March 2018, one of the both daily direct legs in each direction is usually operated with TALGOVI, but the other one with CAF598; iii) only direct services considered, on Sundays only one service per leg; iv) 100 seats, if CRJ1000 is operated; v) the distance covered with CR2 is 179 nm, 331.5 km, according to great circle route at initial heading of 56º (NE) from BJZ to MAD, and of 239º (SW) from BJZ to MAD; vi) when the route is sometimes operated with CRJ1000; vii) the number of seats depends on coach model operated on either express or regular class. Explanatory notes: a) in seasonal; b) in respect of each journey; c) pending further data, soon more information; e) the CAF598 as usual train on this route; f) considering a Passenger Load Factor (PLF) as 100%.

The aim of the current EU common transport policy is to guarantee the sustainable and competitive mobility of people and goods while, at the same time, contributing to the achievement of greenhouse gas emissions reduction target to at least 40% (from 1990 levels) by 2030. With this approach, based on the white paper on European transport, called “roadmap to a single European transport area: towards a competitive and resource efficient transport system”, the EC has also advocated smart pricing strategies and funding policies for modern transport infrastructure to multimodal network within the single European transport area. In order for the State Members to be able to act effectively in such circumstances, the European legal framework for the EU Single Market in aviation allows impositions of Public Service Obligations (PSO) on scheduled air services, if this proves necessary for enhancing the transport network. According to Regulation (EC) No 1008/2008 of the European Parliament and of the Council of 24 September 2008 on “common rules for the operation of air services in the Community”, PSO can be imposed as an administrate concession in order to serve as an incentive for air carriers in creating new scheduled routes from regional airports. In fact, this form of public intervention is usually aimed at addressing market failure resulting from non-sufficient air services on certain routes in special need of operation. In the specific case of the air route between Badajoz and Madrid, no airline was interested in starting operations on this route, once the imposition of PSO had been established. Thus, the Spanish Civil Aeronautic General Direction (DGAC), on behalf of the Ministry of Public Works and Transport (FOM), had no other option than to restrict the access to this to a single air carrier, and thereby to compensate operational losses from these obligations. Likewise, one of the characteristics of the transport system in Extremadura is the structural weaknesses of both its regional airport and its rail infrastructure. Despite the catchment area of the unique airport located in the region that extends beyond its own territory, including nearby Portuguese regions, this aerodrome has not traditionally been attractive to airlines in connecting main airports, mainly linking capital and other major cities. With respect to the railway transport, commuters have suffered frequent delays for years due to technical problems related to non-adequate rail infrastructure on such railway line, which has not even electrified yet. In view of this bleak situation related to transport system, the lack of adequate transportation at competitive fares is a burden for regional development. Figure 2, whilst it is an analysis of a ten-year period, it portrays a dramatic loss of commuters, likely as a result of the reliability of transport services, and thereby impacting on preferences of transport users.

Figure 2: Passengers in thousands yearly transported between Badajoz and Madrid (2004-2019)



Source: Own elaboration from data provided, among others, by AENA, Ministry of Public Works and Transport and RENFE, respectively. Note: No data of rail passengers between 2004 and 2008. No data of bus passengers for 2004.

3. Methodology

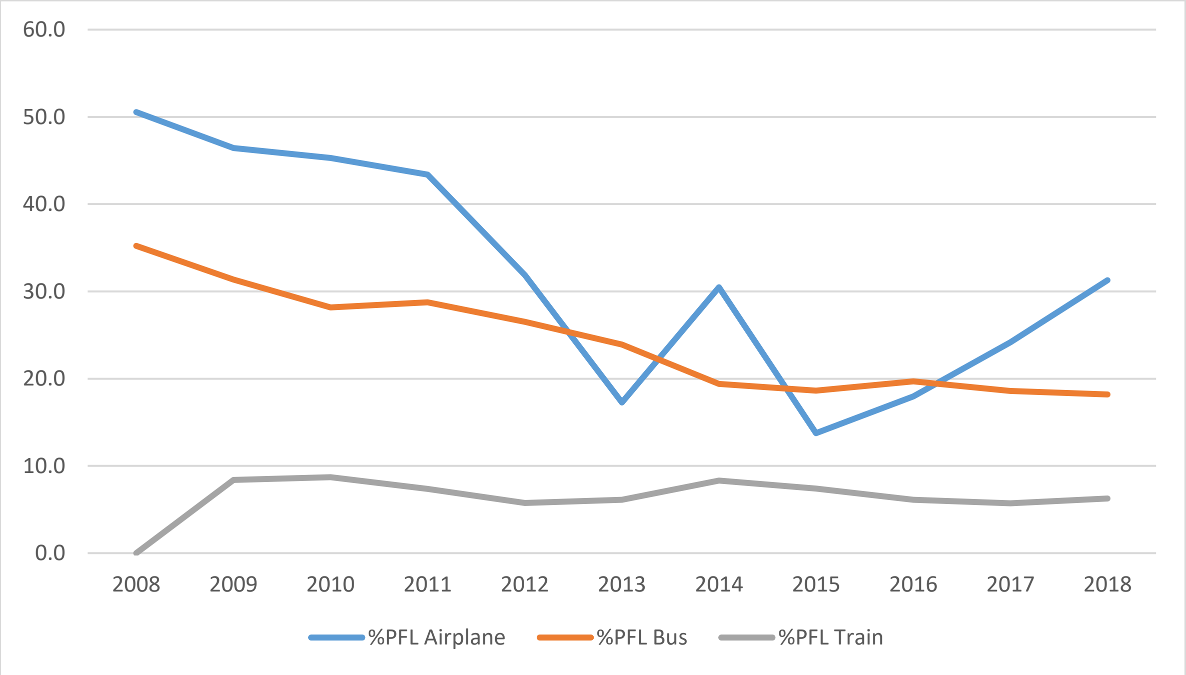
Data collection from primary sources are usually one of the main challenges with regard to trusted sources. It provides data obtained directly from transport operations concerning the routes under consideration. With respect to the present research, the most difficult task for authors are not limited to finding adequate sources of information, but also to locate relevant people from both private organizations and concerned carriers, as well as competent authorities and public entities. This poses a challenge on how to address this issue and what to do to maintain permanent contact with the parties and other relevant actors from the transport sector in both the public and private spheres. Such long and arduous process came with special difficulties with the subject of data protection. In addition, the problem is a little more complex as private companies are not always eager to collaborate with external investigations, and therefore they can deny access to sensitive information, such as data concerning their operations (e.g. load factor, aircraft rotation, diverted and rescheduled transport services, pricing, etcetera). Faced with the impossibility of obtaining passenger load factors (PLF) from carriers on the route between Badajoz and Madrid, either by aircraft, by coach, or even by train, the authors have estimated it by their own means. This was accomplished by collecting passenger statistics of all available years up to 2018 by authors from primary sources. This difficulty has surged, in particular, in the case of certain data provided from rail and coach transport, where specific requests were directly made to both relevant entities and public bodies. However, given the impossibility of obtaining an annual report on operations provided directly from carriers, corresponding PLFs had to be calculated on the basis of the most common equipment on each route, and thus also usual available seats. Particularly, it has not taken into account the possibility of operating with alternative equipment due to operational reasons, or even force majeure. Similarly, the frequency of transport services has been considered on a regular schedule based on the number of seats per leg, ignoring possible diverted and cancelled flights. In any case, the effect of these concerns has not caused a significant deviation in its results due to the low impact of such inconveniences on scheduled transport services with daily operations. However, any shortcoming impact in such sensitive services are usually visible on media, and therefore significant influences on the public opinion in terms of reliability. It would seem obvious to think that repeated disturbances on scheduled transport services usually leads to a loss of confidence in public transportation, causing a considerable loss of commuters. In this regard, Monchambert & de Palma (2014) claims that, despite considering a modelling bi-modal competitive network on the whole public transport system, and therefore not applicable to the present paper, the public transport reliability is often lower at equilibrium compared to first-best Pareto optimal. Unfortunately, the theoretical model of this previous study does not match the market reality of the present case study in question. This is because transport services between Badajoz and Madrid are covered by three carriers, but each operates on its corresponding route in a de facto monopoly situation. That is to say, administrative concession on an exclusive basis in the case of bus service, imposition of PSO limited to one carrier in the case of air route, and monopolistic structure in the case of rail service.

From the regional's perspective, the air transport has not traditionally been considered as a form of accessible transportation with regards to short-term bookings, but rather has been relegated to advance travel planning, or even immediate business trips. At least in comparison with bus transport under administrative concession, airlines concern, and by contrast, dynamic pricing schemes subject to, among other factors, the demand for transport services. As this performance often result in increasing air fares, certain social classes cannot afford to pay high prices, penalising those in population groups with modest incomes who might need adequate transport services at very short notice. In this regard, López Lambas & Cascajo Jimémez (2015) provides an approach to bus transport that can be highly effective when the competitiveness of this mode of transport in the urban environment is strengthened, particularly considering that bus is often considered as a low reliability transport. For instance, the route between Badajoz and Madrid operated by coach, so-named officially VAC-051, does not offer competitive prices, which results in more expensive than concerned rail fares. Despite this, the scheduled bus service offers the highest number of daily frequencies on this route. However, upon careful consideration and analysis of available sources, the collected data (see Figure 1) does not appear to note a high level of interest to new and existing customers. Consequently, these circumstances can have severe implications for the entire public transport system in terms of loss of confidence on the public means of transport, and thus for the reliability of the transportation system.

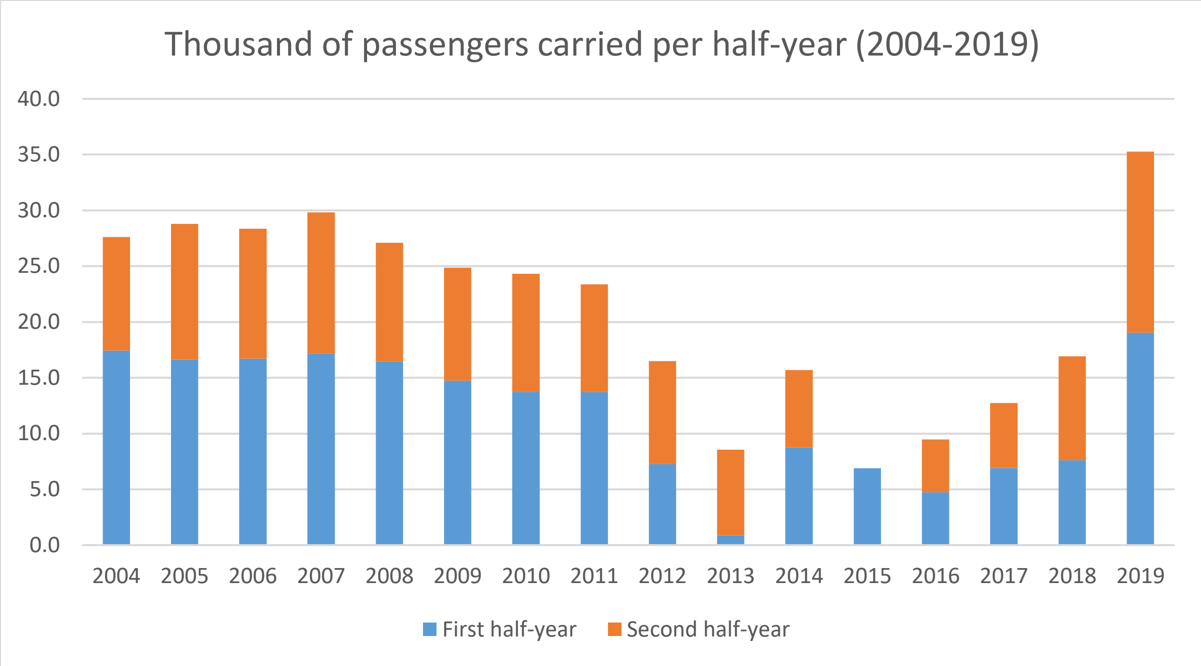
4. Results and conclusions

As noted earlier, the PSO system plays a fundamental role in enhancing regional transport network, in particular in those territories where the economy is less well-developed than the European average. Some aspects related to imposition of PSO on air-scheduled services in Spain have been taken up in this research, as regards recent changes of the legal framework regarding impositions of PSO. Abreu et al (2018) claims that the PSO system is a “key mechanism for countries to improve connections among islands and remote regions with the continent”. However, in the case now analysed, the transport system between Badajoz and Madrid, the location of Extremadura, does not allow one to talk about remoteness, as the justification for PSO imposition on the concerned air route, but rather as a thin route. Furthermore, Wittman et al (2016) state that the PSO system seeks to remedy this situation by promoting a minimum level of scheduled air services, “especially for small or rural communities”. Notwithstanding this fact, this consideration is not completely aligned with the specific characteristics of depressed areas, such as the Extremadura, because the issues lies not so much in how big the region but the reduced population size when compared to others who have larger populations and thus have a weak purchasing power impact when it comes to transport fares. As the low GDP in this Spanish region, the social and economic implication of non-competitive fares appears to be one of the most reasonable causes why the transportation network between Badajoz and Madrid suffers from several weaknesses in the three means of transport examined for this research. This study presents as preliminary results the impact of certain issues related to resilience and reliability on transportation system between both cities. In fact, this individual case can serve as a tool to gain a better understanding of particular matters derived from a lack of competition on regional transportation. In this concern, the Figure 2 is very revealing because it provides a better picture of the long-term passenger traffic trend on this regional transport network. First of all, the total number of passengers transported per year has suffered a general downward trend which has led to a loss of revenues in a falling transport market, as is the present case with Extremadura. Secondly, as can be seen from the Figure 3, there is some evidence that past economic disturbances (e.g. 2008–2014 Spanish financial crisis) reduced the consumption capacity, and thus public transport use. Additionally, in recent years, an unusual increase of incidences on railway services (due to repeated breakdowns) seem to have been a root cause of loss of railway passengers; nevertheless, no increase in bus transport is observed. Apparently, the loss of users of these public transport services is translating into the increase of use of private car, maybe even by moving toward car-sharing services.

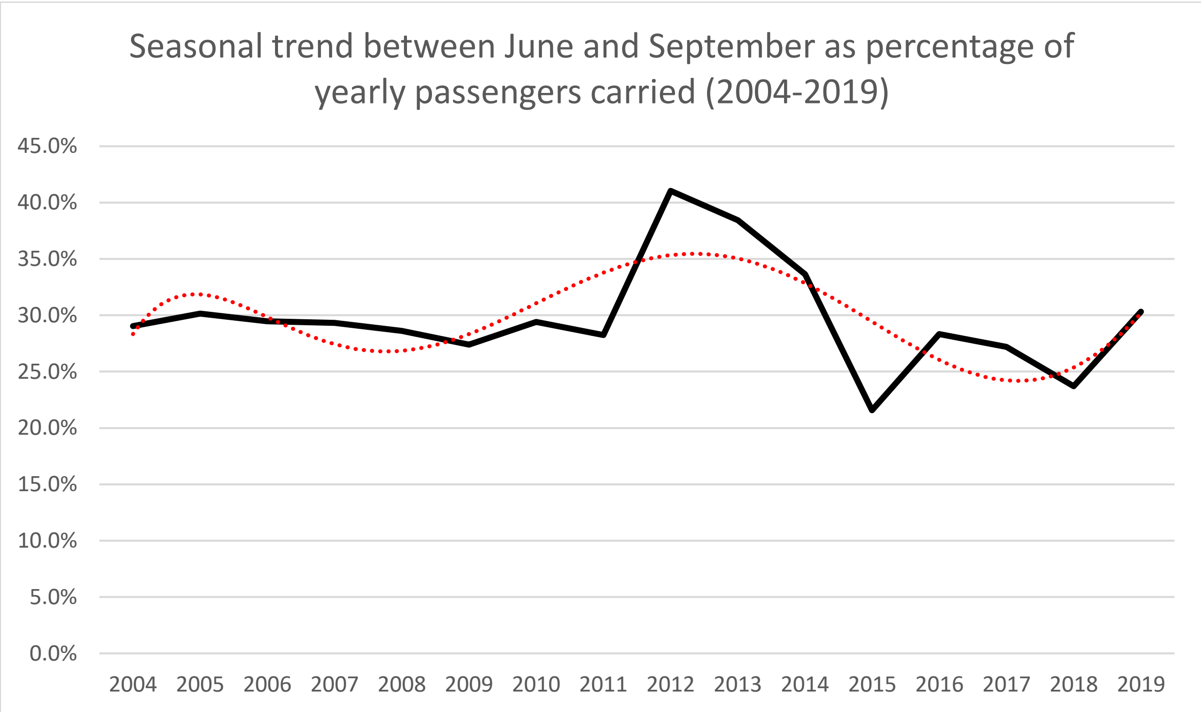
Figure 3: PLF as yearly percentage on transport services between Badajoz and Madrid (2008-2018)



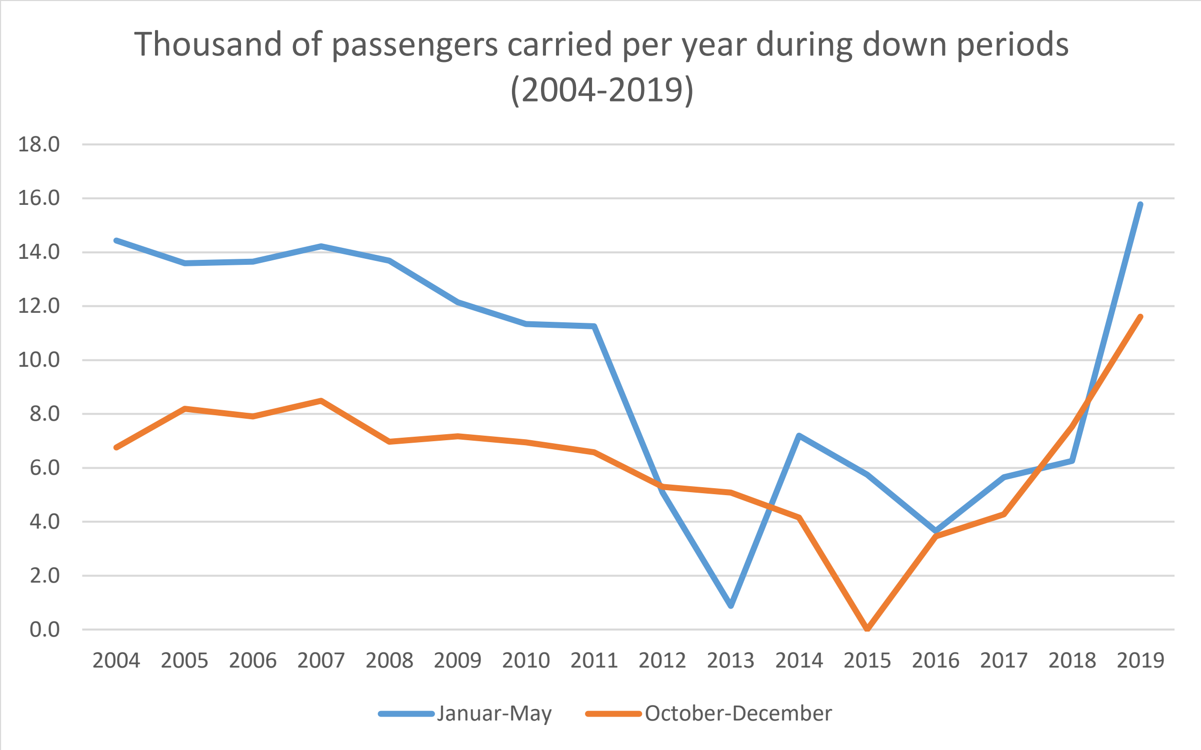
Source: Own elaboration from data provided, among others, by AENA, Ministry of Public Works and Transport and RENFE, respectively. Note: No data of rail passengers for 2008.



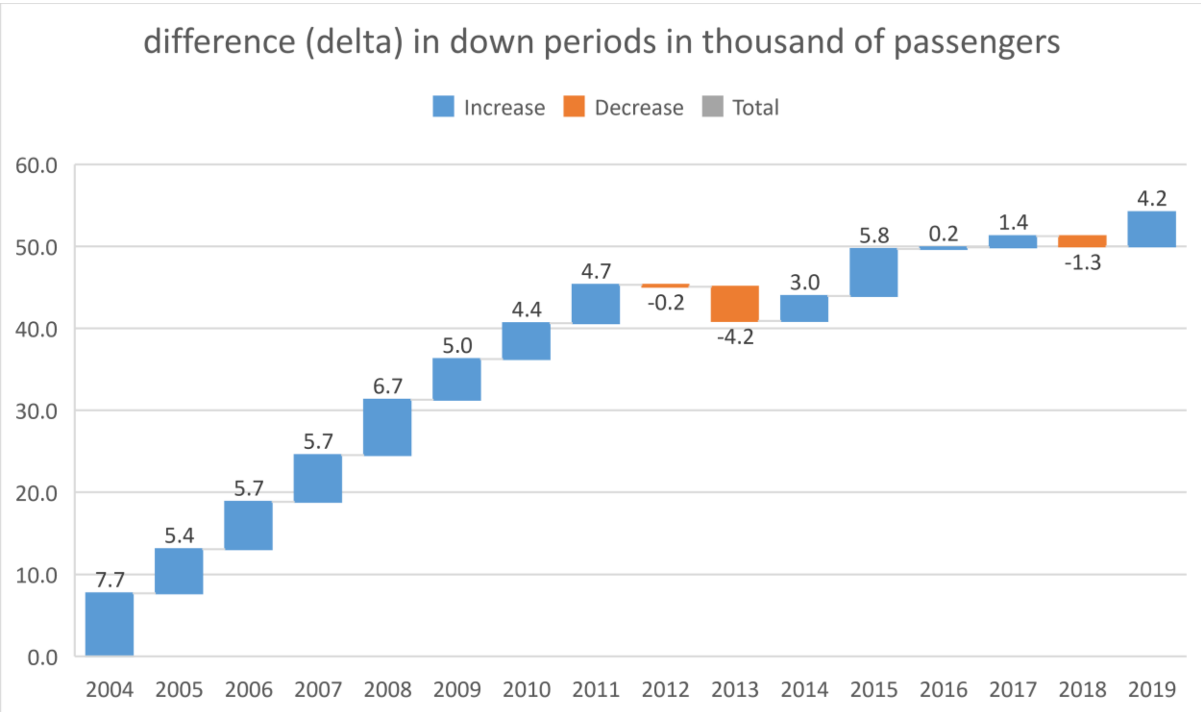
Source: Own elaboration from data provided, among others, by AENA and Ministry of Public Works and Transport



Source: Own elaboration from data provided, among others, by AENA, Ministry of Public Works and Transport and RENFE, respectively. Note: Trend line for polynomials of order 6 applied.



Source: Own elaboration from data provided, among others, by AENA and Ministry of Public Works and Transport.



Source: Own elaboration from data provided, among others, by AENA and Ministry of Public Works and Transport.

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Subsection 3.2.f

THE PSO ROUTE BETWEEN BADAJOZ AND BARCELONA (ES20)

How Public Service Obligations affect transport system for less developed regions of the European Union: The case of scheduled air services between Badajoz and Barcelona

Tentative Article

How Public Service Obligations affect transport system for less developed regions of the European Union: The case of scheduled air services between Badajoz and Barcelona

Part of Doctoral Thesis "The European Single Air Transport Market: An Empirical Approach on the Efficiency and Sustainability of Public Service Obligations in the Spanish Domestic Routes".

Abstract: Transport connectivity plays a vital role in achieving greater territorial cohesion, in addition to combating rural depopulation. The maintenance of public transportation in peripheral areas can also lead to an improvement in the standard of living for citizens, particularly those living in a less developed region of the European Union (EU), such in the Spanish Autonomous Community of Extremadura. The city of Badajoz, despite being the most populated city in the region, has traditionally suffered from a lack of adequate interregional transport services. The aim of this research is precisely to analyze how the imposition of a Public Service Obligation (PSO) on scheduled air services linking Badajoz to Barcelona can enhance the efficiency and sustainability of the domestic transport system. To this end, all means of public transport (bus, train, and airplane) between both cities were examined in order to determine the effect of the public intervention (economic compensation from a PSO contract or a public contract for advertising services) on the European single aviation market. The findings of this study suggest that the PSO schema has been extremely useful in ensuring these passenger air services. It has led to a steady increase in the number of passengers carried but without a significant change in demand on alternative transportation.

Keywords: Transport connectivity; territorial cohesion; rural depopulation; public transportation; Public Service Obligation; public intervention; European single *aviation market*.

1. Introduction

The challenge of rural depopulation is a key element to running more balanced and sustainable development across the EU territory. Since the entry into force of the Treaty of Lisbon on 1 December 2009, the European Commission (hereafter the Commission) has focused their efforts on ensure equal opportunities by introducing the territorial cohesion as a third dimension. Given that transportation is a fundamental part of public services, access to affordable transport modes permits more efficient mobility according to the EU common transport policy, thus stimulating a competitive transport industry within the European internal market. Market deregulation in the aviation sector, however, has not always led to increased growth and better competition in regional transport services, in particular those peripheral routes, and even thin routes. In the case of less developed regions in the EU, the maintenance of regular air transport services has often a prominent socioeconomic element in the regional activity, especially when there is no alternative transportation similar to the air route in terms of time travel and frequencies. This is precisely the case of the route between Badajoz and Barcelona. The findings shown below, either tables or figures, show that the PSO imposition is fundamental for the region.

2. An overview of the PSO system existing in the EU air transport market

Table 1. Justification concerning PSO impositions in the EU air transport market (176 routes as of 18 September 2019).

EU state member	P	D	T
Croatia (HR)	2	10	-
Cyprus (CY)	1	-	1
Czech Republic (CZ)	2	-	3
Estonia (EE)	3	3	3
Finland (FI)	-	1	3
France (FR)	29	30	19
Greece (GR)	28	28	21
Irland (IE)	3	1	-
Italy (IT)	11	11	5
Lithuanian (LT)	1	1	-
Portugal (PT)	19	1	-
Spain (ES)	18	23	5
Sweden (SE)	11	-	11
United Kingdom (GB) *	22	21	1

Source: Compilation based on data provided both by DG MOVE and by MITMA. Key: Peripheral (P), Development (D), Thin route (T). (*) Non-EU member state since 31 January 2020.

3. An overview of the PSO system existing in the domestic air transport market

Table 2. Existing PSO air routes in the Spanish domestic air transport market (as of 14 March 2020).

Route code	Airport (from/to)	IATA [b] code	Airport (to/from)	IATA [b] code	PSO justification [c]	PSO type
ES01	Almeria	LEI	Sevilla	SVQ	P, D	3
ES02	Menorca	MAH	Ibiza	IBZ	P, D	1
ES03	Menorca	MAH	Madrid	MAD	P, D	3 [a]
ES04	P. Mallorca	PMI	Ibiza	IBZ	P, D	1
ES05	P. Mallorca	PMI	Menorca	MAH	P, D	1
ES06	G. Canaria	LPA	El Hierro	VDE	P, D	1
ES07	G. Canaria	LPA	Tenerife S.	TFS	P, D	1
ES08	G. Canaria	LPA	Fuerteventura	FUE	P, D	1
ES09	G. Canaria	LPA	Lanzarote	ACE	P, D	1
ES10	G. Canaria	LPA	Tenerife N.	TFN	P, D	1
ES11	G. Canaria	LPA	S. C. Palma	SPC	P, D	1
ES12	La Gomera	GMZ	La Palma	LPA	P, D	3
ES13	La Gomera	GMZ	Tenerife N.	TFN	P, D	3
ES14	S. C. Palma	SPC	Lanzarote	ACE	P, D	1
ES15	Tenerife N.	TFN	El Hierro	VDE	P, D	1
ES16	Tenerife N.	TFN	Fuerteventura	FUE	P, D	1
ES17	Tenerife N.	TFN	Lanzarote	ACE	P, D	1
ES18	Tenerife N.	TFN	S. C. Palma	SPC	P, D	1
ES19	Badajoz	BJZ	Madrid	MAD	T, D	3
ES20	Badajoz	BJZ	Barcelona	BCN	T, D	3
ES21	Melilla	MLN	Almeria	LEI	T, D	3

ES22	Melilla	MLN	Granada	GRX	T, D	3
ES23	Melilla	MLN	Sevilla	SVQ	T, D	3

Source: Compilation based on data provided both by DG MOVE and by MITMA. Explanatory note: a) Economic compensation applicable in seasonal period only; b) International Air Transport Association (IATA); c) Peripheral (P), Development (D), Thin route (T).

4. Addressing the issue of connecting Badajoz with Barcelona

Table 3. Key facts of air passenger traffic at airports considered (2004-2019).

IATA Code	Airport Group [a]	Airport Typology [b]	Airport Category [c]	Average Annual Passenger Traffic [d]	CAGR (%) [e]
BCN	Major	Barcelona-Hub	Level 3	36,116,000	1.3
BJZ	III	Regional	Level 1	61,000	0.0

Source: Own calculation based on information from Aena database [20]; additional information provided by the Spanish Directorate-General for Civil Aviation (DGAC) upon request. Explanatory notes: a), b) According to the classification provided by Aena; c) According to the categorization under Article 3 of [14] and Article 4 of [15], Spanish air facilities are classified as non-coordinated airports (Level 1), airports with schedules facilitated (Level 2), or coordinated airports (Level 3); d) Total amount including both arrivals and departures at each airport; e) Compound annual growth rate.

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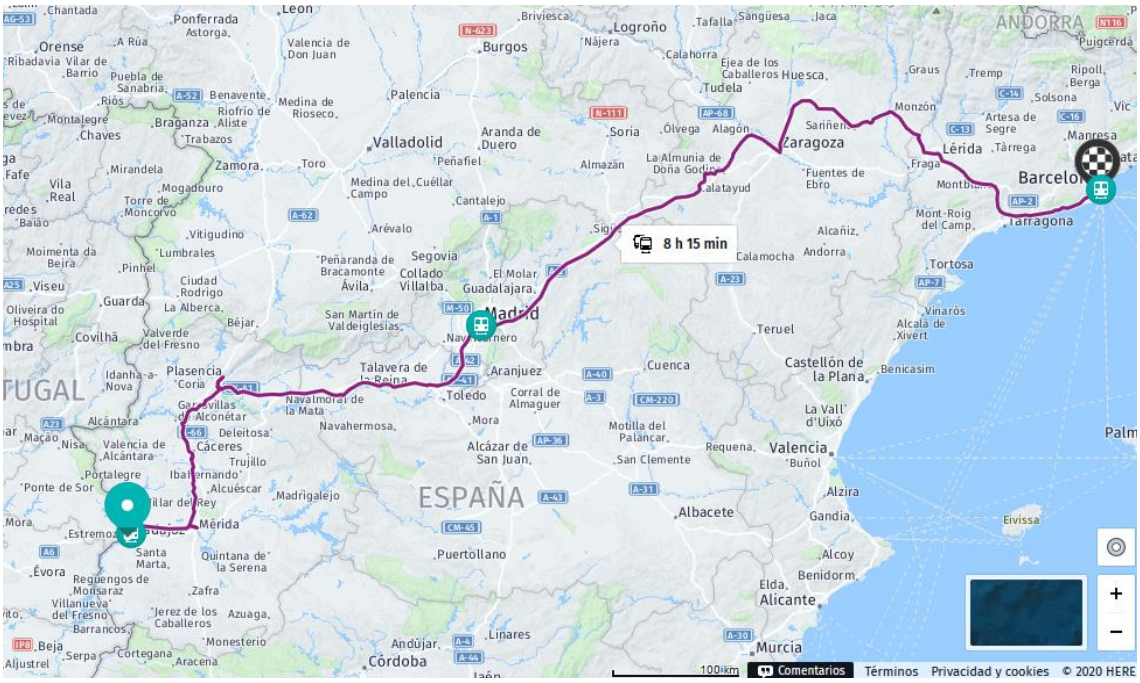

Figure 1. Rail route between BQZ and YJB. Source: Prepared with HERE Technologies.

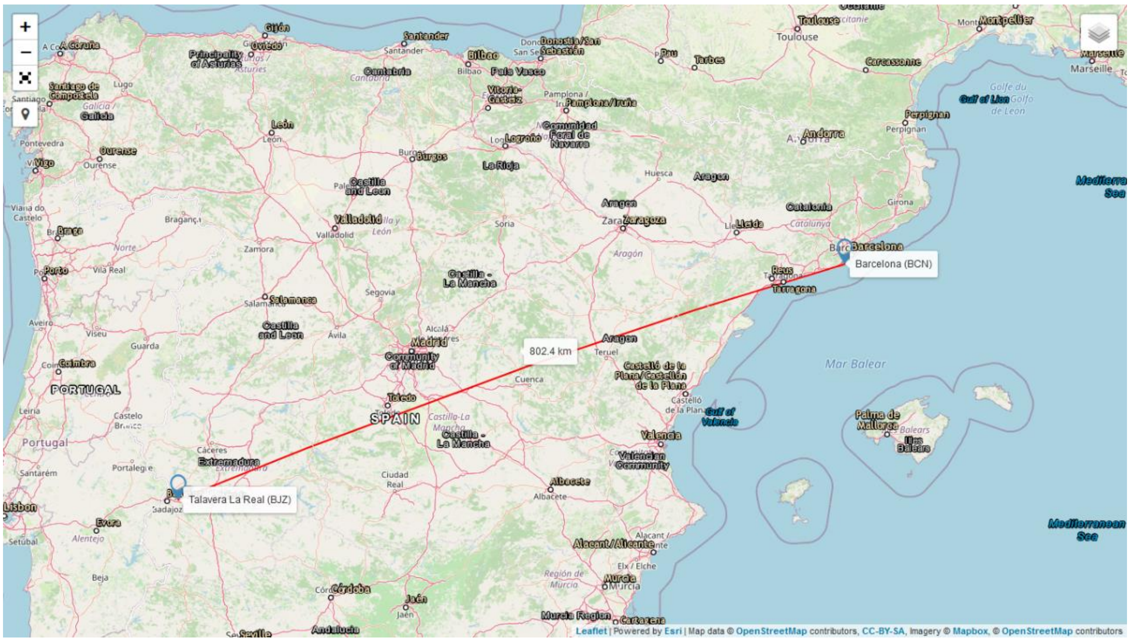

Figure 2. PSO air route (ES20) between BJZ and BCN. Source: Prepared with FreeMapTools.com.

Table 5. Operational facts of PSO air routes among the Balearic Islands (as of 14 March 2020)

PSO Route Code	Travel Distance (km) [a]	Travel Time (h)	Heading Vector Navigation	Block Fuel (kg) [b, c]	CO2 Emissions (kg) [b, c]	Standard Aircraft Equipment	Emissions CO2/PAX (kg) [b, c]	Standard Cabin Config.
ES20	804	1:16	68° (ENE)	3,873.78	9,810.73	CRJ200	196.21	50Y

Source: Own figures partially based on a performance study provided by ATR upon specific request. Explanatory note: a) Orthodromic distance; b) Standard assumptions: Jet A1 density as of 0.804 kg/l, CO2 emissions as of 3.15 kg of CO2 per kg of Jet A1; c) En-route assumptions: Max. payload, no wind, one aircraft per leg under technical specifications by International Standard Atmosphere (ISA), Joint Aviation Requirements (JAR), European Union Aviation Safety (EASA); Passengers (PAX).

5. Overall Findings

Table 6. Summary of public contracts for passenger air services serving the Badajoz airport since 2004

Key	Contract reference	Airline operating	Contract purpose	Tender budget	Award amount	Contract duration
α	06PR0409	YW	Advertising	€3,200,000	€3,196,000	1.5 years
β	PRI0410048	YW	Advertising	€4,100,000	€4,096,634	1.5 years
γ	PRI0512009	H9	Advertising	€4,096,000	€1,800,000	1 year [b]
δ	SER0313063	UX	Advertising	€4,200,000	€4,000,000	2 years
ε	1516SE1CA711	YW	Advertising	€2,420,000	€2,117,500	1 year
ζ	1881SE1CA070	YW	Advertising	€2,468,400	€2,468,400	1 year
η	123/A18 [a]	YW	PSO	€14,000,000	€10,500,000	3 years [c]

Source: Own work based on information collected from tender dossiers concerned. Explanatory note: a) Only applicable in regular services relating to PSO air routes ES19 and ES20; b) Although the contract had originally been awarded for 2 years, the failure of certain contractual service obligations from the airline operating resulted in early termination of the contract from the regional government according to article 49 of the Spanish Public Sector Contracts Law; c) Ongoing contract (as of September 2020).

Table 7. Summary of public contracts for passenger air services serving the Badajoz airport since 2004

Mode of Transport	Route type (IATA code, if applicable)	Path	Features
Air	Orthodromic airway: Badajoz (BJZ) – Barcelona (BCN)	804 km, 68° (ENE)	BJZ: 13/31 BCN: 07L/25R, 07R/25L, 02/20
Rail	Conventional railway: Badajoz (BQZ) – Madrid Atocha (XOC)	458.10 km	not electrified, 1,668 mm (gauge)
Rail	High-speed railway: Madrid Atocha (XOC) – Barcelona Sants (YJB)	649 km	25 kV AC, 1,435 mm (gauge)
Road	Highway: Badajoz – Barcelona (XJB)	1025.5 km	A-5 and A-2 (belonging to E90)

Source: Own work

Table 8. Means of transport operating regular passenger services between Badajoz and Barcelona (as of December 2019)

Features	Plane	Bus	Train
Vehicle [1]	CRJ-200ER	Scania Irizar PB	RENFE S-598
Manufacturer	BOMBARDIER	Irizar	CAF
Seats	50	48	172
Total length (m)	26.77	12.78	1
Travel time (hh:mm)	1:16	8:15	8:15
Travel distance (km)	802.4	1025.5 [a]	1107.1 [b]
Block fuel consumption per journey (l)	3,873.78 liters [ii] (Jet A1)	307.65 (Diesel)	908.83 (Diesel) [c]
CO_2 Emissions (kg) [1]	9,810.73	821.43	1,175.09
CO_2 Emissions (kg/pax)	196.21	17.11	6.22

Engines	2 GE CF34-3B1 turbo-fans	DAF MX340, Euro V	4 MAN D2876 LUE623

[1] Mostly operated on route. [2] CO2 emissions per liter of diesel burned (kg) = 2.67. Explanatory notes: a) On road route along Spanish highways A5 and A2, E-90; b) As the combination of two railways (Badajoz-Madrid-Barcelona, with intercity and high speed respectively) ; c) Fuel consumption per passenger-kilometer (as of 2018) on intercity services.

Table 9. Operating regime of scheduled air services on ES20 since 2004

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2004	●	●	●	●	●	●	●	●	●	●	●	●
2005	●	●	●	●	●	●	●	●	●	●	●	●
2006	●	●	●	●	●	α	α	α	α	α	α	α
2007	α	α	α	α	α	α	α	α	α	α	α	α
2008	●	●	●	●	●	●	●	●	●	●	●	●
2009	●	●	●	●	●	●	●	●	●	●	●	●
2010	●	●	●	●	●	β	β	β	β	β	β	β
2011	β	β	β	β	β	β	β	β	β	β	β	β
2012	●	■	●	●	●	γ	γ	γ	γ	γ	γ	γ
2013	γ	γ	γ■	γ■	γ■	γ■	●	δ	δ	δ	δ	δ
2014	δ	δ	δ	δ	δ	δ	δ	δ	δ	δ	δ	δ
2015	δ	δ	δ	δ	δ	δ	δ	■	■	■	■	■
2016	■	●	●	●	●	ε	ε	ε	ε	ε	ε	ε
2017	ε	ε	ε	ε	ε	ε	●	●	●	●	●	●
2018	●	●	●	ζ	ζ	ζ	ζ	ζ	ζ	ζ, η	ζ, η	ζ, η
2019	ζ, η	ζ, η	ζ, η	ζ, η	η	η	η	η	η	η	η	η
2020	η	η	η	η	η	η	η	η	η	η	η	η
2021	η	η	η	η	η	η	η	η	η	η		

Source: Own work based on information collected from AENA database and tender dossiers concerned. Explanatory note: Black circle "●" denotes the presence of a free regime market with at least one air carrier operating without any public contract, while black square "■" indicates the absence of air carriers concerning regular air services

Table 10. Private car transport along the road route between Badajoz and Barcelona

Features	Average diesel car	Average petrol car	Average petrol hybrid car
Seats	5	5	5
Travel time	9:36	9:36	9:36
Travel distance (km) [1]	1029	1029	1029
Total fuel consumption (l) [2]	57.62	57.62	49.72
Fuel cost of a trip (€) [3]	59.83	65.69	56.68
Fuel cost per person (€) [4]	14.96	16.42	14.17
CO_2 Emissions (kg) [5]	173.32	179.35	118.93
CO_2 Emissions (kg/pax) [6]	43.25	44.83	29.73
CO_2 Emissions (kg/pax) [7]	128.38	132.85	88.09

[1] On-road route along national highways A5 and A-2, which are part of the European highway E90. [2] As 5 liters of fuel burned per each 100km; no jams; average fuel cost (as of August 2020) of 1.0382 €/l and 1.1400 €/l for petrol A and unleaded petrol - 95 octanes, respectively (Source: BBVA). [3] As two stops for refueling per trip. [4] [6] As 4 people with luggage. [5] Calculation based on average values (as of 2019) for a diesel car, petrol car, and petrol hybrid car, whose CO_2 emissions are 168.44 g/km, 174.3 g/km, and 115.8 g/km, respectively (Source: CarbonFootprint.com). [7] As average occupation ratio of 1.35 people per vehicle (as of 2019 in Spain).

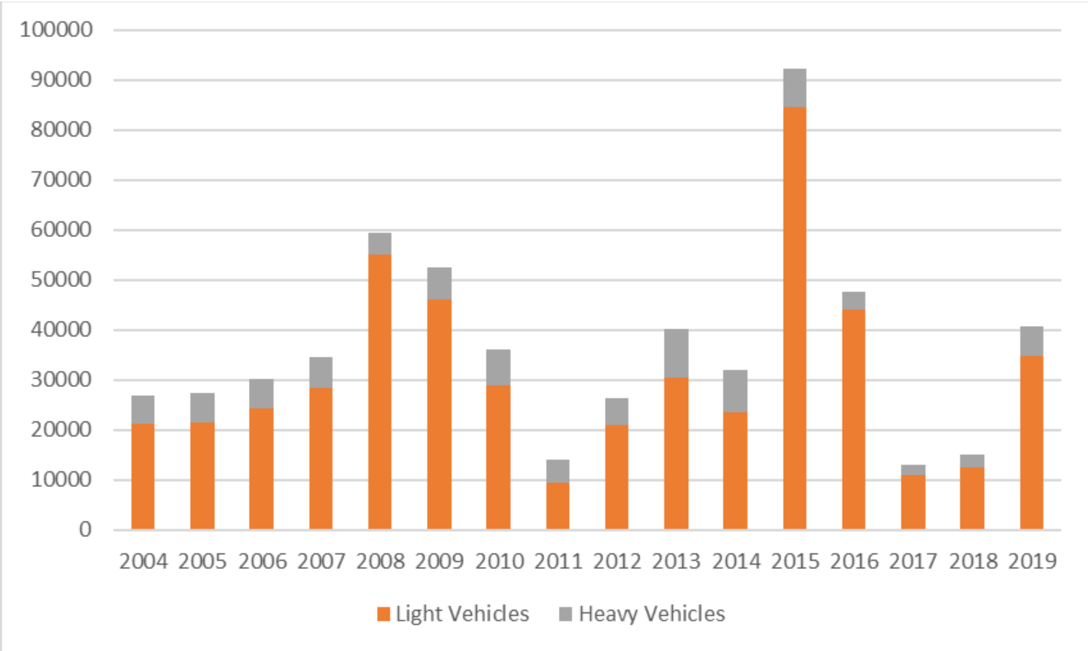

Figure 3. Annual average daily traffic (AADT) on the road route between Badajoz and Barcelona in the period 2004-2019. Source:

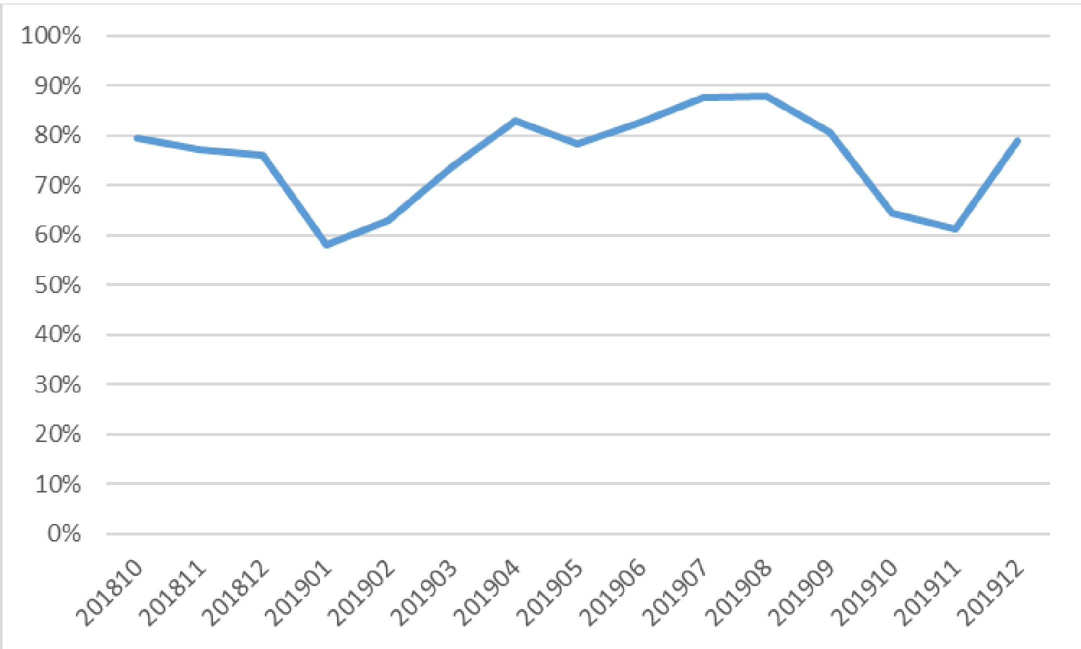

Figure 4. Passenger Load Factor (PLF) of the route ES20 in the period between October 2018 (201810) and December 2019 (201912). Source: Own elaboration based on data provided by MITMA (as of 2020). Explanatory note: Under PSO type 3 only

6. Summary of further results

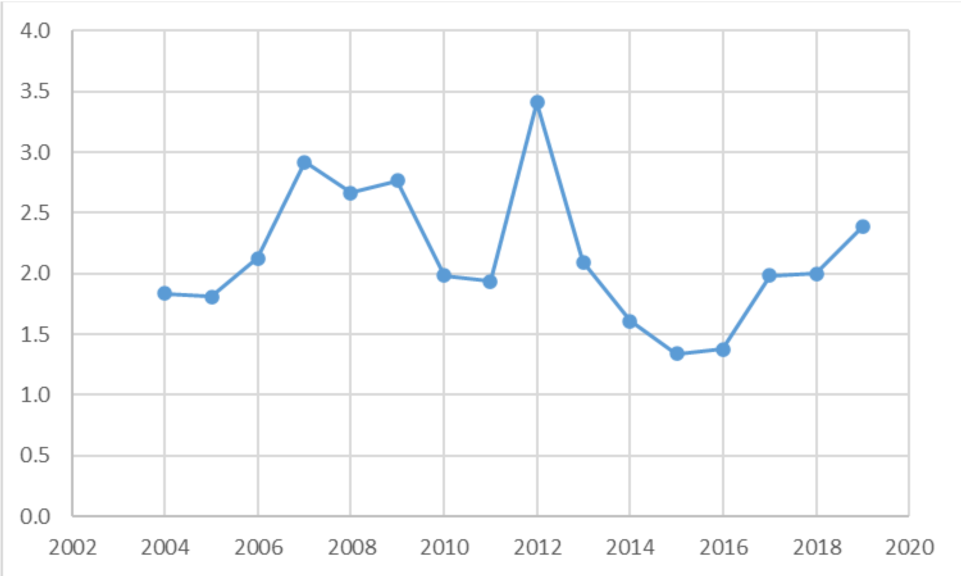

Figure 5. Annual average of passengers carried in air route ES20 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [20].

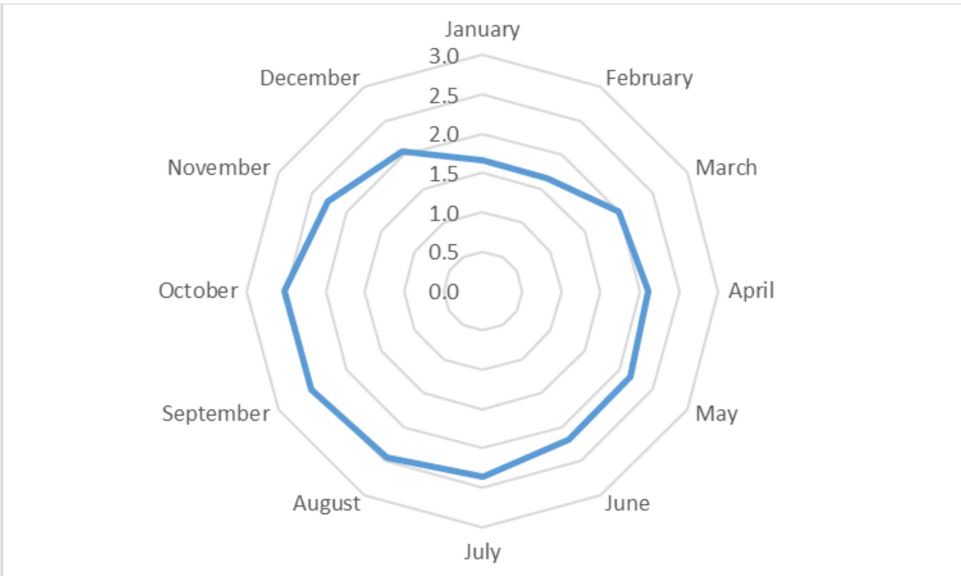

Figure 6. Monthly average of passengers carried in air route ES20 (in thousands) in the period between 2004 and 2019. Source: Own work based on data collected from air traffic statistics [20].

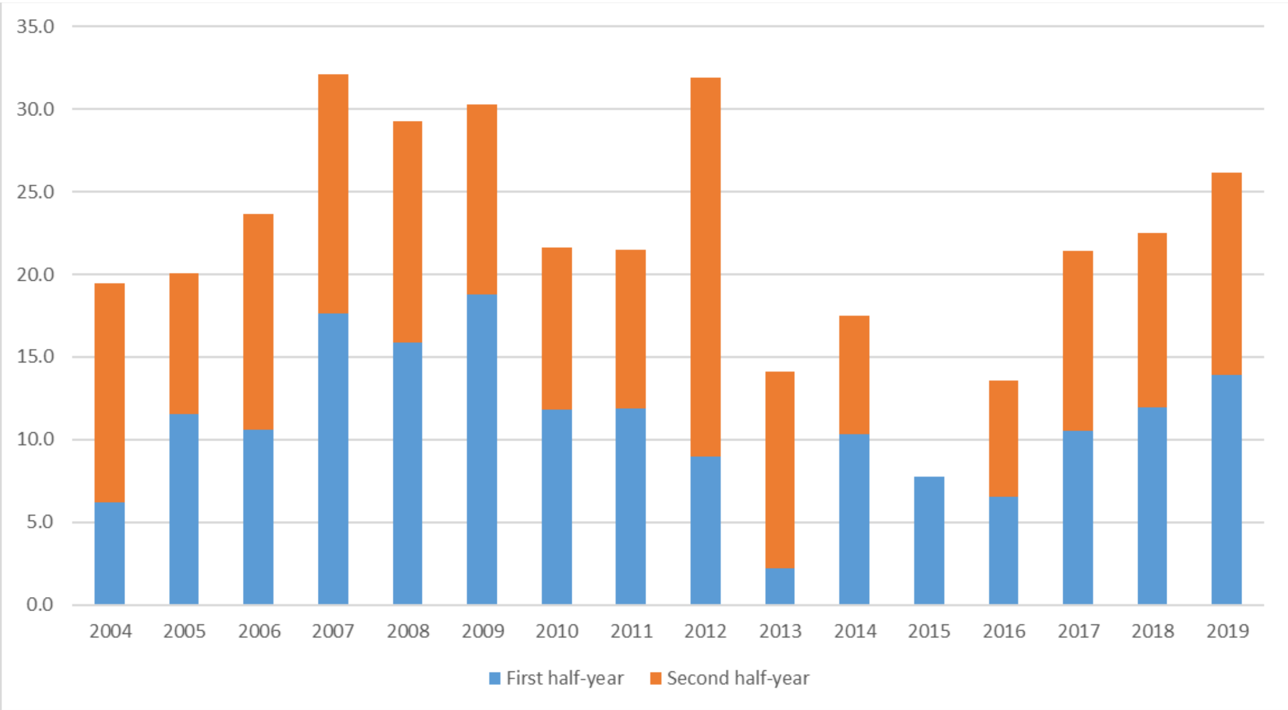

Figure 7. Thousands of passengers carried per half-year on air route ES20. Source: Own work based on data collected from the official database [20].

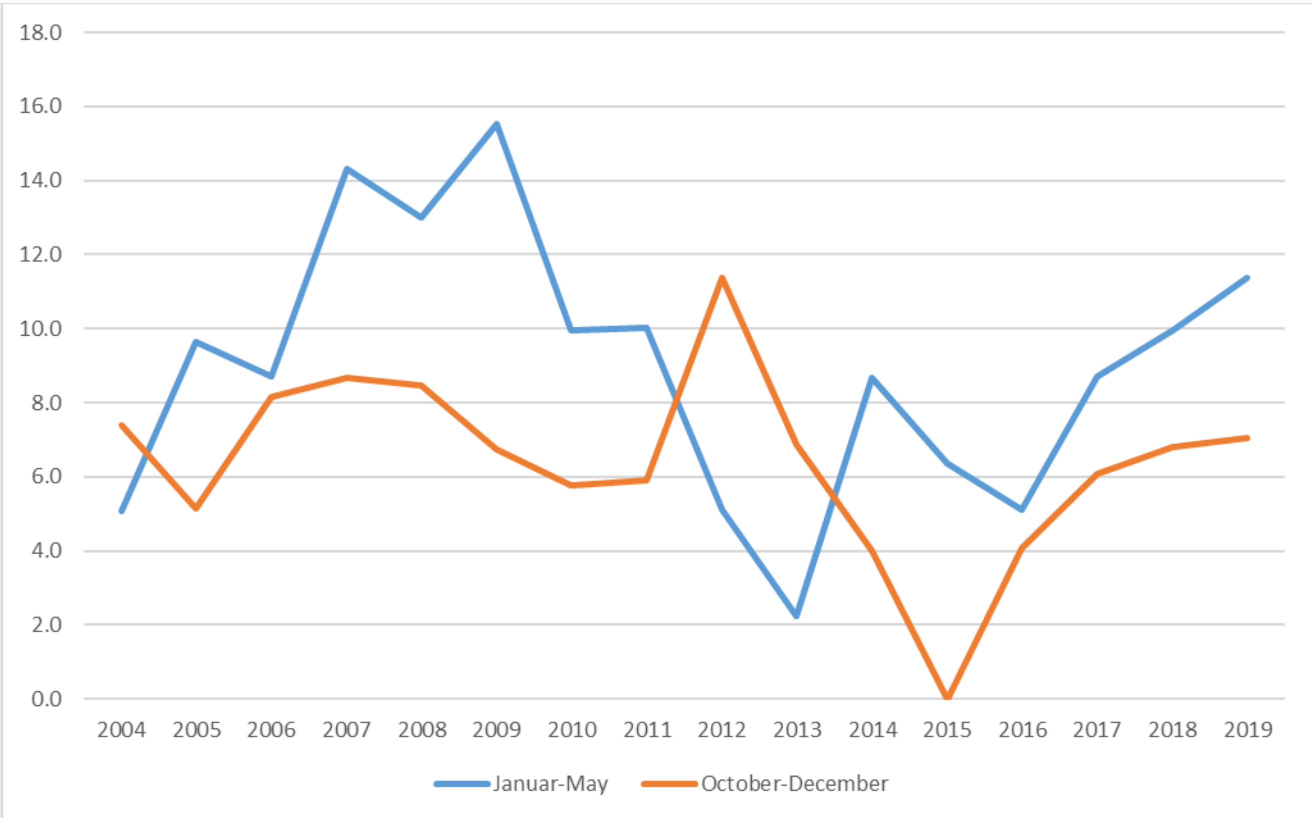

Figure 8. Thousands of passengers carried in low seasons on air route ES20. Source: Own work based on data collected from the official database [20].

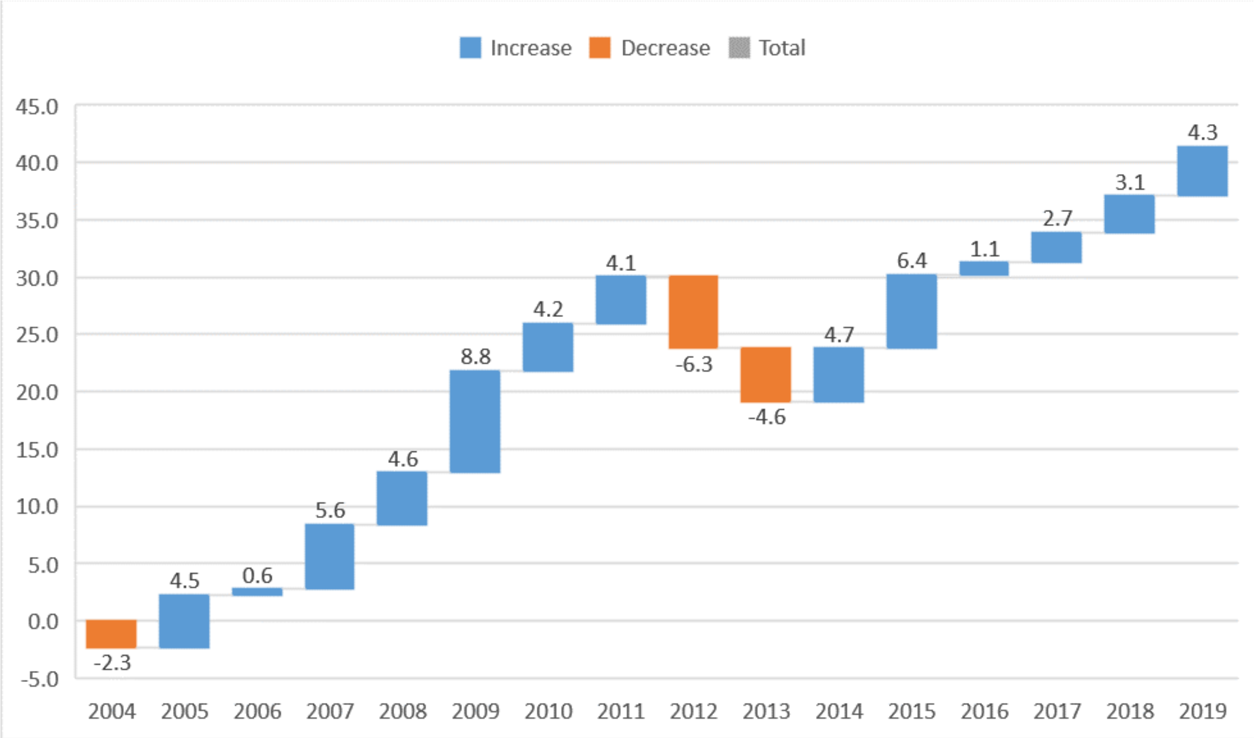

Figure 9. Difference (delta) of passengers carried on the PSO route considered between both periods of each low season per year in the period considered (2004-2019). Source: Own calculation Own work based on data collected from the official data-base [28].

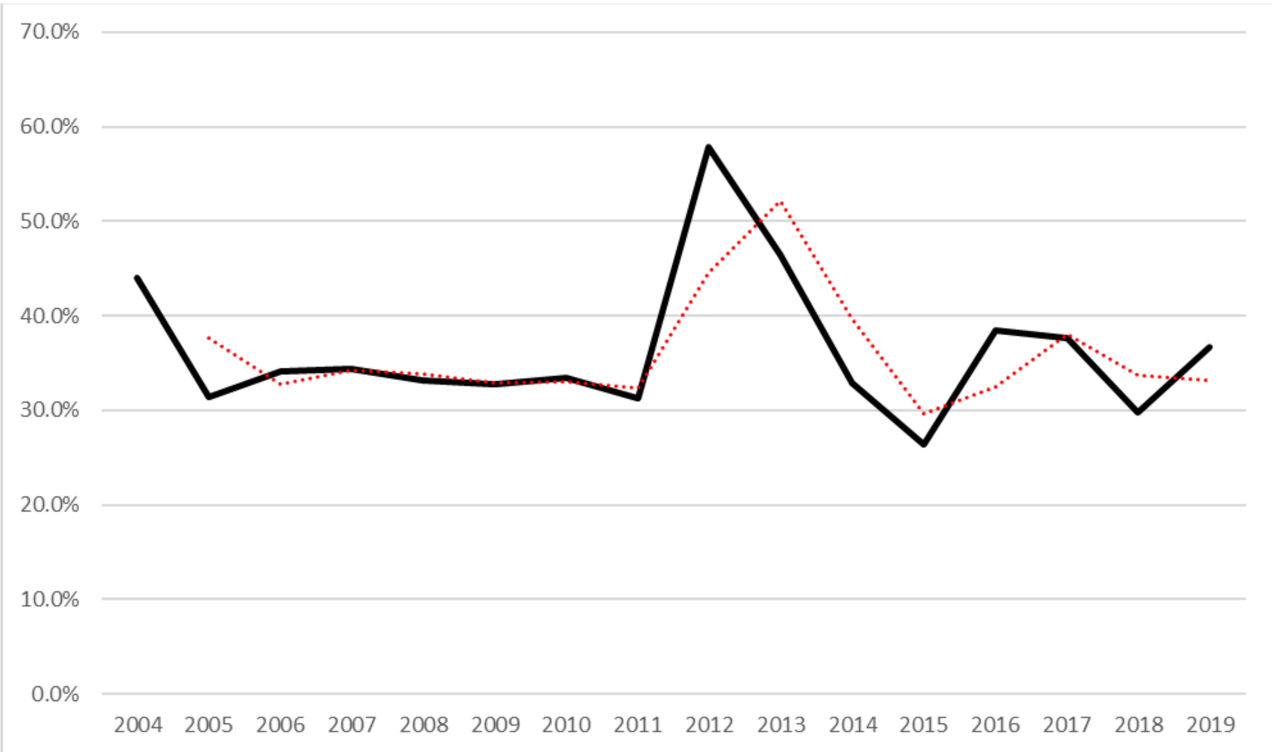

Figure 10. Seasonal trend of activity in peak seasons (June-September) as a percentage of total yearly passengers carried on air route ES20. Source: Own work based on data collected from the official database [28]. Explanatory note: Moving average with 2-period trendline considered

Subsection 3.2.g

THE PSO ROUTES SERVING THE CITY OF MELILLA (ES21-22-23)

Sustainable and Efficient Transportation in special territories of the European Union through Public Service Obligations: The case of scheduled air services serving the Spanish city of Melilla

Tentative Article

Sustainable and Efficient Transportation in special territories of the European Union through Public Service Obligations: The case of scheduled air services serving the Spanish city of Melilla

Part of Doctoral Thesis "The European Single Air Transport Market: An Empirical Approach on the Efficiency and Sustainability of Public Service Obligations in the Spanish Domestic Routes".

Abstract: Public transportation faces a challenge in finding ways to meet the requirements of those citizens living in isolated territories and at the same time to ensure the sustainability of the transport modes concerned. This research aims to assess the efficient use of any public support in ensuring adequate regular passenger transport services serving the city of Melilla, Spain, with mainland Europe. For this purpose, two main intervention forms (economic compensation and resident subsidy) have been studied. In addition to both public actions supported with state funding under European law, the study has extensively examined other public interferences at the regional level in the free market such as marketing contracts for promoting tourism and air links. All these ways of sustaining are in fact legal instruments to guarantee freedom of movement for individuals and goods within the European Single Market. Considering air transportation as an essential service for remote communities, especially those located in special territories of the European Union, the free market system is not always capable of guaranteeing adequate means of transport regarding both travel fares and journey times. In this case study, three thin air routes have been analyzed in the period between 2004 and 2019, showing that, on the issue of sustainable mobility, the imposition of Public Service Obligations can be extremely useful to solve the lack of competition for scheduled air services. These obligations, even in combination with resident subsidies, appear to ensure efficiently the basic air connectivity and quality of regular transport services concerned rather than by awarding regional advertising contracts.

Keywords: Public transportation; sustainability; transport modes; economic compensation; resident subsidy; European Single Market; Public Service Obligations; air connectivity

1. Introduction

For many years, the aviation sector in Europe has advanced under government control from national authorities or related bodies. Airports, mainly public-owned companies at the domestic level, have historically developed a key driver for regional social and economic transformation, and most of them nowadays have even been viewed as strategic facilities at a national level. Airlines, mainly state-owned enterprises, have operated with a business strategy that provides adequate modes of transport to territories that are not well-liked into main transport routes while increasing their revenue. In order to open up the air transport market in the European Union (EU), and thus providing an appropriate operational framework for passenger air transport services under a free regime, national market entry barriers had to be subsequently removed. For this purpose, the European Community (EC) launched, after the Single European Act in 1986, an ambitious process to create a barrier-free single aviation market. The market liberalization was carried out through a gradual and continuous process of deregulation of the air transport sector. This began in 1987 under the auspices of the European Economic Community (EEC) with the first package of liberalization, which comprised the Council Regulations (EEC) no. 3975/87 and no. 3976/87, as well as the Council Directives 87/601/EEC and 87/602/EEC. The second package came into force in 1990 based on the Council Regulations (EEC) no. 2342/90, no. 2343/90, and no. 2344/90. Finally, this liberalization process ended in 1992 with a huge set of legislation, better known as the third package, that included the Council Regulations (EEC) no. 2407/92, no. 2408/92, no. 2409/92, no. 2410/92, and no. 2411/92. As a result of the abundance of legislative measures lead by the European Commission (hereafter the Commission), the air industry had evolved from domestic markets dominated by the principle of the sovereignty of each Member State, in particular regarding the rules on freedom to provide regular air transport services in third EU countries, to a genuine single market without limitations of the establishment. It can therefore be said that the formation of an internal air transport market has been one of the Commission's biggest success stories in liberalizing transportation services across the whole European territory. Generally, the liberalization of the market has often led to affordable airfares and growth in the number of direct flights, particularly those serving tourist destinations. Some airlines have entered other domestic markets across Europe, while certain airports have seen their operations grow substantially. However, air transport market expansion does not always necessarily lead to uniform growth of supply of regular air services, but rather depends on business strategies carried out by airlines for higher yields. Indeed, it is in the free air market, where carriers plan to resume scheduled flights under criteria of profitability, rather than welfare considerations, such as public transportation accessibility. Consequently, the freedom of providing air services can result in a lack of provision of public transportation necessary to ensure access to remote regions and isolated areas, when air routes concerned are not profitable. When this occurs, public intervention may be necessary in order to remedy such market failure. The most common ways to do so are by imposing a Public Service Obligation (PSO) on an unserved air route or by setting a resident subsidy for locals in those territories with insularity or under a special regime due to geographical isolation.

While related literature on public obligations for air transport services in the EU internal market is scarce, some earlier works have examined certain adverse effects of opening up of the European aviation market by analyzing particular case studies in terms of economic efficiency and social sustainability. Market liberalization seems to have led to greater fare instability for air services on low-demand flights (hereafter "thin routes"), especially those serving island territories in seasonal periods, such as during the off-peak season (from October 1 to May 31) in Sardinia [1], and during the low period (between November and March) in the Azores Islands [2]. Likewise, in the Azores case, one of the largest air transport networks that have been fully operated under the PSO system, it is not always easy to find a balance between minimizing total social costs and maximizing social welfare [3]. Other previous articles have also pointed out that resident subsidy can help guarantee the profitability of PSO routes, especially those serving airports located in touristic regions, such as the Canary Islands [4]. In such archipelago, analyzing the domestic passenger traffic in the period between 2002 and 2015, it was further observed that restrictive policies imposed on regular air routes in exchange for a subsidy to the operating airline did not lead to an increase in traffic, and thus the change of legislation, carried out in 2006 and 2011 respectively, has turned from a procompetitive towards a restrictive framework [5]. However, there are many cases where the lack of carriers interested in operating thin routes makes it necessary to tender transport services by restricting access to the market with economic compensation [6]. In fact, the issues more specifically addressed in PSO air routes serving EU special territories have not yet been studied to determine if the demand for alternative modes of transport, when previously only sea transport was available, may be adversely affected by PSO impositions on scheduled air services or if the PSO schema can help in achieving a more sustainable and efficient public transportation network. This is precisely the case of Melilla, an EU special territory under Spanish sovereignty in northern Africa, whose territorial status provides the benefits of its distinct geography within the EU legal framework, where Value Added-Taxes (VAT) rules, along with those relating to customs and excises, do not apply.

2. Functioning of the PSO Schema in the EU Internal Aviation Market

As formerly pointed out, the liberalization of the European aviation market has contributed to the increasing supply of regular air transport services leading to cheaper fares and more direct flights. Overall, all stakeholders (e.g. airlines, airports, passengers, etc.) have been benefited by the internal market opening of the air transport sector, and consequently, of the forming of a great single market in aviation services that even goes beyond the EU borders, namely European Common Aviation Area (ECAA). Although the European aviation market has led to a great expansion of the network for transport services since its liberalization in 1997, the free market regime has not always been able to guarantee scheduled services, particularly in those air routes serving remote territories and peripheral areas. When it occurs, adequate means of transports cannot be deployed to meet the transportation needs of the people concerned, whether for operational reasons or due to insufficient incomes. As these regular transport services often carry passengers on thin routes, flight fares, and ancillary revenues may not be sufficient to cover operating costs from airlines in such cases, thus incurring long-term expenditures. Moreover, an inappropriate air fleet can be a great obstacle to operate certain routes from regional airports. For example, in the case of airports with short runways or certain aeronautical limitation surfaces, it may involve the use of turboprops instead of turbofans in assuring the safety operations of passenger aircraft.

For all these reasons, sometimes the private initiative alone is not sufficient to supply the entire demand of the domestic air transport market under an open market economy. The question this market failure poses is whether air transport should be regarded as a necessity for social inclusion and economic development [7]. Given the importance of ensuring territorial cohesion, the promotion of mobility plays a crucial role in accessible transportation equal opportunities for people living in remote territories and peripheral areas compared to the rest of the European population in the field of air transport. Besides traditional measures at the domestic level, such as public contracts for tourism promotion and resident discounts, some EU Member States have used the PSO schema provided for the Articles 16-18 of the Air Services Regulation 1008/2008 (hereafter [8]) to remedy the lack of scheduled transport services on certain air links, many of which are thin routes. Since the imposition of a PSO in the aviation sector represents a limitation on the freedom to provide services, which is one of the fundamental four freedoms of the EU internal market, any such limitation has to be strictly limited in scope and proportionate to the desired objective. The imposition of a PSO aims to meet specific well-defined public needs in terms of transport and mobility, and thus the conditions for its application should be clear enough to avoid the irruption of an unduly altering the market. For this purpose, nine years later the introduction of the PSO schema, the Commission seized on the opportunity to clarify the application scope, as well as concerning enforcement procedures, through interpretative guidelines (hereafter [9]). Despite the great complexity and variability of the 176 PSO air routes (as of 18/09/2019) so far, these guidelines have been helpful for the design of each PSO from June 2017 onwards. Finally, as can be seen in Table 1, an air carrier can receive compensation from public funds for the provision of the PSO service, but it also has to comply with State aid rules.

Table 1. Key features of PSO schema according to Air Services Regulation 1008/2008

Type of PSO	Any carrier operating	Only one carrier	Minimum annual seats	Maximum flight fares	Economic compensation awarded	Special fares for residents	Domestic resident subsidy [b]
1	●		●	●	◊ [a]	◊	◊
2		●	●	●		◊	◊
3		●	●	●	●	◊	◊

Source: Own work. Caption: Black circle "●" denotes a mandatory requirement from a PSO imposition while blank space indicates "not applicable" under the imposition of a PSO on regular air routes concerned. Rhombus "◊" denotes a specification not strictly necessary. Explanatory note: a) Recently it was noticed that certain PSO air routes imposed by Greek authorities exceptionally have been tendered for regular air services in an open regime; b) Although the existence of resident subsidies is compatible with the imposition of a PSO, it is applicable under the Article 107(1) of the Treaty of the Functioning of the European Union (TFUE).

3. Considerations of the PSO Schema Implemented in the Spanish Domestic Aviation Market

PSO impositions have been implemented in air routes serving regional airports located in remote areas and peripheral territories on Community areas but not often enough. One of the most widely used public mobility tools for promoting regular passenger transport services on thin air routes is furthered by the PSO schema. This has proved to be very helpful in maintaining air transport considered as a social necessity when it cannot be satisfied by airlines from the private initiative in a free market regime, even in those scheduled services that have been designed in linking two secondary airports, such as the only case so far in which a PSO has been imposed on an air route within Spanish Mainland [10]. Although a PSO route may also be designed exclusively for freights on the current legal basis [8], so far there has been no effective impositions on cargo air routes inside the internal market. In the case of the domestic air transport market in Spain, the PSO schema has been mainly directed towards enhancing air connectivity in developmental areas, but solely for public transportation. Additional public actions, such as resident subsidies at the national level and advertising contracts at the regional level, have been implemented to mitigate the lack of adequate transport connections serving certain peripheral airports; thus, preventing depopulation of peripheral areas and fostering tourism in developing territories, respectively. However, neither of them is related to the PSO schema, since both measures are applied to the domestic scope, even though they must be subject to EU law to avoid distortions of competition. Regarding advertising contracts, as they are usually intended for promoting tourism in developing areas, it seeks to add new destinations to and from airports concerned; thus, stimulating the demand for travel services. However, they must be within categories of aid compatible with the internal market [11].

Almost half of PSO air routes imposed so far in Spain have been operated by one single carrier on an exclusive basis from public invitation-to-tender procedures. Specifically, 23 public service obligations have been imposed upon regular air routes for passenger traffic in Spain so far. As shown in Table 2, among them there are 9 ongoing impositions restricted to one carrier from a tendered contract for the provision of air transport services. In Spain, tendering procedures have been conducted by the civil aviation authority of the former Ministry of Public Works, currently named Ministry of Transport, Mobility and Urban Agenda (hereafter MITMA). Furthermore, the specific legal framework for service concession contracts, the so-called Public Sector Contracts Act (hereafter LCSP), aims at achieving greater transparency in public procurement, as well as the best quality-price relation, following the transposition of European Parliament and Council Directives 2014/23/UE and 2014/24/UE into Spanish law [12]. Hence, contracts concerning PSO impositions have been conducted by the MITMA with a high degree of transparency and efficiency through a unique procurement platform for electronic submissions (commonly known as simply the PLACSP) and, since 2018, only under a full e-procurement procedure [6]. Since the implementation of the electronic procedure, eleven calls for tenders have been launched for PSO contracts so far, two of which could not be awarded due primarily to the lack of bidders.

Table 2. Existing PSO air routes under type 3 in the Spanish domestic market (as of 1 March 2020) [1]

Route code	Airport (from/to)	IATA [b] code	Airport (to/from)	IATA [b] code	Case number	Expected termination
ES01	Almeria	LEI	Sevilla	SVQ	43/A18	31/07/2022
ES03	Menorca	MAH	Madrid	MAD	123A2019 [a]	19/11/2020
ES12	La Gomera	GMZ	La Palma	LPA	15/A18	31/07/2021
ES13	La Gomera	GMZ	Tenerife N.	TFN	15/A18	31/07/2021
ES19	Badajoz	BJZ	Madrid	MAD	123A18	27/10/2021
ES20	Badajoz	BJZ	Barcelona	BCN	123A18	27/10/2021
ES21	Melilla	MLN	Almeria	LEI	162A2020	31/12/2020
ES22	Melilla	MLN	Granada	GRX	162A2020	31/12/2020
ES23	Melilla	MLN	Sevilla	SVQ	162A2020	31/12/2020

[1] Source: Compilation based on data provided both by DG MOVE and by MITMA. Explanatory note: a) Economic compensation applicable in seasonal period only; b) International Air Transport Association (IATA).

4. Addressing the Issue of Connecting Melilla Correctly by Imposing Public Services Obligations

Located in a privileged enclave on the Mediterranean coast, the city of Melilla is a part of the Spanish overseas territories in Northern Africa since 1497. Melilla is also considered as a special member state territory since it does not belong to the EU customs union. Besides Melilla, Ceuta is the other Spanish city located in Africa. At the request of the Kingdom of Spain in 1986, the EU authorities excluded both cities from the customs territory of the Community in order to preserve their tax and tariff status which is primarily based on two indirect taxations [13]. The first one relating to Production, Services, and Imports (IPSI) instead of the Value Added Tax (VAT); the second one concerning excise duty on particular issues, such as certain means of transportation and electricity. Due to its special geographical situation, far from the Spanish Mainland, Melilla has traditionally joined a bustling trade exchange with the Moroccan city of Nador through incessant border traffic. Unlike Ceuta, Melilla has joined a commercial customs post, named Beni Enzar, until its current closure in August 2018 thanks to incessant truck traffic for the transportation of goods into the Kingdom of Morocco from the port of Melilla. Furthermore, so far, no regular passenger transport services have been linked to this Spanish major place of sovereignty with Morocco by air or sea. This situation confers Melilla an economic disadvantage for local growth and therefore leads to a limitation in terms of mobility towards Africa. This has therefore forced various public administrations both at the national and local level to strengthen the mobility of citizens by promoting adequate air and sea connections with the Spanish Mainland.

A further significant limitation to the expansion of the domestic aviation market is the lack of competitors interested in scheduling new routes to serve secondary airports, especially in the case of air facilities subject to operational restrictions. This also has a direct impact on aircraft performance, thereby limiting its payload. When it occurs, airlines operating inadequate fleet may incur an operating deficit, not only due to aircraft lease rentals but also crew costs. This is precisely the case of Melilla Airport (MLN) whose take-off and landing procedures determine the specific type of aircraft ideally suited to operating under these limitations. Specifically, only once turboprop planes, such as the ATR family (ATR-42/72 series) or the DHC-8 family (Q100/200/300/400 series), meet operating requirements from this kind of regional airport. Consequently, only airlines operating such aircraft families would be able to take over operations on routes concerned. Furthermore, from the moment that a PSO is designed in these cases, tender documents can become even more specific on this point. Related explanatory reports have ordinarily been based on mathematical figures of the operating deficit by considering only the most efficient aircraft for this type of short-haul routes. Specifically, in the case of procurement procedures concerning PSO routes serving Melilla so far, those with the case number 328A19, 162A2020, and 230A2021, and awarded on 27 March 2019, 30 September 2019, and 5 October 2020 respectively, had related calculations made by considering the turboprop ATR-72 as the most efficient airplane model for the air routes shown in Table 3. Significant investments have been made in the past, few at the Melilla airport to expand its runway (max. surface of 1433x45 m.), as well as improving certain technical aspects concerning obstacle limitation surfaces [16]. Presumably, it will lead to a greater performance on the safety and efficiency of aeronautical operations and thus being able to operate with small-sized commercial turbojets.

Table 3. Operational facts of PSO air routes serving the Melilla airport (as of 31 December 2019)

Route Code	Distance (km) [a]	Travel time (h)	Heading Direction	Block Fuel (kg) [b, c]	CO2 Emissions (kg) [b, c]	Standard Equipment (Aircraft)	Emissions CO2/PAX (kg) [b, c]
ES21	181.7	0:41	17° (NNE)	319.4	1,006.2	ATR72-600	13.9
ES22	224.7	0:46	341° (NNW)	395.1	1,244.3	ATR72-600	17.2
ES23	354.5	1:02	313° (NW)	623.3	1,963.2	ATR72-600	27.2

Source: Own figures partially based on a performance study provided by ATR upon specific request. Explanatory note: a) Orthodromic distance; b) Standard assumptions: Jet A1 density as of 0.804 kg/l, CO2 emissions as of 3.15 kg of CO2 per kg of Jet A1; c) En-route assumptions: Max. payload, no wind, 1 aircraft per leg under technical specifications by International Standard Atmosphere (ISA), Joint Aviation Requirements (JAR), European Union Aviation Safety (EASA).

Besides these three PSO routes covered by Air Nostrum (YW) with ATR-72 series (see Figure 3) so far, other domestic destinations have been regularly operated from Melilla under the free-market regime, one connecting with Malaga (AGP) and the other Table 4 with Madrid (MAD), mainly operated by either Air Europa (UX) or Air Nostrum (YW), even both at the same time. As can be seen from Figure 1, the imposition of a PSO on the three air routes, together with MLN-AGP and MLN-MAD, has led to the creation of a strong domestic air transportation network located in southern Spain, thus connecting Melilla with three airports, whose catchment areas comprises three provinces of Andalusian, such as Almeria, Seville, and Granada (see Table 4). These also have, respectively, a Gross Domestic Product (GDP) per capita of €20,465, €17,894, €19,665 (as of 2017), which together represents roughly a GDP at market prices of 44,35% over the total of this autonomous region [17]. On par with them, Melilla has a GDP per capita of €17,934. Accordingly, none of these four Spanish areas falls within the category of less developed regions, as their GDPs per capita are less than 75% of the EU-27 average (€29,043.45 as of 2019) [18]. That is, respectively, a GDP per capita of 70.46%, 61.51%, 68.74%, and 61,74%. On this basis, the justification given for the imposition of a PSO on air routes shown in Figure 1 revolves around the consideration of development regions, besides thin routes [19]. Hence, this involves a conditioning factor in terms of social needs when the enhancement of air transportation plays a fundamental role in better territorial cohesion. Thanks to the maintenance of loss-making routes through PSO contracts, Melilla has led to a greater transport system, and thus better connectivity.

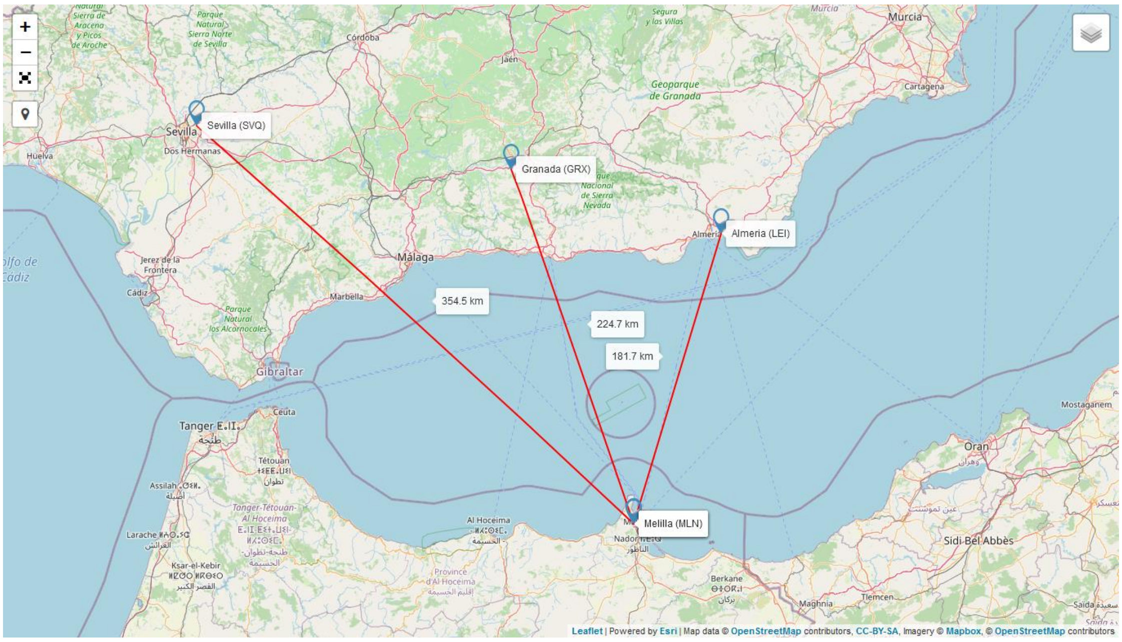

Figure 1. PSO air routes serving the city of Melilla (since 1 May 2019). Source: Prepared with FreeMapTools.com

Table 4. Key facts of air passenger traffic at airports considered (2004-2019)

IATA Code	Airport Group [a]	Airport Typology [b]	Airport Category [c]	Average Annual Passenger Traffic [d]	CAGR (%) [e]
MLN	III	Regional	Level 1	315,000	0.9
LEI	II	Touristic	Level 2	896,000	0.3
GRX	II	Regional	Level 2	952,000	1.3
SVQ	I	Regional	Level 2	4,502,000	2.0

Source: Own calculation based on information from Aena database [20]; additional information provided by the Spanish Directorate-General for Civil Aviation (DGAC) upon request. Explanatory note: a), b) According to the classification provided by Aena; c) According to the categorization under Article 3 of [14] and Article 4 of [15], Spanish airports are classified as the non-coordinated airport (Level 1), airports with schedules facilitated (Level 2), or coordinated airports (Level 3); d) Total amount including both arrivals and departures at each airport; e) Compound annual growth rate.

As shown in Table 4, this case study involves four non-hub airports, three of which are reaching low levels of growth with the exception of the case in Seville. This has become a city-break destination due to a massive increase in flight connections by low-cost airlines. In recent years, the other relevant airports have led to stable demand figures without significant growths. As illustrated in Figure 2, passenger demand is widening the gap among them.

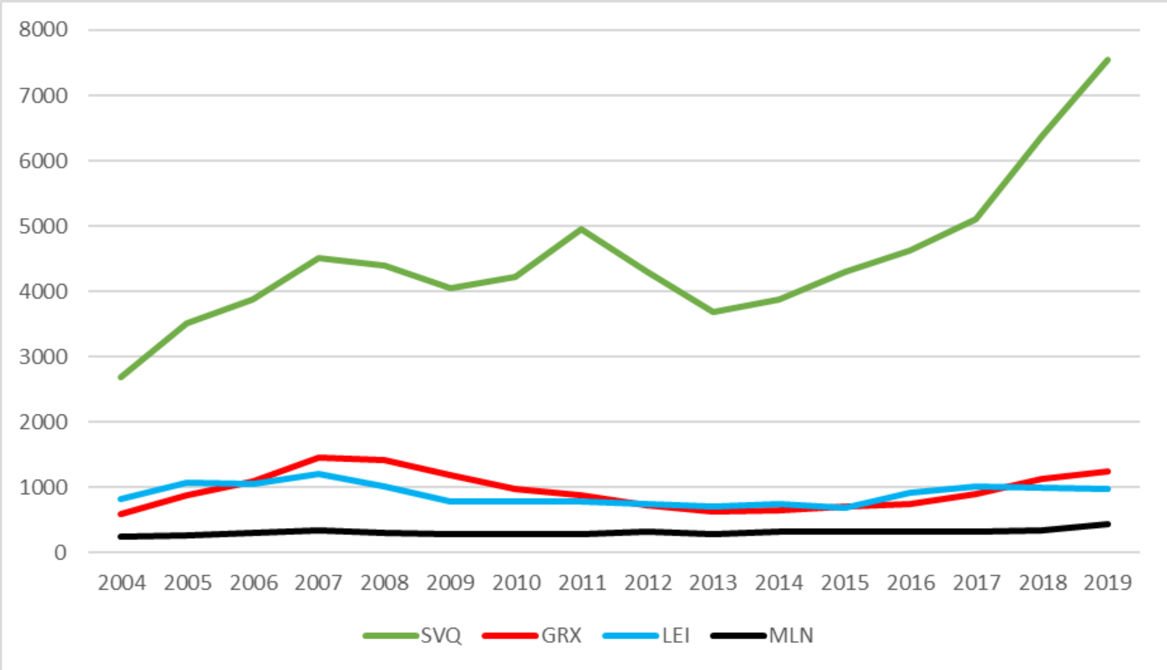

Figure 2. Thousands of passengers in both departures and arrivals at each airport. Source: Own work based on key figures compiled from Aena database [20].

Figure 3. Aircraft type, ATR72-600, mostly operated on routes to and from Melilla airport (courtesy of Air Nostrum)

The air routes displayed in Figure 1, which involve non-hub airports, do not have alternative modes of transport among them, except in the case of ES21 that has a sea link with Almeria by mixed freight-passenger ships (see Figure 5). As shown in Figure 4, the sea route has led to a positive trend in demand for regular transport services, with ups and downs that will be addressed further on, reaching a Compound Annual Growth Rate (CAGR) of 2.3 over the period analyzed.

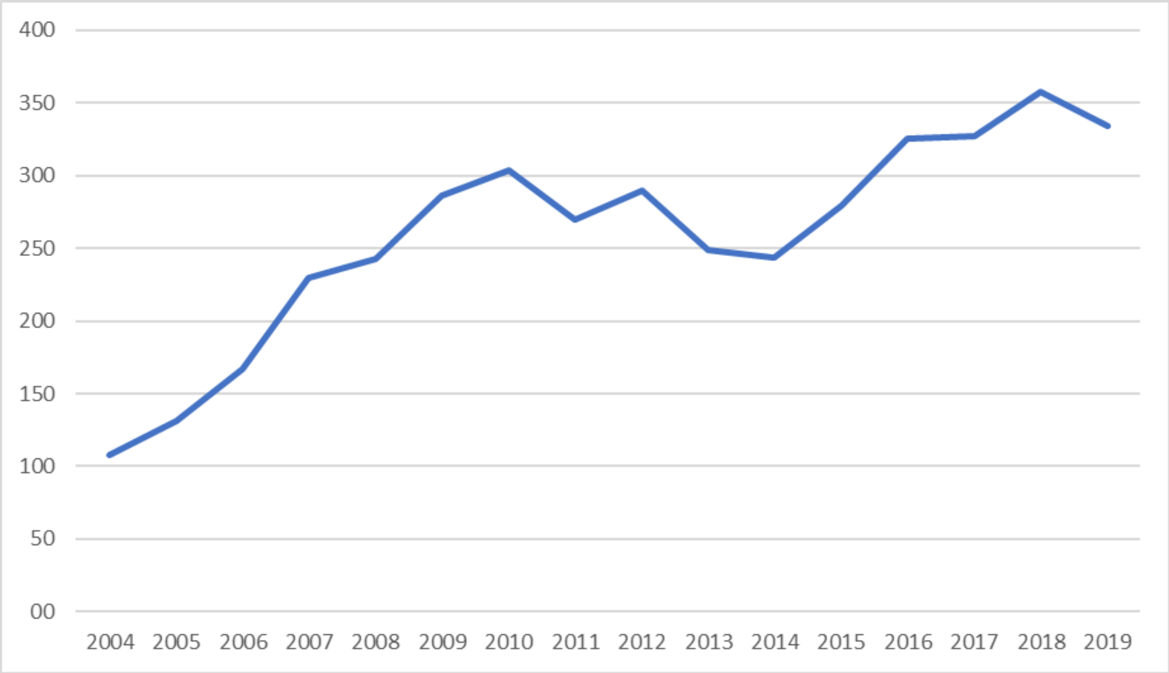

Figure 4. Thousands of passengers carried on regular shipping services between Melilla and Almeria (2004-2019). Source: Own work based on key figures concerning departures and arrivals from annual reports provided by Almeria Port Authority.

Figure 5. Sicilia vessel, IMO 9261542, usually operating scheduled shipping services serving the city of Melilla (courtesy of BALEARIA).

5. Overall Findings and Key Results from the Study

Air transportation is an essential element in the EU special territories, particularly in the case of isolated areas without any rail connection, along with limited road access and scarcely sea linked. This is precisely the case with the transportation system serving the city of Melilla. As previously discussed, the present study seeks to address and explain how public services obligations imposed on scheduled air routes can contribute to achieving sustainable and efficient public transportation. The existence of the PSO schema in such a deregulated services sector like the EU single market in aviation has only been justified by the fact that it is not always possible to provide transport services in the public interest from free-market forces alone. As this form of public intervention on the open market for air transport services can cause distortions of competition, it is extremely important to keep in mind the legal basis of this fact for a better understanding of the results obtained from this research. An analysis on the current legal framework shows that public services obligations have explicitly been included in both the Spanish and European legislation. At the EU level, according to Articles 16-18 of the Air Services Regulation [8], the starting point is that any member state may limit access to the scheduled air services on routes concerned to only one air carrier with an Air Operator Certificate (AOC) issued by a civil aviation authority (CAA) within the EU, providing it complies with the PSO requirements in a transparent and non-discriminatory way. At the domestic level, from Article 95 of the Sustainable Economy Act [21], the key consideration is that the provision of affordable transportation services for the public benefit in terms of frequency, price, quality, and universality, shall be subsided from public funds when it falls out of the scope of private air carriers commercial interest. In this case study, three public measures have been identified as possible ways to forward adequate mobility of people in terms of availability and costs only. Firstly, actions to promote Melilla internationally as a tourist and business destination through public contracts for advertising services had been carried out until 2014. Secondly, the applicable resident subsidy has been increased from 50% to 75% since 2018 [22]. Lastly, but not least, tendering procedures for awarding contracts from the imposition of a PSO of type 3 have been launched since 2019. Of these, as can be seen in Figure 6, the PSO schema seems to be the most effective tools to stimulate the demand for regular passenger services on the three air routes, as they have been restricted to one carrier for the compliance with the minimum conditions provided from PSO requirements. Apparently, this result shows that the effect of such public intervention on domestic market is to rise the demand.

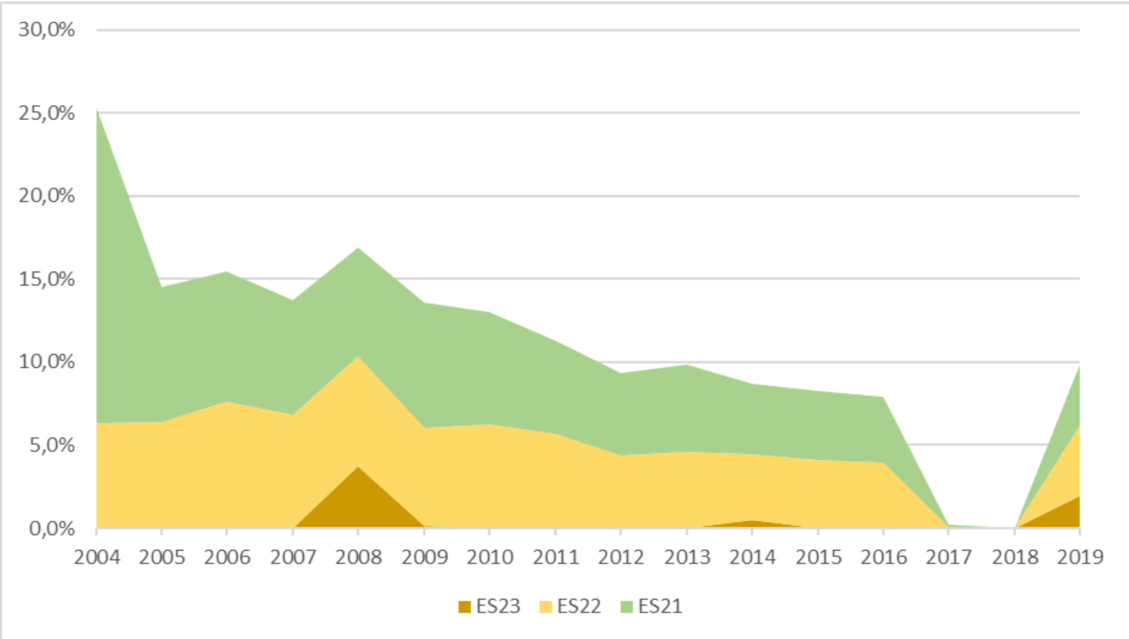

Figure 6. Share market evolution of current PSO air routes at Melilla airport. Source: Own calculation based on key figures concerning passenger departures and arrivals taken from the official database [20].

Regarding public contracts awarded for contributing to open new routes or expand existing ones at Melilla airport, either because of promotional reasons or PSO impositions, there have been observed two facts in terms of efficiency in allocating resources with public budgets. On one hand, the contract period has been adjusted to suit an optimal duration of 12 months against possible needs of updating requirements; thus, adapting quickly to a changing environment as of the air transport industry. On another hand, the contract price has been evolved and adapted to the initial budgetary, as a result of a proper calculation made by DGAC. Nevertheless, public contracts whose ultimate goal is the strengthening of the mobility of citizens towards enhancing air connections at Melilla airport, whether from national or local funds, have had only one bidder; therefore, the same air carrier awarding in all of them. As summarized in Table 5, a substantial change has been observed not just in the formulation finally chosen for this purpose but in the value of the contract awarded. On one side, it appears that the optimal budget to cover the operating loss is near the effective amount required, corresponding to an equivalent of €174,922 for each month of operating from the last tender (ε). On another side, there has been a change in promoting air services in favor of those awarded from PSO impositions instead of hiring of tourist advertising of the autonomous city of Melilla on airplanes and other promotional actions in regular airlines. Furthermore, it appears to be the most effective way of awarding public contracts for providing regular air services from year to year and thus covering the possible shortfall in operating these thin routes. As shown in Table 5, the general trend towards a slow but steady decrease in the effectiveness of public aids through service contracts for tourism promotion (α, β) until 2014 is confirmed.

Table 5. Operational facts of public contracts concerning Melilla airport awarded so far

Symbol Caption	Contract Reference	Public Founds	Contract type	Total Award Amount (€)	Contract Period	Contract Start
α	08/01/06	Local	Administrative	2,000,000	24 months	21.07.2006
β	18/06/10	Local	Administrative	10,400,000	48 months	13.09.2010
γ	328A19 [a]	National	PSO	1,518,402 [b]	8 months	01.05.2019
δ	162A2020 [a]	National	PSO	2,099,699 [b]	12 months	01.01.2020
ε	230A2021 [a]	National	PSO	2,099,066 [b]	12 months	01.01.2021

Source: Own work based on data collected from tender dossiers concerned. Explanatory note: a) only applicable in PSO air routes ES21, ES22, and ES23; b) with a tender budget of €2,100,000.

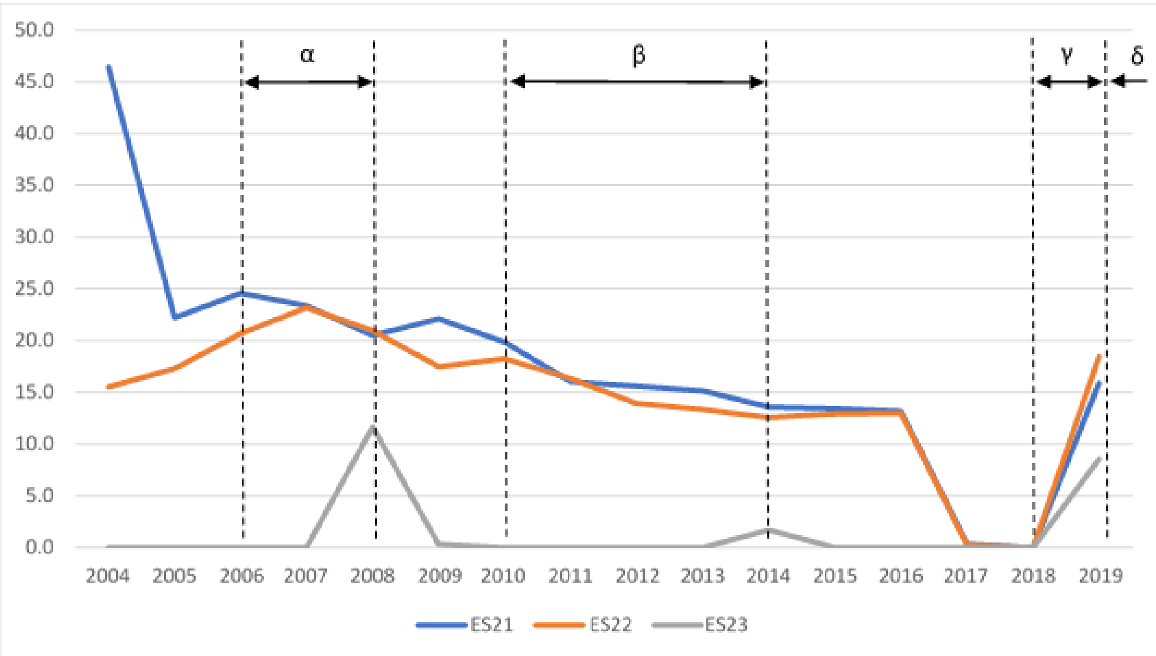

Figure 7. Annual air route performance on regular passenger services at Melilla airport. Source: Own work based on data collected from the official database [20].

While the legal basis to tender advertising contracts for tourism promotion services in aviation is quite different from the legal framework for PSO contracts, although compatible with each other under certain circumstances according to the European law, no overlap was found between both types of public contracts from this case study. Table 6 shows that advertising contracts have not led to significant changes in the demand for regular passenger services on the three air routes discussed. Specifically, there has only been found a slight increase in the demand on air route ES22 during the first period (α). Instead, there has been an impressive rise in the number of passengers carried since May 2019, which coincides with the entry into force of the first PSO contract (γ). Accordingly, the successive contracts (δ, ε) have been tendered without awaiting completion of the previous one to ensure continuity of regular passenger services. Furthermore, unlike advertising contracts concerned, the PSO contracts have been awarded for consecutive periods, however not for longer than one year. As summarized in Table 6, there is a clear difference between the awarded contract period for tourism promotion and other public tenders in aviation, with PSO contracts being more heavily justified than other public procurement procedures in the period considered. After the completion of the advertising contracts concerned, the supply of passenger transport services on these air routes have dropped significantly between September 2014 and December 2016. As a result, the air carrier (YW), which had won the previous advertising contracts (α, β), was operating two air routes (ES21 and ES22) based in Melilla on free market conditions, but without no public contracts of any kind, for a short period until finally they were resumed (respectively, 11 January 2017 and 9 January 2017). As can be seen in Table 6, the air route ES23 had been sporadically operated. This indicates that historical air traffic data of this route is not sufficiently extensive to use in studying effects of public incentives on demand for passenger services, and therefore it is scarcely possible to establish a relation between the positive impact of advertising contracts for tourism promotion and the increase in the number of tourist visiting Melilla from Seville. Rather, the effect of PSO contracts on the demand for regular flights is considerable since launching of passenger transport services from air routes ES21, ES22, and E23 on a one-carrier basis. This form of public intervention, in addition to the existence of a resident subsidy, have helped to revitalize these routes since May 2019.

Table 6. Operating regime of regular flights on air routes ES21, ES22, and ES23 since 2004

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2004	●	●	●	●	●	●	●	●	●	●	●	●
2005	●	●	●	●	●	●	●	●	●	●	●	●
2006	●	●	●	●	●	●	α	α	α	α	α	α
2007	α	α	α	α	α	α	α	α	α	α	α	α
2008	α	α	α	α	α	α	●	●	●	●	●	●
2009	●	●	●	●	●	●	●	●	●	●	●	●
2010	●	●	●	●	●	●	●	●	β	β	β	β
2011	β	β	β	β	β	β	β	β	β	β	β	β
2012	β	β	β	β	β	β	β	β	β	β	β	β
2013	β	β	β	β	β	β	β	β	β	β	β	β
2014	β	β	β	β	β	β	β	β	●	●	●	●
2015	●	●	●	●	●	●	●	●	●	●	●	●
2016	●	●	●	●	●	●	●	●	●	●	●	●
2017	■	■	■	■	■	■	■	■	■	■	■	■
2018	■	■	■	■	■	■	■	■	■	■	■	■
2019	■	■	■	■	γ	γ	γ	γ	γ	γ	γ	γ
2020	δ	δ	δ	δ	δ	δ	δ	δ	δ	δ	δ	δ
2021	ε	ε	ε	ε	ε	ε	ε	ε	ε	ε	ε	ε

Source: Own work based on data collected from tender dossiers concerning PSO air services on these three air routes. Explanatory notes: Black circle "●" denotes the existence of a free regime market with at least one carrier operating regular air transport services, while black square "■" indicates the existence of a free regime market without carriers operating regular air transport services concerned.

The introduction of a resident subsidy program on the domestic air travel market aims at supporting the mobility of residents living in remote territories, such as outermost areas and isolated enclaves. While this type of subsidy belongs to social aids for transport for residents of remote regions, according to article 51 of [23], it is usually a price discount directly applied to the transport ticket, if it has been proved previously that the passenger lives for at least 185 days in a remote territory. In the Spanish case, the resident subsidy is applied for natural persons living in the African enclaves, Ceuta or Melilla, as well as the Canary Islands or the Balearic Islands, whose EU identifiers from Nomenclature of Territorial Units for Statistics (NUTS) are NUTS-ES63, NUTS-ES64, NUTS-ES70, and NUTS-ES53, respectively. This type of state aid has traditionally been implemented through direct grant or interest rate subsidy and is compatible with internal market rules from articles 107.3.a and 107.3.c of the Treaty on the Functioning of the European Union (TFEU). Although the effect of the discount for island residents on air fares has not been widely studied, some earlier works have shed light on the matter by trying to model the market impact through microeconomic methods under specific conditions. Regarding the Canary Islands case, it has been discussed whether the intensive use of subsidies for resident passengers through either ad valorem or a specific subsidy may produce certain market inefficiencies [24]. The intra-Canarian islands market has also been studied in the context of PSO policies since the two reforms (2006 and 2011) carried out so far [25]. However, both approaches are not entirely applicable to the case of Melilla for two reasons. Firstly, there is no alternative mode of transportation to regular flights, except for the sea link with Almeria, thus competing with the air route ES21. Secondly, there is restricted access to information concerning resident subsidy schema to obtain relevant data disaggregated by either purpose of the travel (tourism, work-related or private reasons) or income level (based on annual minimum interprofessional wage). Although requested, no information about the total amount of resident subsidies for passengers flying on the three air routes concerned (formerly operating in the free market, currently under PSO impositions on a non-exclusive basis) has been provided by DGAC, since it is considered non-public information according to Spanish law [26]. By contrast, the evolution of the Passenger Load Factor (PLF) on these routes over past years can help to shed some light on the impact of these public instruments, either directly such as PSO impositions or indirectly through advertising contracts, on the performance of regular transport services covered. As shown in Figure 8, the introduction of PSO contracts has led to the highest occupancy rates achieved so far, and remarkably in the case of air route ES22.

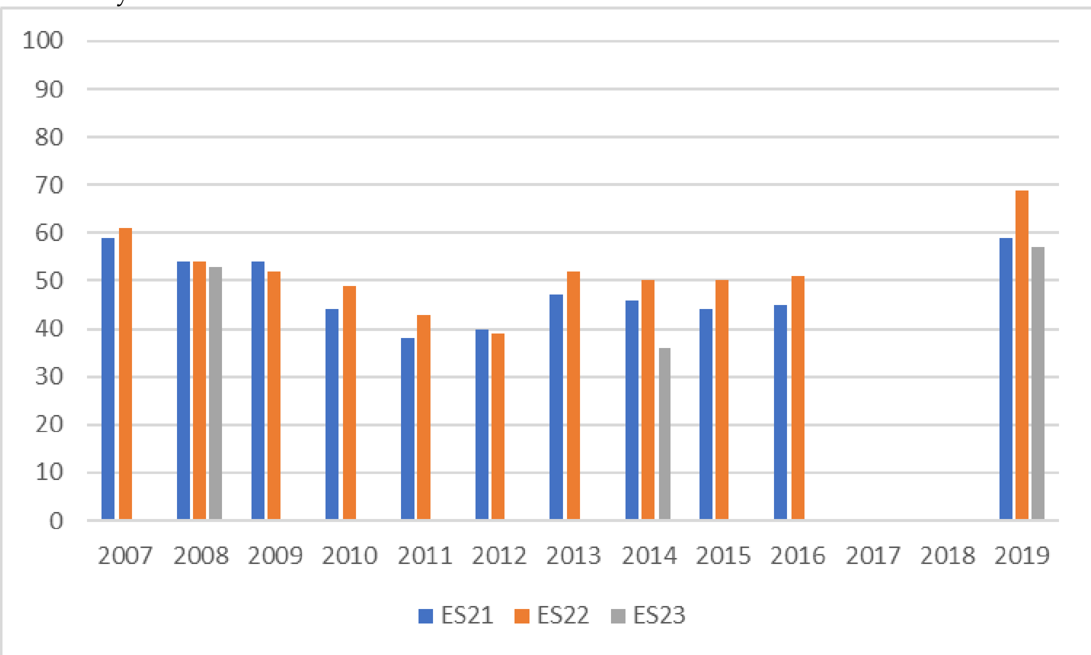

Figure 8. Annual performance as PLF (%) of PSO air routes serving Melilla. Source: Own work based on data collected from tender documents in the public domain through [27], and other figures with specific access rights that were submitted to MITMA under special request.

6. Further Considerations and Related Discussion on Findings

As formerly mentioned, air transport liberalization within the EU single market in aviation has led to a great increase in the choice of air routes, mainly those relating to tourist destinations linking main airports. The great expansion in the supply from European aviation across the internal market has been due to the deregulation process, which has given rise to the entry of newcomers. Regarding short and medium-haul routes, the market presence dominance of former incumbent carriers (so-called legacy airlines) has gradually been replaced by new players (better known as low-cost airlines) in the last 25 years. During this time, the air transport industry has faced a common strategic competition to address the development of tourism. While low-cost carriers have increased their supply of direct flights from a point-to-point model, legacy carriers have expanded their flight networks through codeshare flights from a hub-and-spoke model. Budget air tickets from low-cost airlines have increased their market shares in many European countries. For instance, three low-cost carriers have led the overall passenger traffic in the Spanish national airport system (AENA) by the year 2019, such as Ryanair (RK, FR, RR), Vueling (VY), Easyjet (DS, U2, EC), with 18.8%, 12.5%, and 7.7% of the total passengers carried, respectively. As a result, traditional airlines have faced the challenge of competing with the low-cost revolution by strengthening worldwide strategic alliances (Star Alliance, Sky Team, and One World) [28]. Aiming to save operating costs, as much as possible, airlines have homogenized their fleets and concentrate their flights on profitable high-demand routes, thereby increasing their competitiveness. However, not all European airlines have not been able to keep up with rapidly changing travel market developments, since they are neither legacy nor low-cost, such as small-size and regional airlines with a high level of entrepreneurship [29]. In addition to the disappearance of such companies, airports located in remote territories or developing regions have also suffered a loss of business due to a lack of commercial interest in thin routes from existing carriers. Consequently, certain regional airports are faced with low demand problems which could seriously put at stake the economic profitability and even the viability of their facilities. Therefore, it was examined whether small airports should be closed when they are not able to be competitive in attracting airlines for launching new routes or keeping the existing ones, in spite of the connectivity loss for the population caused by closing them [30]. Given the fact that the three of four facilities from the present study are airports with annual traffics of less than 1 million (see Figure 1), this is a point that can deserve attention in strict terms of economic efficiency. However, these airports (MLN, LEI, GRX) play an enormous role in bringing tourists, thus providing a significant added value on local economies. Moreover, the issue in consideration is also highly profitable from a social viewpoint, as the city of Melilla is an isolated enclave from the Spanish mainland in terms of transportation. By ensuring adequate means of transport from affordable and reliable regular services, people can continue to live there, without having to move to other places. To that end, air tickets purchased by citizens of Melilla are entitled to a resident subsidy (since 16 July 2018, with a discount of 75% on any fare ticket). This situation means that the interpretation of the results obtained from this study should consider the foreseeable effect of resident passengers on the demand. Existing national legislation, however, does not allow for routine consultation of data relating to the number of subsidized passengers on each public route. Nevertheless, this inconvenience has been overcome with a detailed analysis of all existing traffic data disaggregated by scheduled transport services. Subsequently, the collected data has been processed depending on either touristic season or semester (spring-summer season and autumn-winter season) to detect possible seasonal variations in demand. Furthermore, based on the information contained in the tender documents and procurement-related reports concerning PSO impositions, estimated values of PLF on each air route have been calculated for comparison with the consolidated values. As outlined below, all air routes considered have shown improvement in PLF since the entry in force of related PSO contracts, albeit at low numbers than the estimated figures. Moreover, it is worthy to note that estimated average incomes per passenger carried is always less than reference fares on each route from the present study. Regardless of the margin profit applied to these procurement procedures, it was confirmed from explanatory reports for launching calls for tender that has been consistent in all of these contracts, which is 5% of the total costs.

6.1. Considerations on Findings about Performance of PSO Imposition on Air Route ES21

The imposition of a PSO on the air route linking Melilla with Almeria has made it possible to ensure minimum conditions of connectivity in terms of flight frequencies and available seats offered. As summarized in Table 7, requirements have remained almost unchanged in all contracts from a PSO imposition of type 3. It also was confirmed that the maximum fare (€106 as of May 2019) is more expensive than the reference fare and even much higher than the estimated average income. Until the imposition of this PSO, regular transport services had been dealing with a dramatic fall in demand over the past years. This situation became untenable for the airline operating (YW) in the free market, partly due to the increased competition from the maritime mode, particularly since the entry of more players in the market. In 2016, it came to have three sea carriers (Acciona Trasmediterránea, Baleària Eurolíneas Marítimas, and Naviera Armas) operating the sea route between both cities. This resulted in expanding the transportation supply, and therefore more possibility of choice between both modes of transport. It was exactly this year when the demand for air services suddenly dropped, as shown in Table 7. Moreover, it has been noted that there is an effect of the contraction in demand for maritime passenger transport services during two periods (from 2010 to 2014, and from 2018 to 2019), coinciding the first one with the existence of a public contract (β). In that regard, the effect of tourism promotion from two special administrative contracts awarded (α and β) in order to enhance the image of the city as a tourist destination on air travelers does not seem to have had much influence on demand for air transport services, at least over what is referred to as domestic traffic between both airports. It should also be noted that there is no significant difference in demand distribution between the two half-years, as can be seen in Figure 9.

Table 7. Key requirements from PSO contracts tendered so far

Air route ES21	Reference standard fare	Minimum weekly frequencies	Minimum capacity available	Required flight timetables	Estimated average income	Estimated passenger demand	Estimated PLF (%)
γ	€85	5	26,000	*	€60	17,200	66.1
δ	€85	5	26,000	*	€60	18,950	72.8
ε	€85	5	26,000	*	€55	21,000	80.7

Source: Own work based on the compilation of data from tender dossiers concerning PSO transport services on air routes concerned. (*) Explicitly not required from bidding documents.

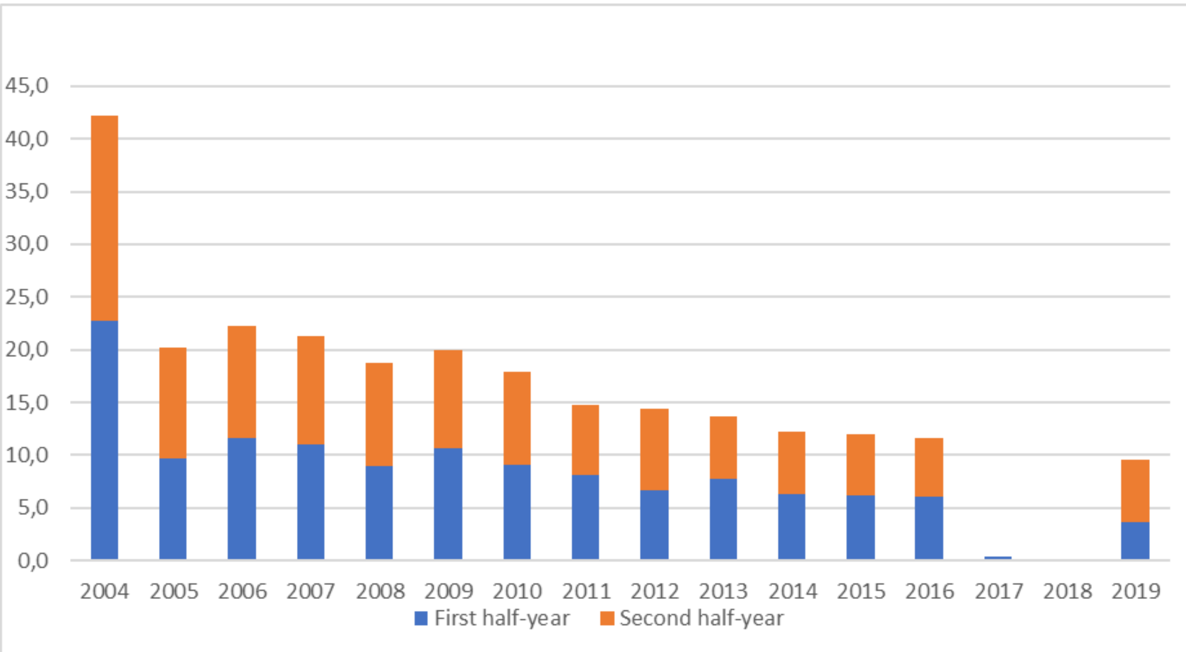

Figure 9. Thousands of passengers carried per half-year on air route ES21. Source: Own work based on data collected from the official database [20].

In order to determine which is the most representative component of the demand on this air route, traffic data have been disaggregated by operating season. It also may be wondered whether the demand trend for regular air transport services on the route considered is positive or negative. From Figure 10, it can be concluded that the possible impact of public measures on demand has varied significantly in the period between June and September (peak season), depending on whether it was due entirely to public contracts for tourism promotion services or PSO impositions. Clearly, the impact is higher during the PSO contracts period than in the other one. Similarly, Figure 11 shows the evolution of demand in low seasons throughout the period considered, where a significant difference in falling demand from passengers between both periods is now seen.

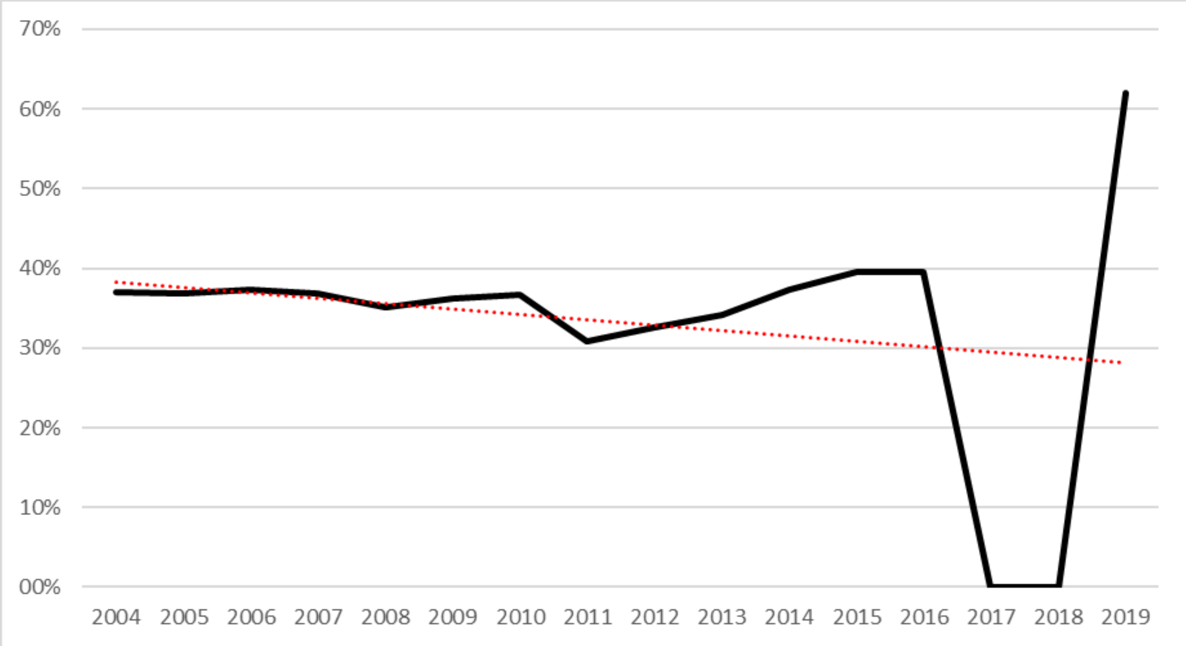

Figure 10. Traffic trend in peak season as a proportion of the annual number passengers carried on air route ES21. Source: Own work based on data collected from the official database [20].

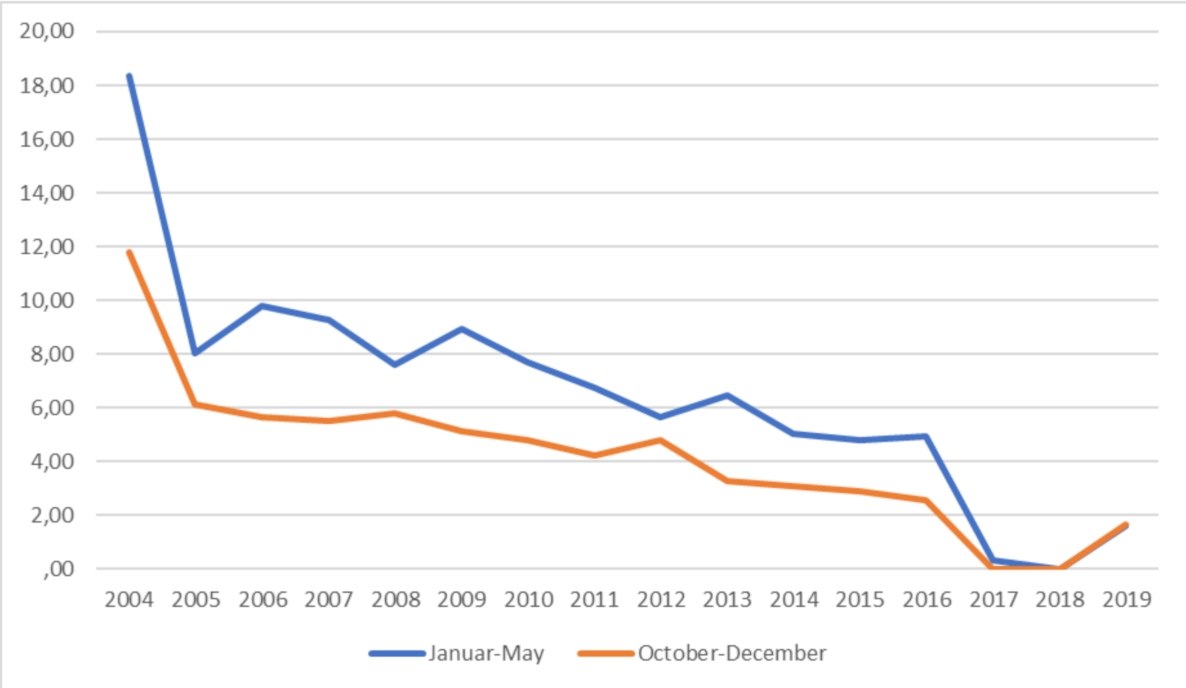

Figure 11. Performance of air route ES21 in low seasons between 2004 and 2019. Source: Own work based on data collected from the official database [20].

6.2. Considerations on Findings about Performance of PSO Imposition on Air Route ES22

Besides ensuring minimum conditions of connectivity in terms of frequencies and capacity, the imposition of a PSO on the air route linking Melilla with Granada has played a fundamental role in revitalizing scheduled transport services that had been resumed in January 2017. As with the case of the ES21, related public contracts for the ES22, once tendered, have been awarded to the same carrier that was operating regular air transport services on the route considered between September 2014 and December 2016 on its own. In fact, all public contracts awarded so far concerning scheduled flights from and to Melilla, either for tourism promotion or PSO impositions, have been awarded to the most important Spanish regional airline (YW). As can be seen in Table 8, contractual terms from tender documents concerning PSO contracts have remained almost unchanged over the years. In line with the previous case, the maximum fare (€106 as of May 2019) is more expensive than both the reference fare and the estimated average income. Interestingly, it has been noted that the expected average occupation ratio from the estimated value of PLF has been much higher than in the case of ES21. In that regard, Figure 8 points to the best performance from annual passenger traffic on air route ES22, as its annual PLF ratio has achieved the highest value among the three routes over past years. From the analysis of annual traffic data disaggregated by half-years, it has been noted that the second semester shows a better performance than the first semester for the first time in 2019, as can be seen in Figure 12. In the light of the evolution of this air route, it seems that the growth for the period between 2006 and 2008 could be indirect as a result of the existence of public contract tourism for promotion (α). In contrast, the following contract (β) does not show a significant impact on the demand on this route. Nevertheless, the most significant change is due to the first PSO contract (γ).

Table 8. Key requirements from PSO contracts tendered so far

Air route ES22	Reference standard fare	Minimum weekly frequencies	Minimum capacity available	Required flight timetables	Estimated average income	Estimated passenger demand	Estimated PLF (%)
γ	€85	5	26,000	*	60	17,100	65.7
δ	€85	5	26,000	*	60	18,850	72.5
ε	€85	5	26,000	*	60	23,000	88.4

Source: Own work based on the compilation of data from tender dossiers concerning PSO transport services on air routes concerned. (*) Explicitly not required from bidding documents.

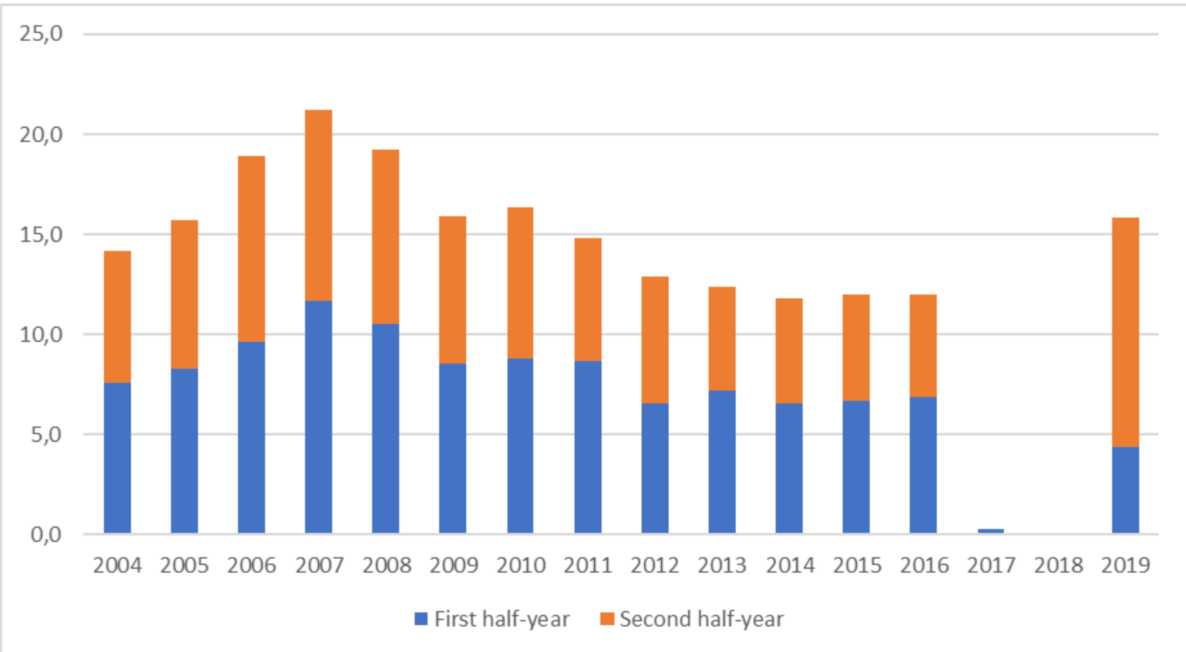

Figure 12. Thousands of passengers carried per half-year on air route ES22. Source: Own work based on data collected from the official database [20].

After having disaggregated the historical traffic data by operating season, the following other interesting findings have been achieved. From Figure 13, the impact of public measures on demand has not altered the continuing fall for each of the peak seasons, except during PSO contracts (γ), where the impact is the greatest. Also, it is observed that the demand trend in such periods is negative. As has occurred with the previous case, the passenger traffic on the ES22 does not seem to have a prominent tourist component so far. Regarding demand behavior in low seasons, Figure 14 shows a significant difference between both periods until the entry in force of the PSO imposition.

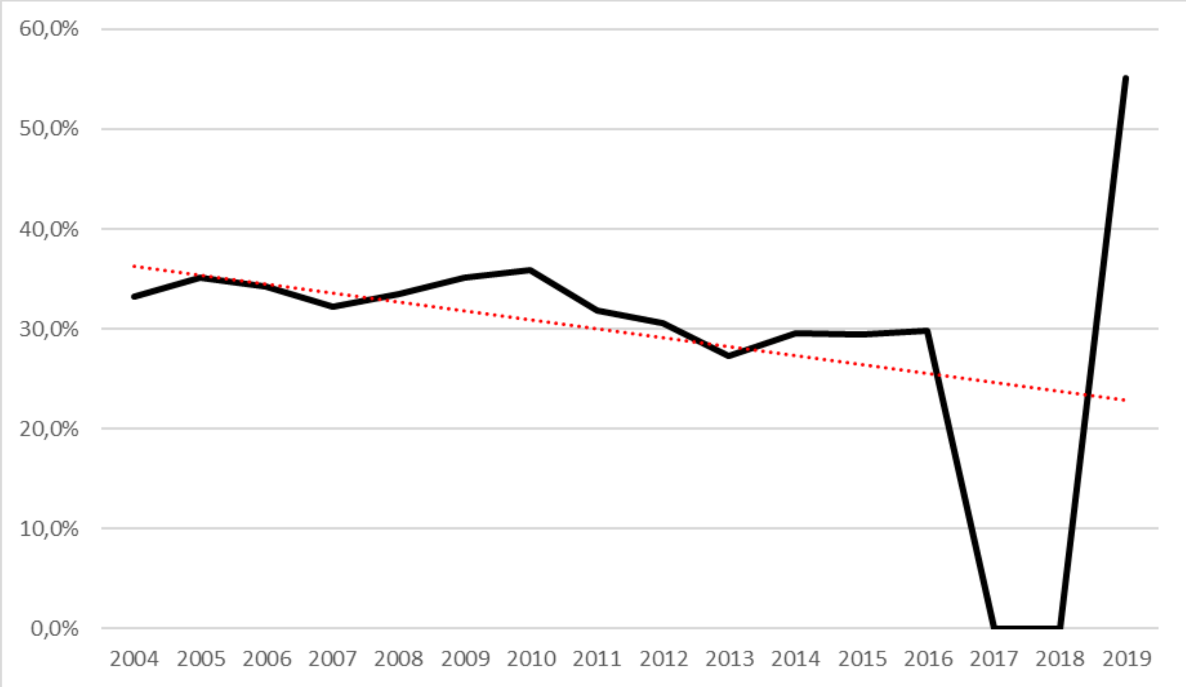

Figure 13. Traffic trend in peak season as a proportion of the annual number of passengers carried on air route ES22. Source: Own work based on data collected from the official database [20].

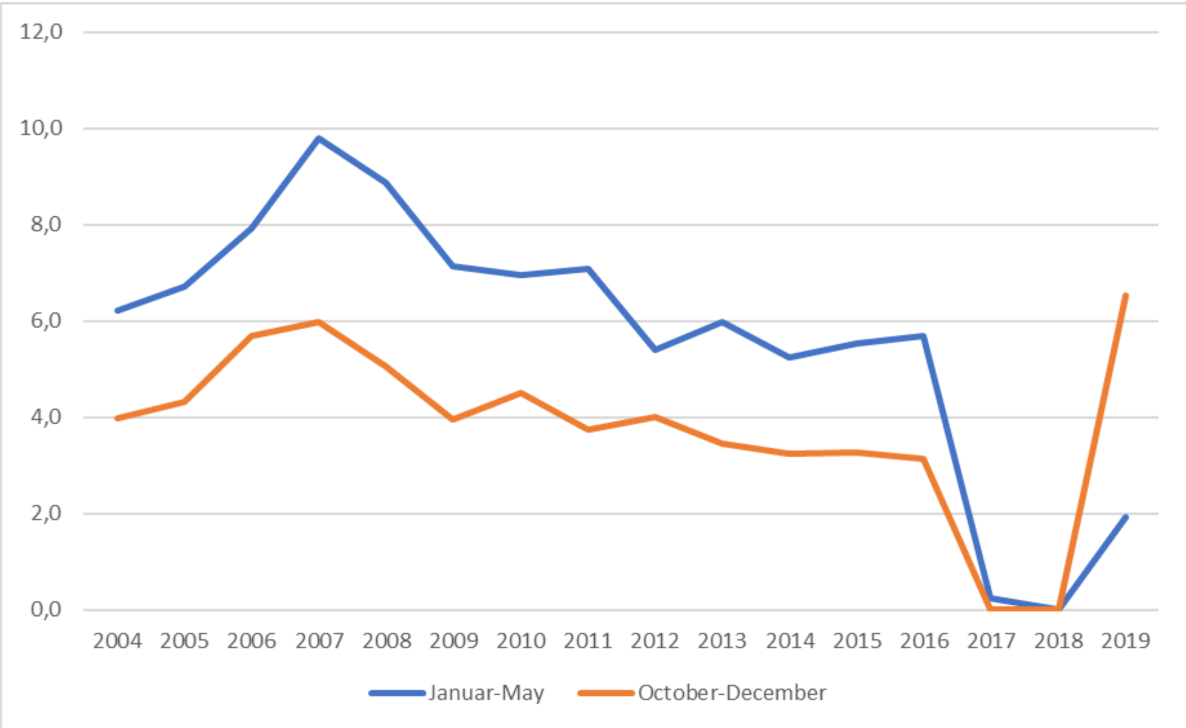

Figure 14. Performance of air route ES22 in low seasons between 2004 and 2019. Source: Own work based on data collected from the official database [20].

6.3. Considerations on Findings about Performance of PSO Imposition on Air Route ES23

Unlike the two cases considered above, the air route linking Melilla with Seville had not been operated over the last years, except for short periods at two different points of time (2008 and 2014, respectively). With this background, the calculation of the estimation of the demand has been very tentative, particularly in the first contracts. Apparently, this is the reason why the difference of estimated demand values for the first periods (γ and δ) is twice as large compared to the last one (ε), and so in the PLF ratios, as can be seen in Table 9. Since the demand on the ES23 is much weaker than on the other two air routes, scheduled air services have been designed conservatively. In that regard, as shown in Figure 8, the limited PLF ratios available have been below the estimated PLFs shown in Table 9. Once terminated the first PSO contract (γ), and already started the second one (δ), which is currently ongoing, the tender specifications for the third one (ε) have been set in calling for tenders from estimated values under the most optimistic expectations. It could help in improving public resources in terms of efficiency relating to PSO contracts, as the operating deficits can be calculated much better adapted to expectations. Moreover, the maximum fare is €131 (as of May 2019), as in the rest of the air routes considered in this study, which is less than the reference standard fare and therefore below the estimated average income. Regarding the related traffic data disaggregated by semesters in each year during the period between 20014 and 2019, results shown in Figure 15 do not provide relevant facts due to few data acquired from the previous activity performed so far. Based on the 2008 data, being the only year entirely scheduled with direct flights on the route and solely operated by the same regional airline (YW) so far, the demand has behaved identically over both half-years. Nevertheless, no definite conclusions can be made from this result.

Table 9. Key requirements from PSO contracts tendered so far

Air route ES23	Reference standard fare	Minimum weekly frequencies	Minimum capacity available	Required flight timetables	Estimated average income	Estimated passenger demand	Estimated PLF (%)
γ	€105	3	15,600	*	80	6,700	42.9
δ	€105	3	15,600	*	80	7,400	47.4
ε	€105	3	15,600	*	70	11,600	74.3

Source: Own work based on the compilation of data from tender dossiers concerning PSO transport services on air routes concerned. (*) Explicitly not required from bidding documents.

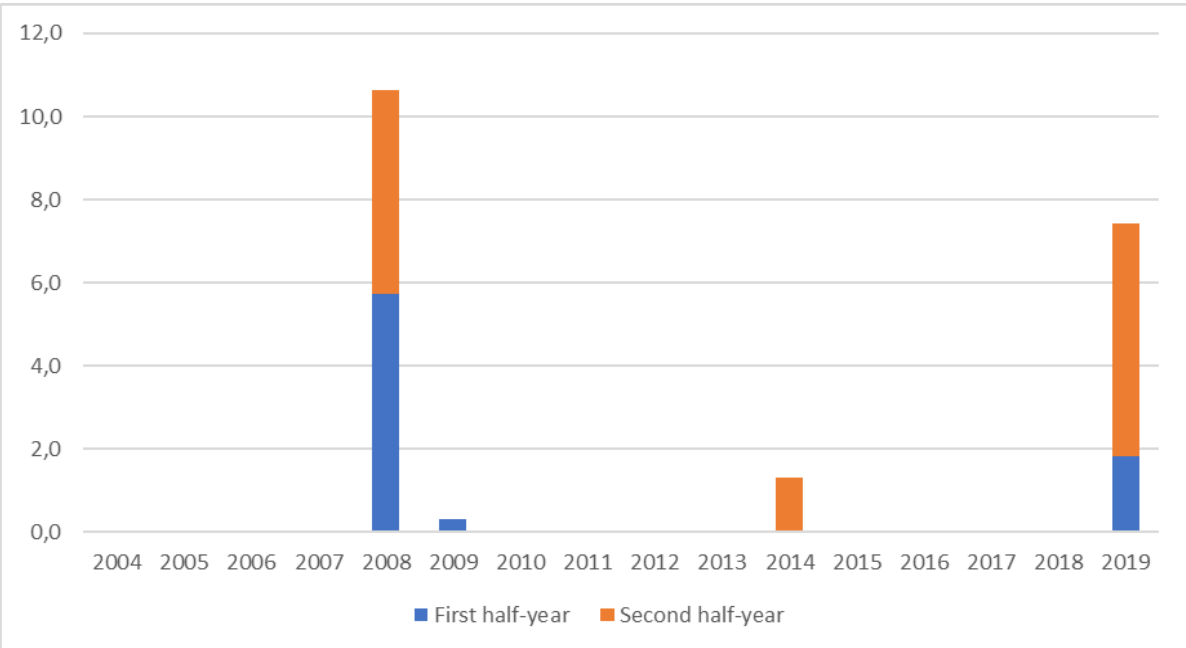

Figure 15. Thousands of passengers carried per half-year on air route ES23**.** Source: Own work based on data collected from the official database [20].

Annual traffic data disaggregated by operating seasons on air route ES23, such as the period between June and September (peak demand) and the rest of the year (low demand), provide some interesting figures, but not sufficient to gather definitive conclusions on seasonal demand trends. Since it had been operated only for short periods during 2008 and 2014, and more recently on a regular basis from the PSO imposition of type 3, as shown in Figure 16, the demand trend for regular air transport services is positive. It can also be seen that the demand appears not to have been caused by a strong tourist component. According to Figure 17, the demand is similar over both semesters.

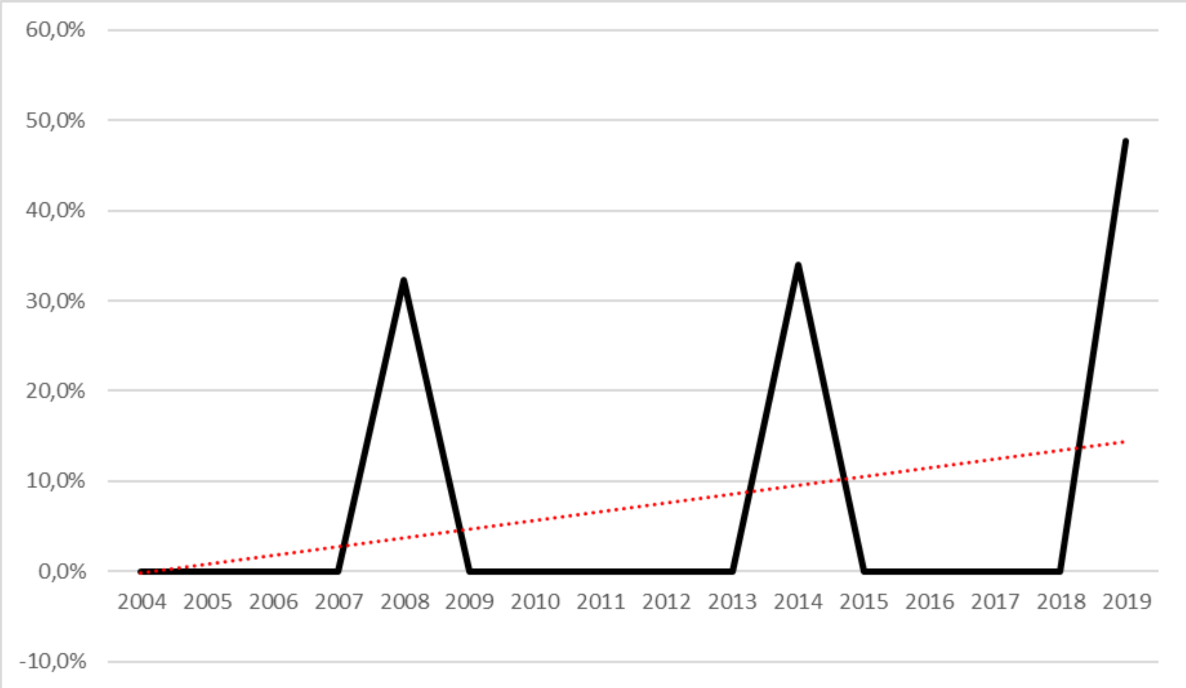

Figure 16. Traffic trend in peak season as a proportion of the annual number of passengers carried on air route ES23. Source: Own work based on data collected from the official database [20].

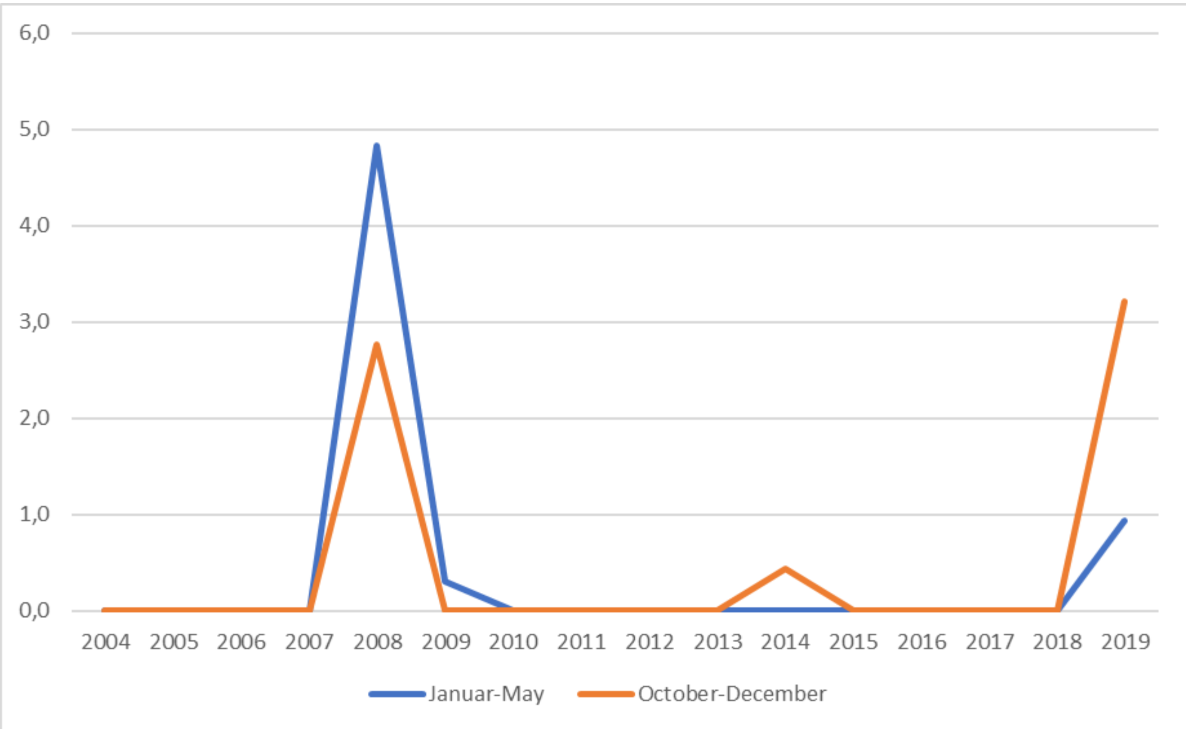

Figure 17. Performance of air route ES23 in low seasons between 2004 and 2019. Source: Own work based on data collected from the official database [20].

7. Conclusions

The present study has been aimed at assessing the efficiency and sustainability of public measures in promoting adequate transportation in peripheral regions and remote areas, such as the case of Melilla, where public transportation is essential for the sustained development of the local economy. When it is about strengthening the connectivity of people living in such an isolated city, air transport is often the only way to move rapidly freights and passengers almost everywhere. In contrast, maritime transport tickets are usually much cheaper than airfares and, where possible, can even carry persons and vehicles. By hiring of tourism promotion of the city on airplanes and other promotional actions in regular airlines, local authorities had awarded two special administrative contracts, as part of their institutional responsibilities, in order to propel this Spanish autonomous city as a tourist destination for all those who fly, either for leisure or business, on the awarded airline. Apparently, the public stimuli from awarding contracts to airlines for advertising activities does not seem to have succeeded in, among other things, increasing domestic demand on the three air routes considered in the research. Throughout this paper, instead, it has been noted that the imposition of a PSO on these air routes has led to a huge stimulation of demand for passenger air transport services. As the PSO schema results in a derogation from the general free market and price-fixing regime, competent authorities must be extremely careful in imposing a PSO on a certain air route, where there is an alternative mode of transport or even citizens being eligible for transport subsidies. Obviously, except for the case of ES21, in both ES22 and ES23, there is no other choice. As pointed out earlier, the findings show an important effect from PSO contracts on the maintenance of regular transport services, if the three routes have an operating deficit. Moreover, it seems obvious that, on the basis of the findings obtained, the increase in the supply of flights with more frequencies and available seats offered, as well as improving the resident subsidy (from 50% to 75% of discount over airfares since 16 July 2018) and scheduling the related transport services, has raised the demand for flights on these routes. Therefore, it can be concluded that the imposition of a PSO on the routes considered, in addition to resident subsidies, has revitalized the related connections since May 2019. Since regional airlines often have the most appropriate fleet to operate in domestic markets, they can be better prepared in the event of a sudden call for tenders in order to select a carrier that will be eligible for providing required air transport services. Regarding the competitiveness of regional airlines, airlines under the PSO schema usually have higher costs [31]. In designing strategies for further cost reduction, however, special attention should be paid to avoid entry barriers to competing for regional PSO contracts and can thus be targeted to bidders from other EU state members [32]. This also means a harmonized legal basis in tendering PSO contracts at the EU level in terms of transparency from tenderers for better clarity in air transport contracts in remote regions [33]. Whereas a reasonable profit for PSO contracts has been considered as 5% over total costs so far, this focuses on the way in which call for tenders can be more attractive for regional airlines, thus avoiding that PSO biddings can be declared void and thus not awarded. Indeed, all public contracts for aviation relating to the city of Melilla, either for promotional reasons or PSO purposes, have had an only one bidder interesting in operating the routes considered on an exclusive basis. In the case of PSO contracts serving Melilla, the most suitable bidder is the carrier operating ATR72-type airplane, as this is the aircraft equipment used in the calculations carried out for the optimal operations in terms of efficient and sustainable operations at this airport. Dealing with sustainability, a turboprop aircraft usually provides more efficient combustion and lower air emissions in comparison with a turbofan aircraft on the three routes considered. This is precisely the reason why the ATR72-family has been considered the optimal aircraft from related tender documents. It also has been observed that, unlike advertising contracts (α, β), each of PSO contracts (γ, δ, ε) have included a specific condition on this issue, requiring that the average age of the fleet of the company operating on the route shall be not older than 10 years. While this clause has not been a must for potential bidders, this leads one to suspect that a mandatory condition on average fleet age, and thus introducing a cause for exclusion in next procurement procedures. In this issue, there are only three commercial airlines (UX, YW, and NT) registered in Spain whose fleets currently operate ATR72 aircrafts. However, only two of them (YW and NT) have ATR72 would meet the minimum age requirement.

8. Future Directions and Research Limitations

While recognizing the complexity of the research topic relating to social needs transportation, and how this affects, among others, local economies and territorial cohesion, it might be interesting to evaluate what further public actions could be made through the strengthen of mobility. It can also be interesting to analyze the impact of the pandemic due to COVID-19 on the demand for passenger transport services, as well as addressing how transportation sector should face this challenge of moving towards new scenario under stringent sanitary conditions. Since this paper has sought to lay the groundwork for future works aiming at expanding the scope of sustainable and efficient transportation solutions, it should encourage competent researchers to focus more keenly on the socioeconomic effects of PSO schema in other regions in the EU.

Acknowledgments: The authors would like to thank all those who have contributed in providing data at the level of detail necessary to carry out this study. A special mention is attributed to the cooperation demonstrated by public bodies and related authorities at the Spanish national level, such as Aena SME S.A. and Ministry of Transport, Mobility and Urban Agenda (MITMA), and others at regional level, such as the Office of the Government Delegate for the autonomous city of Melilla, as well as the Directorate-General for Mobility and Transport (DG MOVE) of the EU Commission and Almeria Port Authority. Sincere thanks also go to the only sea carrier, BALEÀRIA EUROLÍNEAS MARÍTIMAS S.A., that agreed to collaborate with this research by providing significant information. Finally, the authors appreciate the anonymous reviewers for their thoughtful comments and constructive suggestions on an earlier version of the manuscript.

Appendix A

Airlines named in the paper: Air Europa (UX), Air Nostrum (YW), Binter (NT), Easyjet (DS, U2, EC), Ryanair (RK, FR, RR), Vueling (VY).

Airports named in the paper: Adolfo Suárez Madrid–Barajas (MAD), Almería (LEI), Badajoz (BJZ), Josep Tarradellas Barcelona-El Prat (BCN), El Hierro (VDE), Fuerteventura (FUE), Gran Canaria (LPA), F.G.L. Granada-Jaén (GRX), Ibiza (IBZ), La Gomera (GMZ), La Palma (SPC), Lanzarote (ACE), Málaga-Costa del Sol (AGP), Melilla (MLN), Menorca (MAH), Palma de Mallorca (PMI), Sevilla (SVQ), Tenerife Norte (TFN), Tenerife Sur (TFS).

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CHAPTER 4: KEY CONCLUSIONS

Doctoral thesis

KEY CONCLUSIONS

The European Single Air Transport Market: An Empirical Approach on the Efficiency and Sustainability of Public Service Obligations in the Spanish Domestic Routes.

Air transport, which needs a liberalization process that incurs worldwide globalization, has been playing a key role in the consolidation of the single European market. Thus, facilitating two of the four freedoms of the same (free movement of people and goods). This has led to a remarkable expansion of the aviation sector, which is but a result of the passage of an airport services market subject to the rigidity of planned economies, and strongly regulated by the EU-Nation States, to another that is based on market economy, and ultimately overseen by supranational entities. As earlier pointed out, air transport services, besides maritime transportation, are operated by carriers providing services of general economic interest, and therefore subject to Article 106(2) of the Treaty on the Functioning of the European Union (TFEU) regarding rules governing competition. The imposition of a PSO on air routes is a form of public intervention in the EU single aviation market based on Air Regulation 1008/2008. Market deregulation in the aviation sector was carried out by the Commission through an orderly legislative process with three liberalization packages successively implemented in December 1987, June 1990, and July 1992. Although the air transport market enjoys a high level of competition from free regime rules across the EU territory in its internal market, market opening by itself appears to have not been sufficient to the promotion of competition in certain domestic routes over past years, especially in those whose probability is low (i.e. thin routes), thus causing possible net deficits for operating them. In the case of island territories, moreover, the need for regular transport services with other surrounding communities is often essential in connecting scattered populations living amongst them, as mobility plays a vital role in territorial cohesion.

Since the study focuses on the efficiency and sustainability of regional aviation regarding public obligations for the provision of scheduled transport services in Spain, it has been identified a total of twenty-three air routes imposed with a PSO so far. Of these, eleven routes were tendered for regular transport services, mostly serving airports situated in both island territories and ultraperipheral regions, such as the Balearic and the Canary Islands, respectively. Specifically, it has been analyzed as the PSO schema can contribute to greater mobility in less-favored regions not only in economic terms but weakly connected with main transport hubs. In that regard, the subject of public service obligations in the case of air links involving islands is indeed little treated in the literature and thus leading the thesis to a potential basis for future analysis and methodological formalization of a topic that is an interesting approach towards sustainable transportation.

Nowadays, the differences between full-service airlines and budget airlines are increasingly minor in many cases, even almost imperceptible from the view of the customer, since the price-formation is very dynamic on the basis of high elasticity of demand in air transport services. Given that fact, airlines are extremely concerned with the scarce profit margin in short-haul flights. Regional airlines, usually focused on specific geographic areas, depending on their core businesses, can often face much better the challenge of operating thin routes, even non-profitable routes with an economic compensation because of operating deficits. This can lead to a lack of adequate and affordable transport services to meet mobility needs in a sustainable manner in the regions concerned. Throughout this work, it has been noted how the socioeconomic objectives of public transportation in terms of efficiency and sustainability can be addressed from an overall perspective over the past years in the European single aviation market. Because of the interwoven nature of its supply and the cross-cutting nature of its activities, the transportation sector is subject to various externalities that go beyond the national sphere. Supranational challenges often condition the transport industry and thus hindering the mobility of people and goods. One example is the current coronavirus pandemic since it has created a deep economic crisis that is engulfing the vast majority of countries worldwide. As a result, mobility restrictions and border closures have been set by several countries across the world. Although this research had been carried out to assess the effect of the PSO schema on air transport services operating in Spain between 2004 and 2019, the outbreak of the COVID-19 early in 2020 has significantly altered the aviation sector across the EU territory. To this end, in some previous subsections, such as those relating to the case studies of the PSO routes serving the Canary Islands and the Balearic Islands (3.2.b. and 3.2.d, respectively), a brief analysis has been carried out. Based on the results of this work, the PSO schema appears to the only viable option to ensure essential air transportation in certain less-developed regions, particularly those situated in ultraperipheral territories or remote areas. Indeed, the resident subsidy system is not sufficient by itself on this issue, but it is necessary for accomplishing equal access to public transport across the EU territory, irrespective of the place of residence. Furthermore, the air transport sector has traditionally suffered from structural weaknesses due to some disruptive events of a global nature, such as a pandemic, terrorist acts, and climate adversity. Air carriers are also subject to possible strong variations in fuel pricing, thus leading to adverse economic effects. Regulatory changes, systemic factors, and wrong calculated risks can even cause the market exit, and sometimes permanent cessation of the operations. But the fact remains that, despite the significant loss of layers in the European skies over the past years, low barriers to market entry have allowed to creation of a significant number of small airlines thanks to free-market rules of the EU single market (see Chapter 2). A much more structured market situation, with a scenario with players focused on value and not so much on the massive recruitment of customers based on making the market more competitive, would allow airlines to stabilize their revenues. In recent years, several network airlines have joined strategic partnerships with each other from one of the three existing global alliances in the worldwide air transport market (see appendix 5.1). This is of special relevance in the context of PSO schema, as some tender procedures for the provision of related transport services have significatively valued the fact of offering indirect routes with connecting flights. The existence of these alliances could help to achieve the objective of awarding PSO contracts to airlines with good air transport network connectivity.

With regard to the governance of the PSO system, the conditions for imposing PSOs are always assessed on a route-by-route basis to check if there is a real transport need that is not satisfied by the market, and this is a task for each member state in the first place. However, this is neither administrated nor funded at the EU level, but by individual states. A model of multilevel governance for the PSO schema, similar to that existing in certain domestic public transportation systems, should also be useful to coordinate the EU transport policies on this matter. Theoretically, a centralized system for administration and funding at the EU level could result in a more efficient and equitable distribution of such public subsidies from PSO impositions, thus achieving common social and regional development goals.

Concerning alternative transport modes to the air transport in PSO routes imposed in Spain so far, only those operating in mainland Spain enjoy an alternative means of public transport, either train or bus. However, both transport means cannot reasonably be regarded as an alternative in terms of travel time for those individuals wanting to travel directly between cities concerned (ES01, ES19, and ES20). The results obtained from the study, in the case of routes serving the Spanish region of Extremadura (see 3.2.e and 3.2.f, as well as appendix 5.3), suggest that the resilience of the air transport on ES19 and ES20 is very significant, as air travelers have not significantly moved into alternative means, either bus or train. Similar findings have been stated in the case of ES01 (see subsection 3.2.a and appendix 5.4) since the use of air transport is the most preferred for individuals traveling between both cities. It points to a slight increase in the use of private vehicles, very likely through car-sharing solutions. Excepting the case of occasional travels, this may be challenging for the environment since the use of private cars is less sustainable in terms of emission per passenger carried in comparison with public transportation, for instance, frequent trips concerning ES01 and ES19. Spain has placed an important emphasis on promotion towards heavy investment in implementing high-speed railway infrastructures as a way to promote a very fast form of transport.

The particular conclusions of some cases considered, however, have highlighted that this fact is part of current negative externalities since there is not enough capillarity of the transport network to cover a very large of populated areas. Interestingly, as discussed in Subsection 3.2.c, the analysis of the route ES03 shows that the suitability of awarding public contracts to maintain regular transport services solely in low seasons, as the route concerned has habitually enjoyed a high level of concurrence. This is, actually, the only PSO imposition in Spain whose contract had been awarded to a joint venture association with two airlines, one is a regional company the other a legacy (YW and IB, respectively).

The most recent challenge faced by the air transport industry, COVID-19 and Brexit, have forced airlines to address a low-demand scenario due to the mobility restrictions among countries. Nevertheless, domestic travels may be essential for maintaining the activity of the sector. Thus, the PSO system can open new windows of opportunity for airlines, mostly regional carriers, in achieving immediate business goals of the airlines, in particular preserving treasury companies. However, it is very difficult and especially very expensive for companies to have planes abroad to set a regular domestic line in another member state, as aircrafts concerned should be based at other airports. Further, it is also very likely that some legacy airlines do not have any proper regional airliner for regional airports under operating requirements. For instance, the case of Melilla (ES21, ES22, ES23), as explained in Subsection 3.2.g.

Regarding the effects of Brexit in the European aviation market, despite the existing withdrawal agreement implemented on 1 January 2021, it still has to be clarified how technical regulation will be entirely substituted by competent authorities of the United Kingdom of Great Britain and Northern Ireland (UK) in its skies, as the country has been forced to withdraw the European Union Aviation Safety Agency (EASA) as a voting member at the same time. As pointed out in Appendix 5.5, some airlines may find it difficult to demonstrate the nationality of their shareholders according to Article 4.f of Air Regulation 1008/2008, since up to 49% of the undertaking and effectively control of any airline operating the domestic route in the EU single market is only allowed.

Finally, it has been highlighted in previous chapters that the use of aircraft can vary on demand for air transport services, particularly in those routes with high seasonality in the summertime. Then this occurs, according to data analyzed in this study, air carriers have had two choices, on one hand, matching demand and supply by increasing the number of weekly flights during peak seasons; on the other hand, moving some aircraft with more seating capacity. In the majority of the cases considered, carriers have cut frequencies down instead of reducing the number of available seats per flight in order to adapt to the fall in demand during low seasons. Furthermore, rather turbojets, turboprops have been widely operated in most PSO routes considered in the study. Besides reduced utilization operating costs, the use of turboprops has produced fewer emissions than heavier airplanes in terms of Maximum Take-Off Weight (MTOW) usually powered by a turbofan engine. This has precisely been noted on the routes ES01 and ES02, ES04, and ES05, as earlier discussed in Subsections 3.2.a and 3.2.b, respectively.

CHAPTER 5: APPENDICES

Appendix 5.1

AN OVERALL OUTLOOK OF THE AIRLINE INDUSTRY WORLWIDE

A comprehensive approach about the impact of strategic partnerships on the worldwide air transport market: A brief overview of global airline alliances

A comprehensive approach about the impact of strategic partnerships on the worldwide air transport market: A brief overview of global airline alliances

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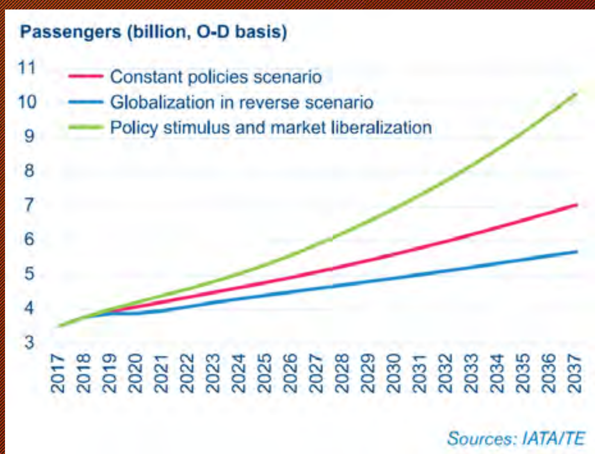
I. BACKGROUND (1 of 6)

IATA Forecast Predicts 8.2 billion Air Travelers in 2037

Passenger demand is seeing robust growth again in 2018, as the demand for air passenger services remained solid, with industry-wide RPKs increasing by 7.4% over the year as a whole.
Source: IATA (2019)



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II. BACKGROUND (2 of 6)

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20-Year Forecast Highlights - 2018

Source: IATA (2018)

III. BACKGROUND (3 of 6)

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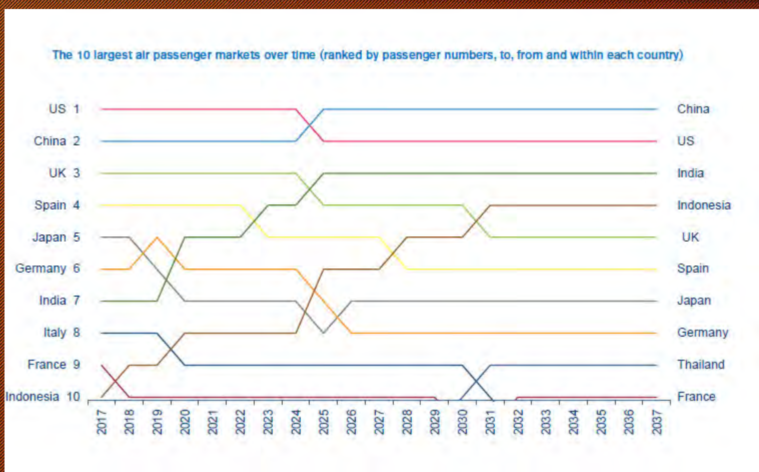
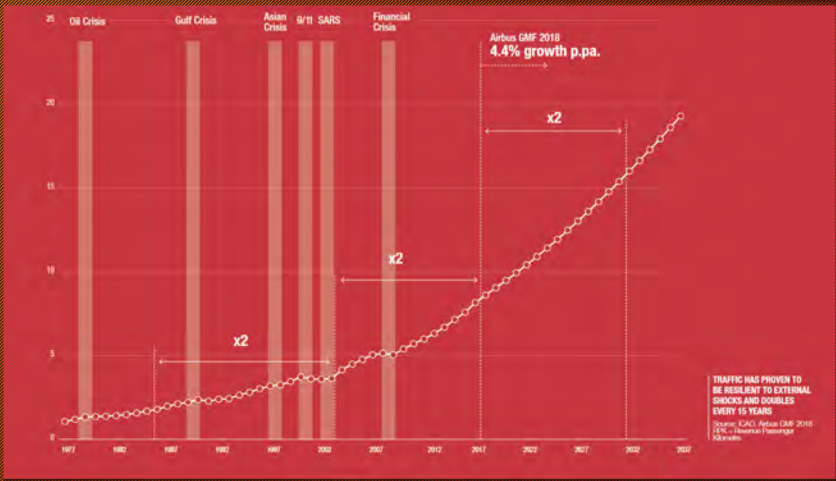


Source: IATA (2018)

IV. BACKGROUND(4 of 6)

World annual traffic (tr RPKs)



Source: Airbus (2018)

5

V. BACKGROUND (5 of 6)

Freedoms of Air → Treaty on Open Skies

Bilateral Agreements   Multilateral Agreements

6

VI. HSR FACING CHALLENGES IN AVIATION

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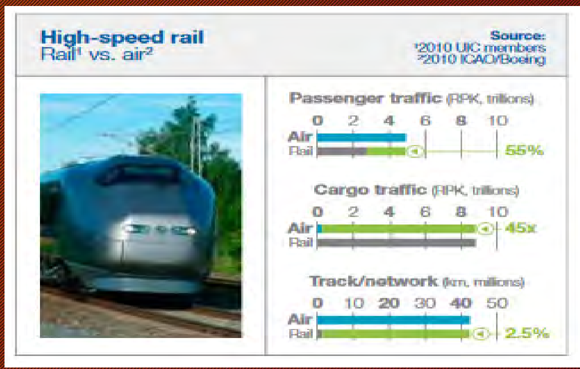

Source: "Current Market Outlook 2012-2031", Boeing (2012)

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VII. CONCEPTUAL FRAMEWORK (1 of 2)

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- Airline alliances (AA) usually include not only world's top aviation companies but also smaller regional airlines.
- Memberships within the same AA may have different frequent-flyer programs.
- Airline Alliances are global partnership agreements, and therefore it should not be confused with other purposes strictly limited to codeshare agreements.

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VIII. CONCEPTUAL FRAMEWORK (2 of 2)

- Beyond the extended route maps and service, airline alliances also benefit passengers with their loyalty programs, award mile earnings, and lounge offerings for qualified frequent flyers.
- When moreover, delays or cancelations happen, member airlines often offer to re-ticket you on partner airlines to ensure passengers reach their intended destination.

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IX. KEY QUESTIONS

Why several main airlines have been involved in AA?

They are seeking to overcame restrictive barriers to entry in international markets

What is the main purpose thereof?

These alliances attempt to introduce service in those regions or countries where there have been legal or market restrictions for non-local airlines.

When was the first AA?

In 1986, one of the first international airline alliance was signed between former Air Florida and British Island Airways (BIA). Hence, a passenger feed was paid by Air Florida for BIA´s scheduled air services on the LGW-AMS route.

How these coalitions provide their benefits for passengers?

They aim at simplifying the procedures for accessing to more destinations, streamlined connections, and competitive pricing due to smaller operational costs.

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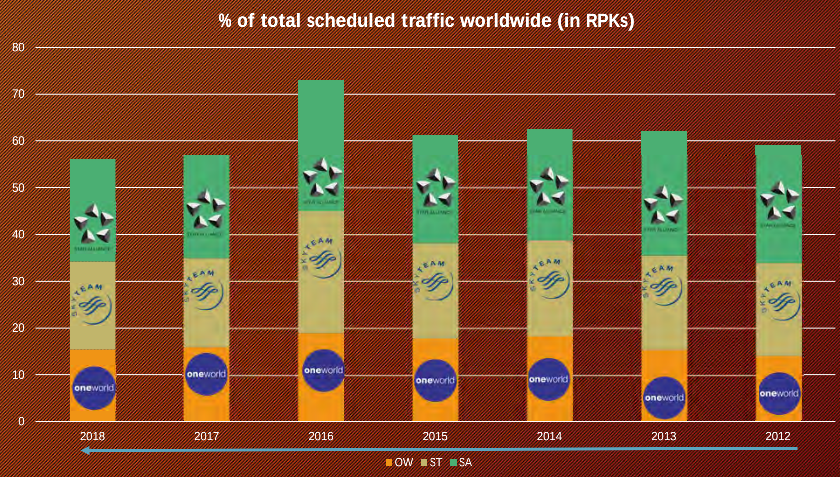
X. KEY FACTS (1 of 2)

Alliance alliances (as of October 2019)	oneworld	SkyTeam	Star Alliance
Trade name	oneworld Management Company, Inc. ("oneworld")	SkyTeam Airline Alliance Management Coöperatie U.A. ("SkyTeam")	Star Alliance Services GmbH ("Star Alliance")
Headquarter	2 Park Avenue, Suite 1100, New York, NY 10016, USA	Schiphol Boulevard 367, 1118 BJ Schiphol, The Netherlands	Frankfurt Airport Centre, Main Lobby, 60546 Frankfurt/Main, Germany
Number of member airlines	13	19	26
Destinations / Countries	1,000 / 180	1,150 / 175	1,294 / 190
Total fleet size	3,500	3,265	4,056

XI. KEY FACTS (2 of 2)

Alliance alliances (as of October 2019)	oneworld	SkyTeam	Star Alliance
Total Annual Passengers (2018) Source: AA, 31.03.2019	550m	630m	762m
% of total scheduled traffic worldwide (in RPKs) (2018) Source: IATA, 31.07.2019	15.4	18.8	21.9
Strengths	strong presence in the American continent	only alliance with a cargo element	consistency of rules and perks (free luggage, lounge access, etc); strong African network.
Weaknesses	almost null presence in the African market	scarce presence in the African market	difficult to manage all members: imbalanced internal competition
Current alliance slogan	*Travel Bright*	*Caring more about you*	*The Way the Earth Connects*

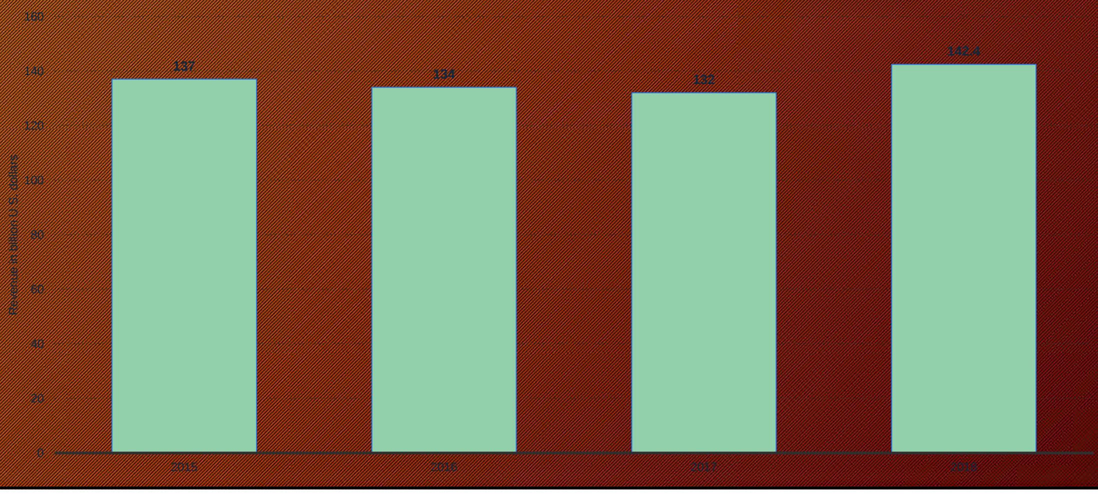
XII. MARKET SHARING QUOTA



Source: Own preparation based on data from IATA

13

XIII. Revenue of oneworld from 2015 to 2018 (in billion USD)



Note: Retrieved from Statista. Worldwide; 2015 to 2018
Source(s): Flight Airline Business; Cirium

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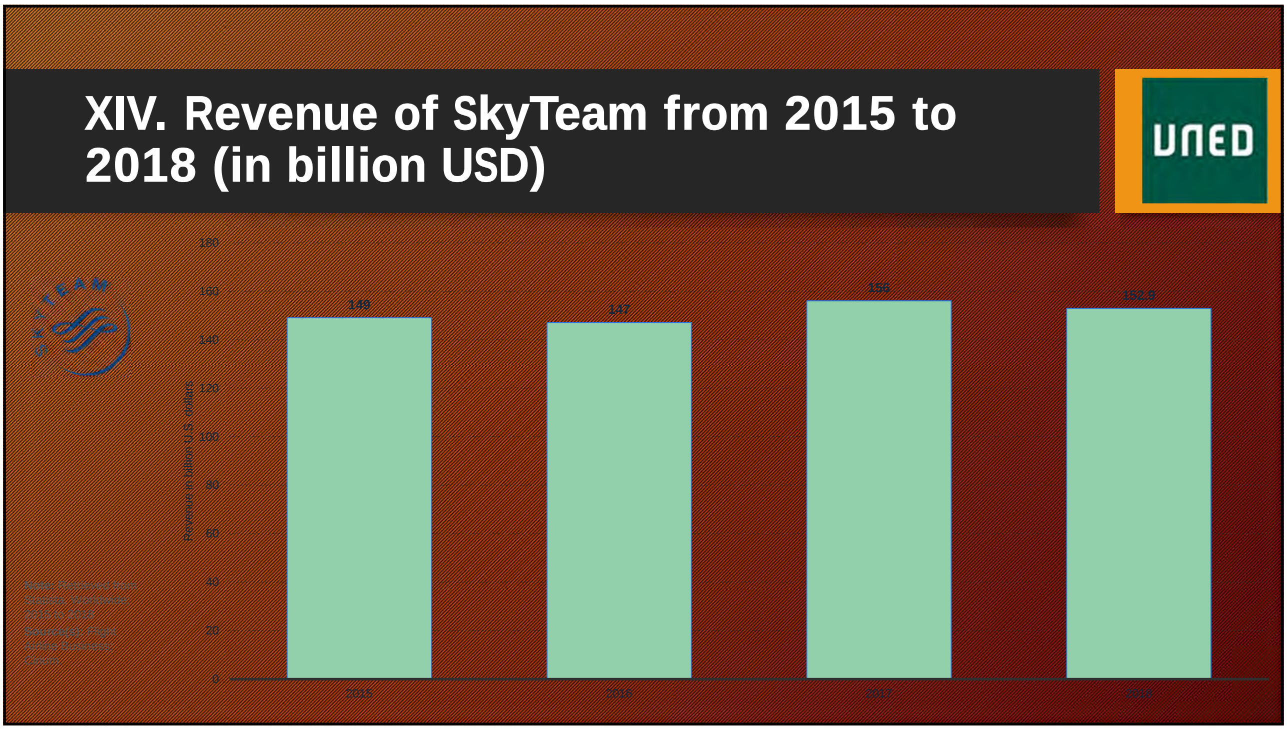
XIV. Revenue of SkyTeam from 2015 to 2018 (in billion USD)
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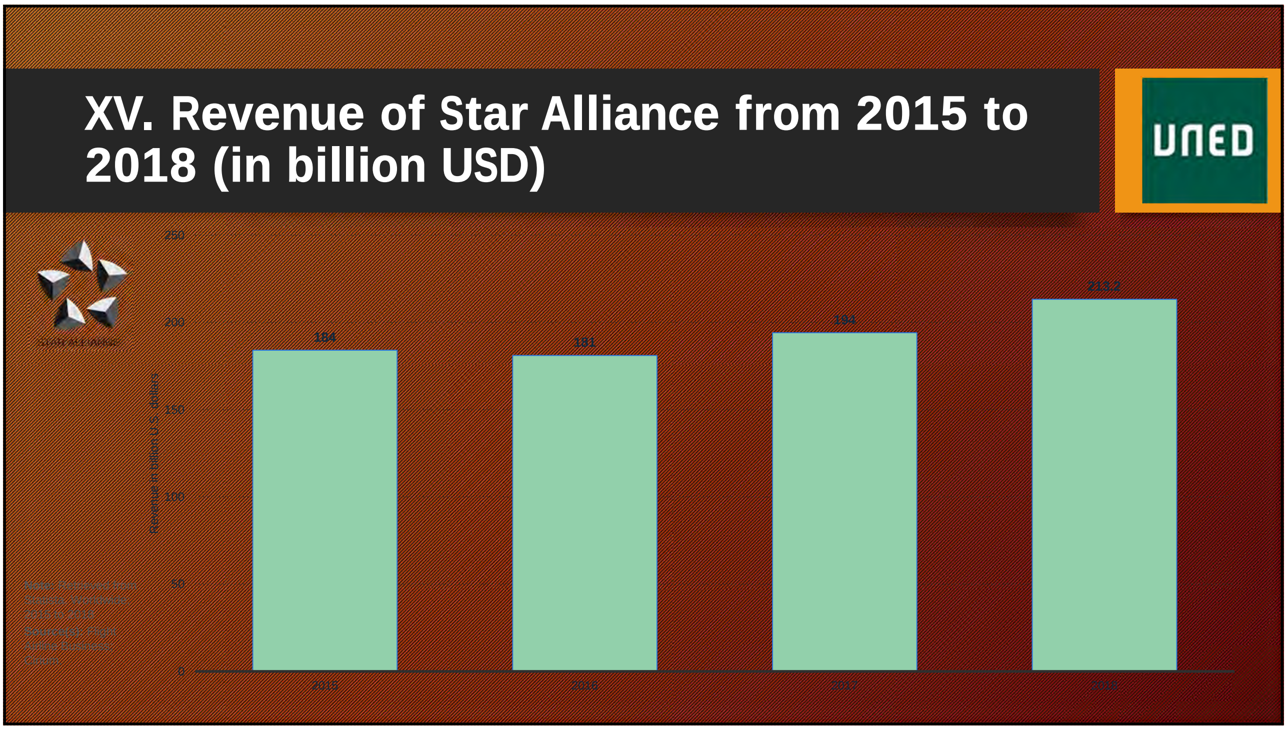
149
147
156
152.8

15


XV. Revenue of Star Alliance from 2015 to 2018 (in billion USD)
UNED
184
181
194
213.2

16

XVI. Full members list of oneworld (as of IATA SS2019)

UNED

oneworld	Country	Fleet size (as of 2019)	Founded	Destinations/ Countries [2018]	Joined oneworld	Average Fleet Age (as of 2019)	Operating Revenue [FY2018]	Annual Passengers [FY2018]
American Airlines		941	1930	350 / 50	1999	11	USD44.5bn	203.7m
BRITISH AIRWAYS		277	1924	250 / 90	1999	13.8	GPB13bn	126.2m
CATHAY PACIFIC		154	1946	90 / 35	1999	8.5	TWD2.3bn	35.4m
IBERIA IBERIA EXPRESS IBERIA REGIONAL AIRNOSTRUM		89 23 50	1927 2011 1994	130 / 47	1999	9.8 15.8 8.2	EUR4.6bn (as of 2016)	26.2m
LATAM		328	2012 (1929 as LAN, and 1975 as TAM)	143 / 26	1999	9.1	USD9.89bn	68.8m
FINNAIR		71	1923	150 / 45	1999	10.3	EUR2.8bn	13.2m
JAPAN AIRLINES		171	1951	80 / 20	2007	10.6	JPY1,488bn	4.6m

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XVII. Full members list of oneworld (as of IATA SS2019)

UNED

oneworld	Country	Fleet size (as of 2019)	Founded	Destinations/ Countries [2018]	Joined oneworld	Average Fleet Age (as of 2019)	Operating Revenue [FY2018]	Annual Passengers [FY2018]
malaysia airlines		84	1947	55 / 17	2013	7.2	MYR8.7bn (as of 2017)	77.4m
QANTAS QANTASLINK		136 84	1920 2001	80 / 20	1999	12.1 16.9	USD17,060m	55.2m
QATAR AIRWAYS القطرية		231	1993	200 / 100	2013	6.1	QAR42bn	29.1m
الملكية الأردنية ROYAL JORDANIAN		25	1963	45 / 30	2007	9.6	JOD653m	3.26m
S7 Airlines		102	1992	196 / 33	2010	10.1	RUB117.7bn	15.96m
SriLankan Airlines		27	1979	111 / 48	2014	9	USD100.1m	15.28m

Source: Author, based on data collected from airlines

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XVIII. Full members list of SkyTeam (as of IATA SS2019)

UNED

SkyTeam	Country	Fleet size (as of 2019)	Founded	Destinations/ Countries [2018]	Joined SkyTeam	Average Fleet Age (as of 2019)	Operating Revenue [FY2018]	Annual Passengers [FY2018]
AEROFLOT Russian Airlines		250	1932	146 / 52	April 2006	4.9	RUB446.6m	32.8m
Aerolíneas Argentinas		56	1949	58 / 13	August 2012	9	USD2.04bn	13.1m
AEROMEXICO		70	1934	92 / 24	June 2000	7.8	MXN61.5bn	20.7m
AirEuropa		64	1986	53 / 23	September 2007	9	EUR1.9bn	10.6m
AIRFRANCE		223	1933	195 / 93	June 2000	13.8	EUR25.8bn	97.8m
Alitalia		117	1946	95 / 44	July 2010	12.7	EUR3.0bn	21.8m
中華航空 CHINA AIRLINES		89	1959	156 / 29	September 2011	9.6	TWD139.8bn	15.1m

XIX. Full members list of SkyTeam (as of IATA SS2019)

UNED

SkyTeam	Country	Fleet size (as of 2019)	Founded	Destinations/ Countries [2018]	Joined SkyTeam	Average Fleet Age (as of 2019)	Operating Revenue [FY2018]	Annual Passengers [FY2018]
中國東方航空 CHINA EASTERN		552	1988	257 / 35	June 2011	6.5	RMB93.6bn	103.1m
CSA CZECH AIRLINES		13	1923	49 / 26	October 2000	13.2	CZK9.1bn	2.9m
DELTA		916	1924	324 / 57	June 2000	15.1	USD41.3bn	180m+
Garuda Indonesia		142	1949	90 / 14	March 2014	7.8	USD4.2bn	24m
Kenya Airways The Pride of Africa		41	1977	52 / 40	June 2010	7.8	KES106.3m	3.7m
KLM		120	1919	164 / 73	September 2000	11.8	EUR10.3bn	32.7m
KOREAN AIR		164	1962	123 / 43	June 2000	9.7	KRW11.8tn	26.7m

XX. Full members list of SkyTeam (as of IATA SS2019)

SKYTEAM	Country	Fleet size (as of 2019)	Founded	Destinations/ Countries [2018]	Joined SkyTeam	Average Fleet Age (as of 2019)	Operating Revenue [FY2018]	Annual Passengers [FY2018]
MEA		18	1945	32 / 23	June 2012	8.3	LBP1.0bn	3m
السعودية SAUDIA		149	1946	90 / 37	May 2012	6.8	SAR20.5bn	31.2m
TAROM		25	1954	40 / 23	June 2013	16.3	USD252.4m	2.4m
Vietnam Airlines		89	1956	49 / 17	June 2010	5.9	VND88.4bn	26.5m
厦门航空 XIAMENAIR		167	1984	94 / 16	November 2012	6	RMB23bn	27.2m

Source: Author, based on data collected from airlines

XXI. Full members list of Star Alliance (as of IATA SS2019)

STAR ALLIANCE	Country	Fleet size (as of 2019)	Founded	Destinations/ Countries [2018]	Joined Star Alliance	Average Fleet Age (as of 2019)	Operating Revenue [FY2018]	Annual Passengers [FY2018]
AEGEAN		49	1999	134 / 44	June 2010	11	EUR98.6m	14m
AIR CANADA		182	1937	199 / 63	May 1997	13.2	CAD4,246m	50.9m
AIR CHINA 中国国际航空公司		422	1988	189 / 42	December 2007	7.3	RMB136,774m	611m
एअर इंडिया AIR INDIA		127	1932	123 / 31	July 2014	7.7	INR239bn	21m
AIR NEW ZEALAND		64	1939	31 / 19	May 1999	7	USD323m	8.5m
ANA		238	1952	98 / 23	October 1999	8.6	YEN1.97tr	44.15m
ASIANA AIRLINES		86	1988	90 / 27	March 2003	11.5	KRW6252bn	18.4m [2016]

XXII. Full members list of Star Alliance (as of IATA SS2019)

UNED

STAR ALLIANCE	Country	Fleet size (as of 2019)	Founded	Destinations/ Countries [2018]	Joined Star Alliance	Average Fleet Age (as of 2019)	Operating Revenue [FY2018]	Annual Passengers [FY2018]
Austrian		82	1957	130 / 58	March 2000	15.4	EUR2.2bn	13.9m
Avianca		107	1919	102 / 27	June 2012	6.8	USD1.9bn	30.5m
brussels airlines		54	2006	118 / 49	December 2009	15.2	USD1.557bn	10.03m
CopaAirlines		95	1944	81 / 33	June 2012	8.5	USD2,68bn	16.2m
CROATIA AIRLINES		13	1989	39 / 24	December 2004	14.6	HRK1.7bn	2.17m
EGYPTAIR		67	1932	72 / 47	July 2008	8.6	EGP35,778m	8.46m
Ethiopian		118	1945	126 / 75	December 2011	6.4	USD3.7bn	10.6m

XXIII. Full members list of Star Alliance (as of IATA SS2019)

UNED

STAR ALLIANCE	Country	Fleet size (as of 2019)	Founded	Destinations/ Countries [2018]	Joined Star Alliance	Average Fleet Age (as of 2019)	Operating Revenue [FY2018]	Annual Passengers [FY2018]
EVA AIR		83	1989	58 / 18	June 2013	5.2	USD4.1bn	13.13m
POLISH AIRLINES LOT		76	1929	90 / 50	October 2003	8.7	USD1.51bn	8.8m
Lufthansa		300	1926	214 / 75	May 1997	11.9	EUR15.9bn	142.3m
SAS		158	1946	126 / 30	May 1997	10.2	SEK44,7m	28.7m
深圳航空 Shenzhen Airlines		184	1992	84 / 10	November 2012	7.1	CNY31,119m	110m
SINGAPORE AIRLINES		137	1947	63 / 32	April 2000	6.8	USD16,323m	20.7m
SOUTH AFRICAN AIRWAYS		47	1934	32 / 22	April 2006	12	ZAR30,7bn [2017]	9.7m [2017]

XXIV. Full members list of Star Alliance (as of IATA SS2019)

STAR ALLIANCE	Country	Fleet size (as of 2019)	Founded	Destinations/ Countries [2018]	Joined Star Alliance	Average Fleet Age (as of 2019)	Operating Revenue [FY2018]	Annual Passengers [FY2018]
SWISS		89	2002	100 / 44	April 2006	9.9	CHF5.3bn	17.9m
TAP AIR PORTUGAL		106	1945	99 / 36	March 2005	10.6	EUR3.251bn	15.8m
THAI		82	1960	76 / 31	May 1997	10.2	THB199,500m	76.1m
TURKISH AIRLINES		301	1933	311 / 124	April 2008	7	TRY62.85bn	75.2m
UNITED		789	1926	353 / 58	May 1997	15.6	USD41.3bn	158m

Source: Author, based on data collected from airlines

XXV. ESTABLISHMENT

Relevant Agencies	Membership	Mandate
ICAO · OACI · ИКАО	last State members (2019): non-member:	The International Civil Aviation Organization (ICAO) is an UN specialized agency to manage the administration and governance of the Convention on International Civil Aviation (Chicago, 1944), which is also the basis of Public International Air Law.
EASA European Aviation Safety Agency		This is an agency of the EU that, among other tasks, ensures the highest common level of both safety and environmental protection for EU citizens, and whose technical regulation becomes compulsory for all EU member States.
EUROCONTROL		The European Organization for the Safety of Air Navigation (EUROCONTROL) is an intergovernmental organization that is committed to manage a legislative framework for European aviation through the Single European Sky (SES), which has been launched by the European Commission in order to meet future capacity and safety needs in its Air Traffic Management (ATM).

XXVI. IMPORTANT CLARIFICATION (1 of 2)

UNED

Entity	IATA	
Official Name	International Air Transport Association	International Civil Aviation Organization
Headquarter	800 Place Victoria, Montreal	999 Robert-Bourassa blvd, Montreal
Founded	La Habana, 19 April 1945	Chicago, 4 April 1947
Form of establishment	International trade association	UN specialized agency
Full members	290 airlines of 120 countries (82% of the world's air traffic)	193 countries (as of 13/4/2019)

XXVII. IMPORTANT CLARIFICATION (2 of 2)

UNED

Cluster	IAG INTERNATIONAL AIRLINES GROUP	SAS
Registered Office		
Headquarter		
Brands	IBERIA, BRITISH AIRWAYS, vueling, Aer Lingus, LEVEL	SAS
Form of cluster	multinational airline holding company	consortium pool


XXVIII. PAST NEWS
UNED
Aer Lingus
December 1999
May 2007
oneworld
"Aer Lingus Could Rejoin OneWorld"
Willie Walsh, February 1, 2019

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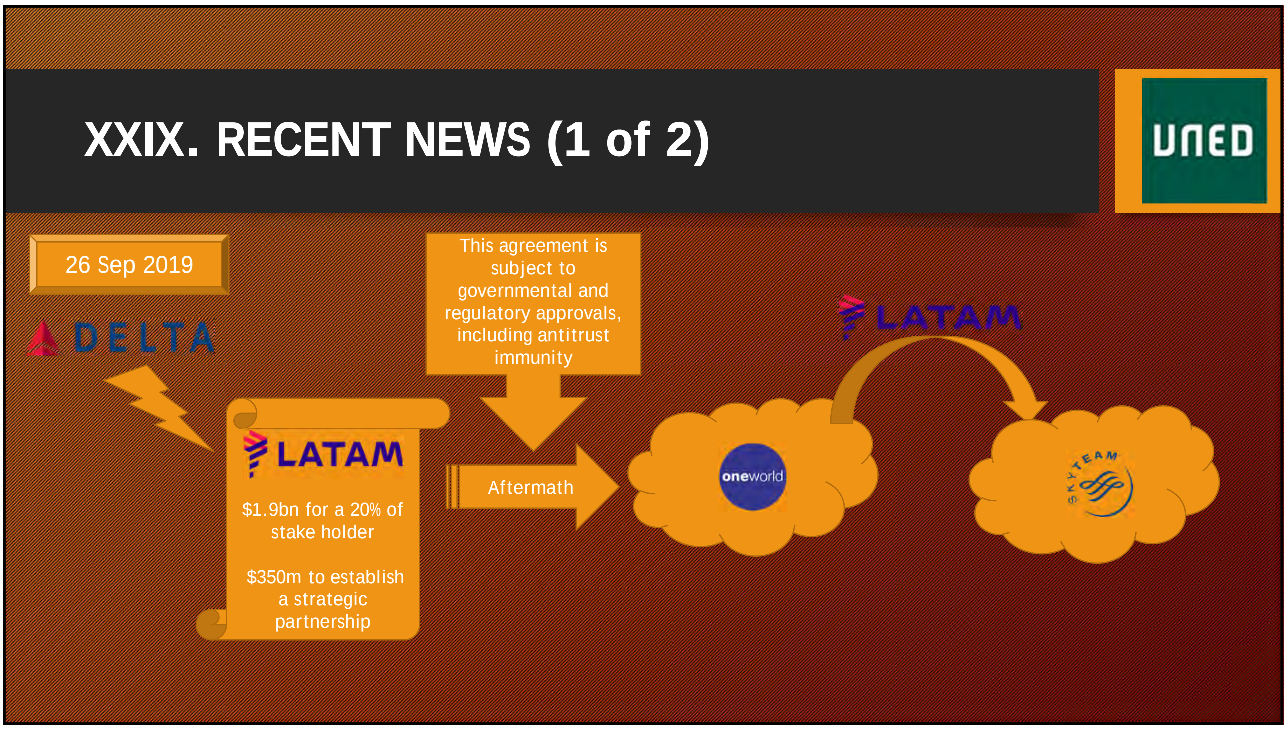
XXIX. RECENT NEWS (1 of 2)
UNED
26 Sep 2019
DELTA
This agreement is subject to governmental and regulatory approvals, including antitrust immunity
LATAM
LATAM
$1.9bn for a 20% of stake holder
$350m to establish a strategic partnership
Aftermath
oneworld
SKYTEAM

XXX. RECENT NEWS (2 of 2)

UNED

Dec 2018

中國東方航空
CHINA EASTERN

SKYTEAM

中国南方航空
CHINA SOUTHERN

June 2011

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XXXI. RECENT CODE-SHARING AGREEMENT

UNED

15.10.2019

vueling

Joint Application of Vueling Airlines S.A. and American Airlines, Inc. for a Blanket Statement of Authorization and Amended Exemption

American Airlines

oneworld

Explanatory note: A blanket statement of authorization under 14 C.F.R. Part 212 to the extent necessary to permit Vueling to display the AA* designator code on flights operated by Vueling in connection with scheduled foreign air transportation of persons, property, and mail: (i) between points in the European Union (“EU”) and points in the United States; (ii) between points in the EU; (iii) between points in the EU and points in the European Common Aviation Area (“ECAA”); and (iv) beyond the EU and ECAA to any point or points. 2) An amendment to American’s third-country codesharing exemption under 49 U.S.C. § 40109, which the Department of Transportation granted to American in Docket DOT-OST-2009-0337, to the extent necessary, to add Vueling to the list of foreign air carriers with which American has codeshare authorizations and to permit American to display the AA* designator code on flights operated by Vueling.

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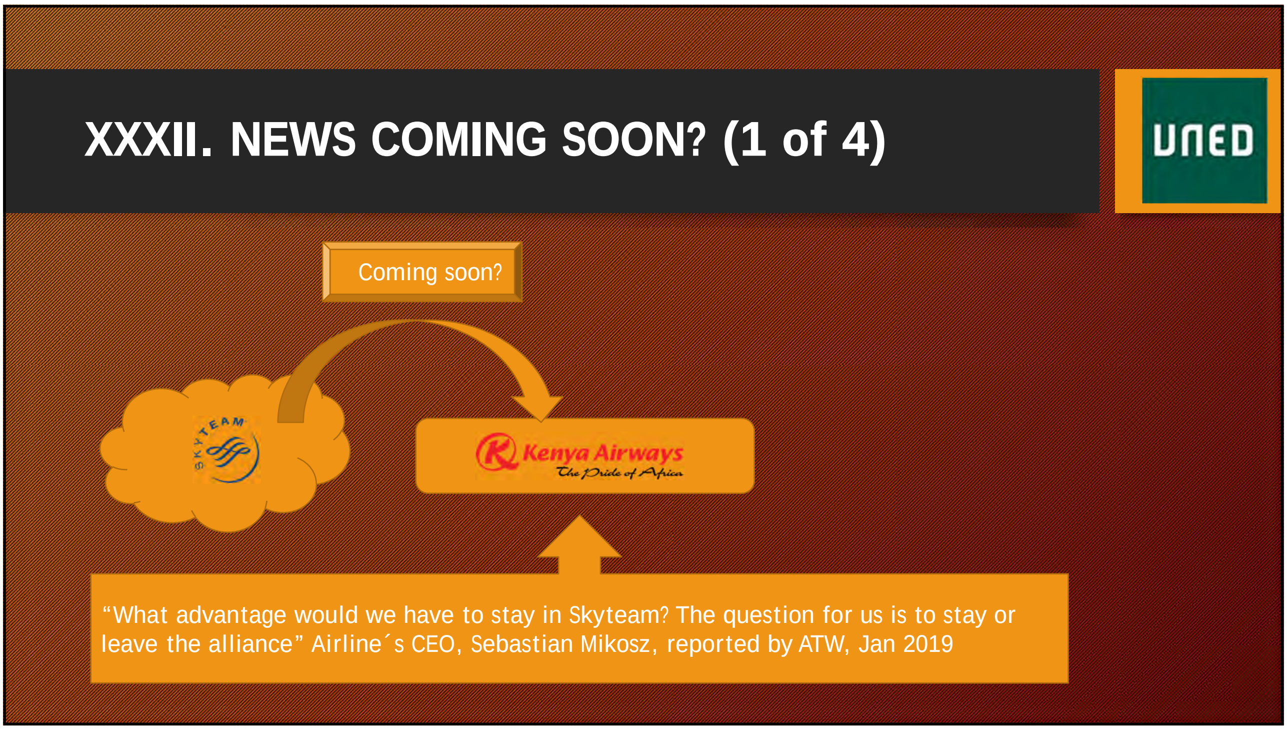
XXXII. NEWS COMING SOON? (1 of 4)
UNED
Coming soon?
SKYTEAM
Kenya Airways
The Pride of Africa
“What advantage would we have to stay in Skyteam? The question for us is to stay or leave the alliance” Airline´s CEO, Sebastian Mikosz, reported by ATW, Jan 2019

33


XXXIII. NEWS COMING SOON? (1 of 4)
UNED
Coming soon?
„We in the matter of a month or two will give you the news if we are going to stay or we are going to withdraw. And I think it is the latter that will happen” ITB Berlin, Press conference, March 2019
oneworld
QATAR
AIRWAYS القطرية
“Qatar Airways will pull out of the Oneworld alliance if certain partner airlines continue with unfounded accusations and blocking tactics, warns group chief executive Akbar Al Baker”, FlightGlobal, October 2018

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XXXIV. EXAMPLE OF ONE-WAY TRIP

UNED

Types of air traffic / Airports	HEL	MAD	SCL	ASU	Airline alliances
Gateway to gateway		from	to		oneworld, SkyTeam, Star Alliance
Gateway to beyond a gateway		from	via	to	oneworld
Behind a gateway to a gateway	from	via	to		oneworld, SkyTeam
Behind a gateway to beyond a gateway	from	via		to	oneworld

XXXV. BONUS TRACK: PROJECT SUNRISE

UNED

Test of the longest non-stop commercial passenger flight completed	QANTAS oneworld
Great circle distance **Route**	16,013km / 8,646nm JFK-SYD
Flight time	19:15h
Aircraft **Registration**	B787-9 VH-ZNI
Passenger capacity (nominal) [during this test flight only 50 passengers and crew on board]	Business: 42 Premium Economy: 28 Economy: 166 <u>Total Passengers</u>: 236

XXXVI. BONUS TRACK: PROJECT SUNRISE

UNED

Image credit: Courtesy of QANTAS

XXXVII. BONUS TRACK:

UNED

1st Longest non-stop commercial passenger flight on scheduled air route	SINGAPORE AIRLINES STAR ALLIANCE
Great circle distance **Route**	15,345km / 8,285nm EWR-SIN
Total duration	19:5h
Aircraft **Registration**	A350-900ULR 9V-SGA
Passenger capacity	Business: 67 Premium Economy: 94 Total Passengers: 161

XXXVIII. BONUS TRACK:

UNED

2nd Longest non-stop commercial passenger flight on scheduled air route	CATHAY PACIFIC oneworld	
Great circle distance **Route**	13,121km / 7,085nm IAD-HKG	
Total duration	15:50h	
Aircraft **Registration**	A350-1041 B-LXL	
Passenger capacity	Business: 46 (flat bed) Premium Economy: 32 Economy: 256 Total Passengers: 334	

XXXIX. QUESTIONS & FINAL

UNED

"Probable impossibilities are to be preferred to improbable possibilities", Aristotle (384 BC - 362 BC).

Thanks for you attention!

Appendix 5.2

AN OVERALL OUTLOOK OF PSO SCHEMA ACROSS THE EU TERRITORY

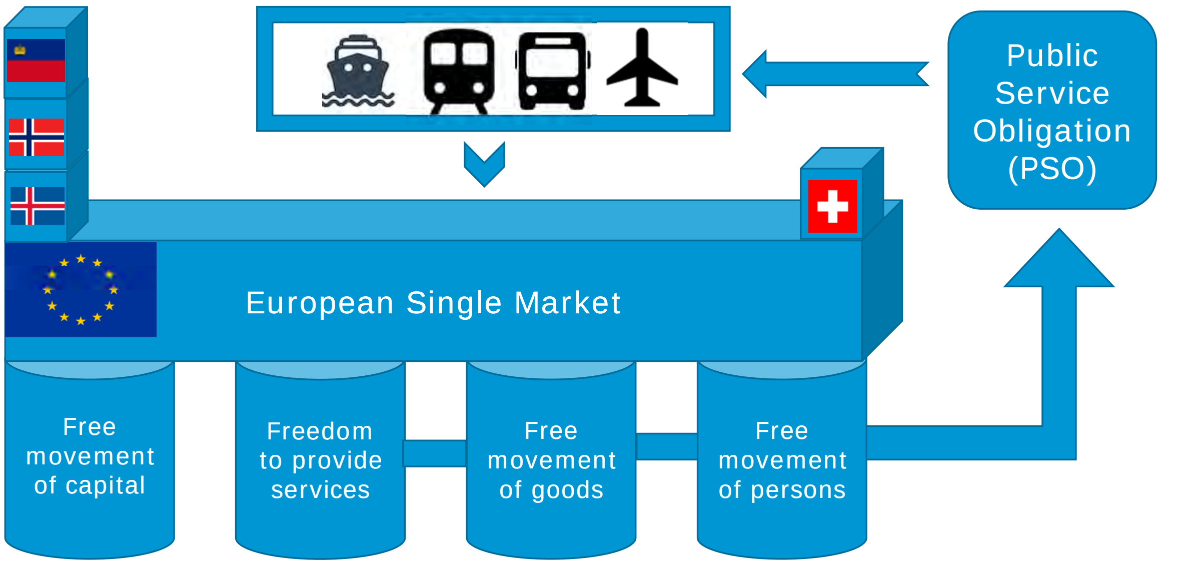
Some considerations about efficiency and sustainability of the public service obligations in the air transport system within the EU Single Market

Some considerations about efficiency and sustainability of the public service obligations in the air transport system within the EU Single Market

Antonio Martínez Raya,
M.A., M.Sc., Ph.D. candidate

Rev. 1.7

Introduction: The four cornerstones of the European Single Market



Introduction: Why does PSO system exist?

MARKET FAILURE

The lack of adequate means of transport, particularly in island, peripheral and remote territories, may have a stifling effect on freedom of movement of both persons and goods

ADMINISTRATIVE INTERVENTION

This form of public intervention on the transportation market is used to correct this market failure. However, the imposition of a PSO in the aviation sector represents a limitation on the freedom to provide services.

Background: Historical background

- Deregulation process since 1983; air transport liberalization came into effect on 1st January 1993 through the “third package”, and with it the PSO schema.
- Market-entry barriers and protectionist policies removed.
- Harmonize regulations & legal certainty through common rules achieved.

- Airline Deregulation Act since 1978.
- Addition of Section 419 to the Federal Aviation Act by implementing EAS program through community eligibility.
- Airlines are total free to determine which markets to serve domestically and what fares to charge for air services.

- Certain subsidization schemes since 1953.
- RASS since 1983, whose funding is provided through the Regional Aviation Access Program (RAAP) for communities living in remote/isolated territories.
- Besides, RAAP supports investments to improve air infrastructures in certain specific cases.

Background: Similar schemes in other areas

Subsidy schemes of regular air transport	Public Service Obligations (PSO)	Essential Air Service (EAS)	Remote Air Services Subsidy (RASS)
Scope of application			
Additional scope		n/a	n/a
Air routes served	176 in 14 EU Member States as of Sept. 18, 2019	111 communities in 35 States and 63 communities in Alaska as of Sept. 1, 2018	372 communities in 10 regions as of Sept. 17, 2017
Eligible air services	Peripheral or development region, or even thin route	Peripheral region and small communities	Communities in remote and isolated areas
Main purpose	Transportation of passengers through the imposition of PSO on scheduled air services	Transportation of passengers on EAS communities	Transportation of passengers and delivery of essential supplies on RASS communities
Funding	244 in millions of EUR as of Sept. 27, 2018	288 in millions of USD as of Sept. 1, 2018	18 in millions of AUD as of Sept. 17, 2017
Contract duration	Up to 4 years, without any extensions	Up to 2 or 4 years	2 years with possible extension to 2 years
Administrative body	European Commission, EU Member States	US Department of Transport	AU Department of Infrastructure, Transport, Cities and Regional Development

Source: Own elaboration based on data collected from EU DG Move (2019), US DoT (2019) and AU DoITCaRD (2019), respectively.

Background: PSO schema (I)

Free market regime (type 0)	Open PSO with certain limitations (type 1)	Closed PSO without any compensation (type 2)	Closed PSO with compensation (type 3)
• Freedom to operate flights on regular routes within internal market on basis of slot coordination (EU AOC carrier only)	• No barrier to entry on the routes concerned • Maximum fares • Minimum No. of frequencies, and of annual seats required	• Exclusivity to a single operator • No subsidy • Maximum fares • Minimum No. of frequencies, and annual seats required	• Exclusivity to a single operator • Subsidy to compensate the operating costs • Maximum fares (typically) • Minimum No. of frequencies, and annual seats required

In all cases, such imposition and design of the PSO has to meet the criteria set out in Art. 16-18 of the Regulation (EC) N° 1008/2008

Background: PSO schema (II)

Advantages

- PSOs enhance transportation in the absence of adequate means of transport, even when these routes are not commercially viable.
- The imposition of PSO is a growing instrument in which there is a room for medium-sized air carriers, even for entrepreneurial companies.
- PSO schema may stimulate demand for domestic routes, but also considered vital for the economic development in peripheral or isolated areas.

Disadvantages

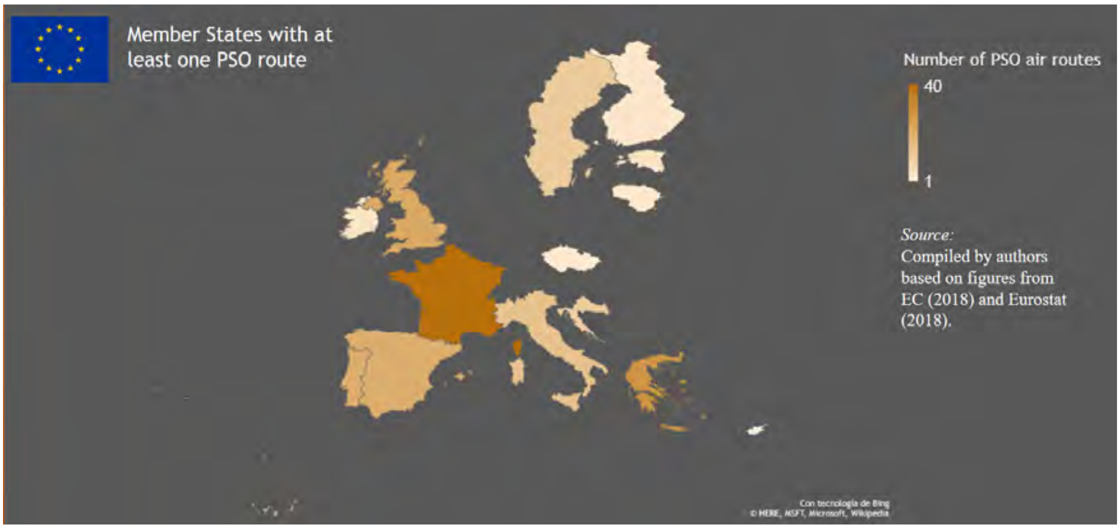
- PSO policies may ultimately be ineffective in controlling air fares.
- Neither low cost carriers nor charter air carriers have traditionally been interested in taking part in PSO bidding procedures.
- Low number of air carriers in submitting bids for PSO call-for-tenders.
- Apparently, the uncoordinated application of this instrument led to imbalances in the level and provision of air services in small and remote areas.

PSO system: Current situation (as of 18/9/2019)

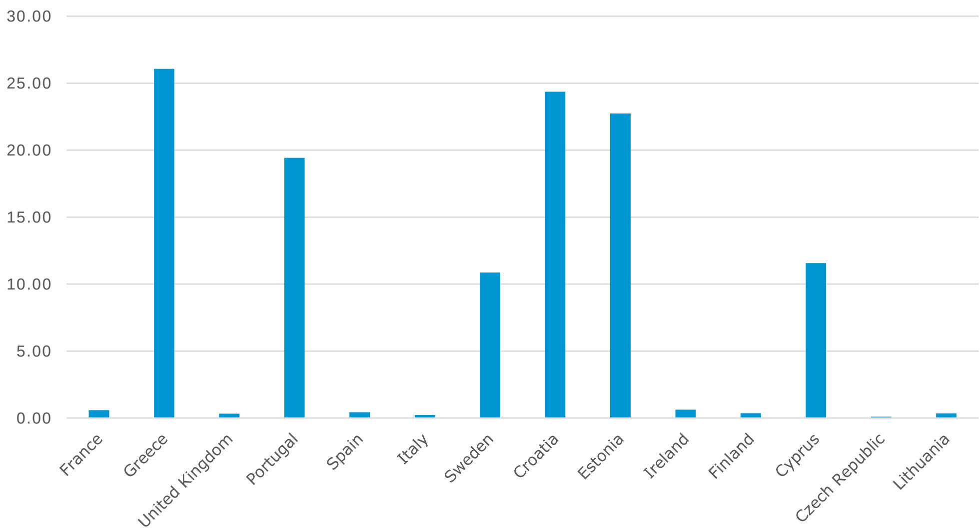
176 PSOs	open PSO with certain limitations (type 1)	closed PSO without any compensation (type 2)	closed PSO with compensation (type 3)
France (37)	9	0	28
Greece (28)	11	3	14
United Kingdom (22)	0	0	22
Portugal (20)	4	0	16
Spain (23)	14	0	9
Italy (11)	0	2	9
Sweden (11)	0	0	11
Croatia (10)	0	0	10
Estonia (3)	0	0	3
Ireland (3)	0	0	3
Finland (3)	0	0	3
Cyprus (1)	1	0	0
Czech Republic (3)	3	0	0
Lithuania (1)	0	0	1

Source: Own elaboration based on data provided from DG MOVE (2018)

PSO system: Overview (as of 27/09/2018)

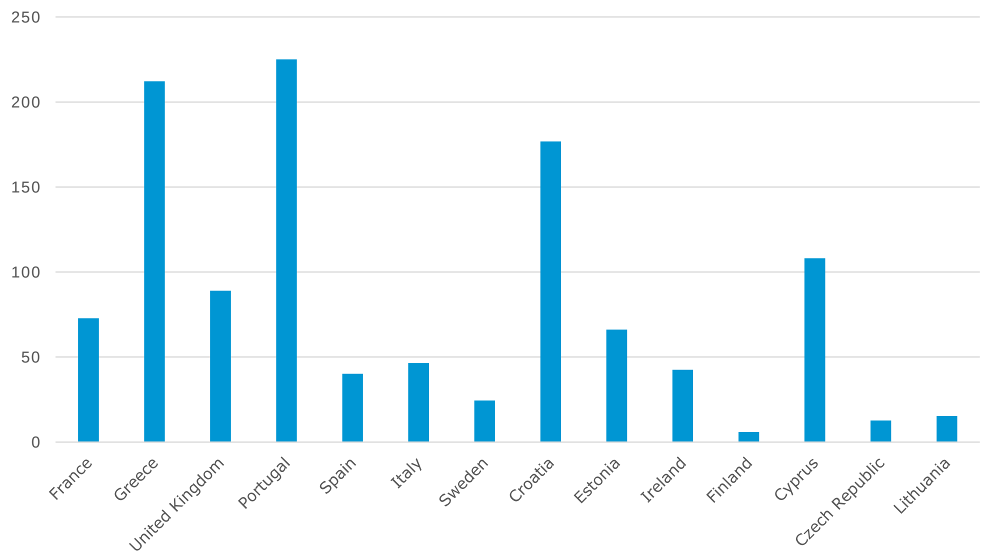


PSO system: Number of PSO air routes per million inhabitants (as of 27/09/2018)



Source: Own elaboration based on data provided from DG MOVE (2018) and Eurostat (2018)

PSO system: Number of PSO air routes per total area [Mm2] (as of 27/09/2018)



Source: Own elaboration based on data provided from DG MOVE (2018) and Eurostat (2018)

PSO system: Funding for the EU schema (as of 27.09.2018)

Country	PSO impositions	Unsuccessful tender (U) / Not operated (N) / Cancelled (C)	PSO routes as restricted to one carrier (type 2 & 3)	Total amount (€) of annual compensation
France	40	5 (N)	25	94,094,094.32
Greece	28	none	17	8,419,886.75
United Kingdom	22	none	22	14,476,746.30
Portugal	20	none	16	29,756,961.20
Spain	20	none	9	3,950,956.50
Italy	14	3 (U)	14	52,082,826.55
Sweden	11	none	11	13,674,266.00
Croatia	10	none	10	12,589,832.08
Ireland	3	none	3	8,028,034.00
Estonia	3	none	3	2,601,766.00
Finland	2	none	2	3,223,268.67
Cyprus	1	none	n/a	n/a
Czech Republic	1	1 (C)	1	1,486,480.00
Lithuania	1	none	n/a	n/a
TOTAL EU	176	9	132	244,385,118.37

Source: Authors, based on information from DG MOVE (2018)

PSOs imposed by each EU Member State

	ICAO Airport (First leg	ICAO Airport (Second leg)	Status	PSO type	PSO compensation in 2018 (€/PAX)	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
HR-01	LDDU	LDZA	Contract until 28/03/2020	3	12.59	CROATIA AIRLINES	P, D
HR-02	LDSP	LDZA	Contract until 28/03/2020	3	22.36	CROATIA AIRLINES	D
HR-03	LDZA LDZD	LDZD LDPL	Contract until 28/03/2020	3	177.55	CROATIA AIRLINES	D, T
HR-04	LDZA	LDSB	Contract until 28/03/2020	3	74.88	CROATIA AIRLINES	P, D, T
HR-05	LDOS	LDDU	Contract until 28/03/2020	3	53.11	CROATIA AIRLINES	D, T
HR-06	LDOS	LDSP	Contract until 28/03/2020	3	47.30	CROATIA AIRLINES	D, T
HR-07	LDOS	LDZA	Contract until 28/03/2020	3	599.17	TRADEAIR	D, T

PSOs imposed by each EU Member State

	Airport	Airport	Status	PSO type	PSO compensation in 2018 (€/PAX)	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
HR-08	LDOS LDPL	LDPL LDSP	Contract until 28/03/2020	3	120.32	TRADEAIR	D, T
HR-09	LDOS	LDRI	Contract until 28/03/2020	3	234.88	TRADEAIR	D, T
HR-10	LDRI LDSP	LDSP LDDU	Contract until 28/03/2020	3	204.72	TRADEAIR	D, T

Source: Own preparation based on data from DG MOVE, as well as corresponding national CAA and public bodies.

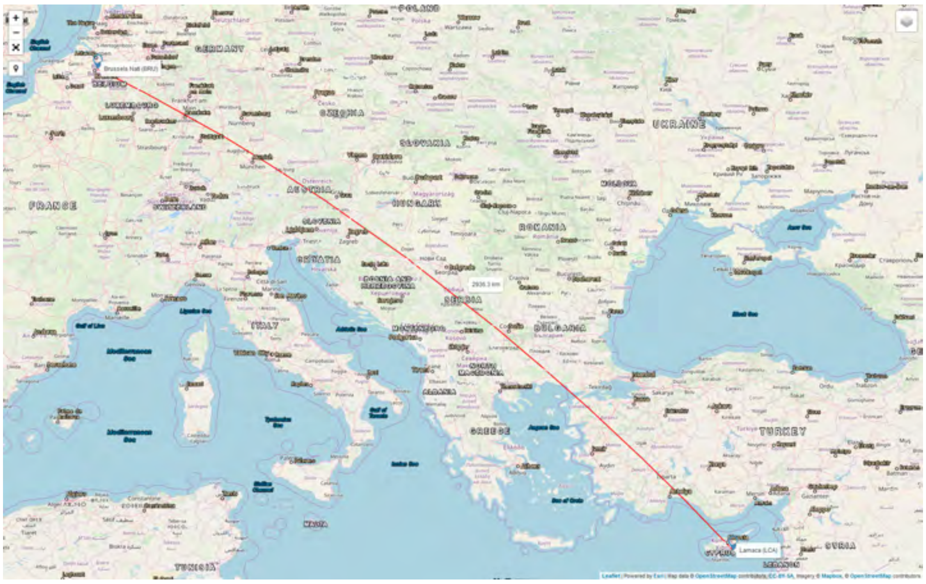
PSOs imposed by each EU Member State

PSOs imposed by each EU Member State

	Airport	Airport	Status	PSO type	PSO compensation in 2018 (€/PAX)	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
CY-01	LCLK	EBBR	indefinite duration	1	n/a	RYANAIR	P, T

Source: Own preparation based on data from DG MOVE, as well as corresponding national CAA and public bodies.

PSOs imposed by each EU Member State



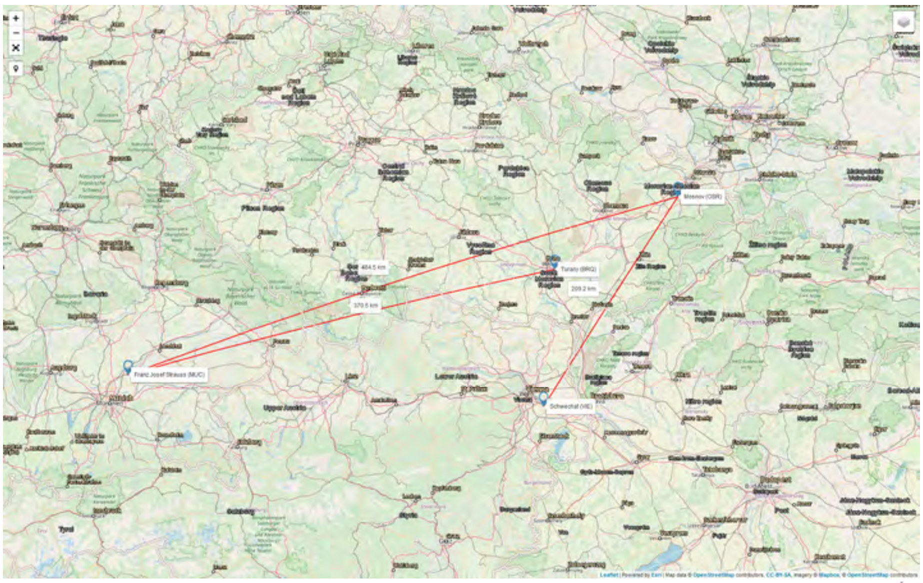
PSOs imposed by each EU Member State

	Airport	Airport	Status	PSO type	PSO compensation (€/PAX)	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
CZ-01	LKTB	EBBR	Ongoing new tender *	3	59.97	* flybmi	T
CZ-02	LKMT	EDDM	Pending tender	3	n/a	n/a	D, T
CZ-03	LKMT	LOWW	Pending tender	3	n/a	n/a	D, T

(*) Operations were ceased because of the collapse of the air carrier on 16th February 2019; new tender process has been re-opened on 8th November 2019.

Source: Own preparation based on data from DG MOVE, as well as corresponding national CAA and public bodies.

PSOs imposed by each EU Member State

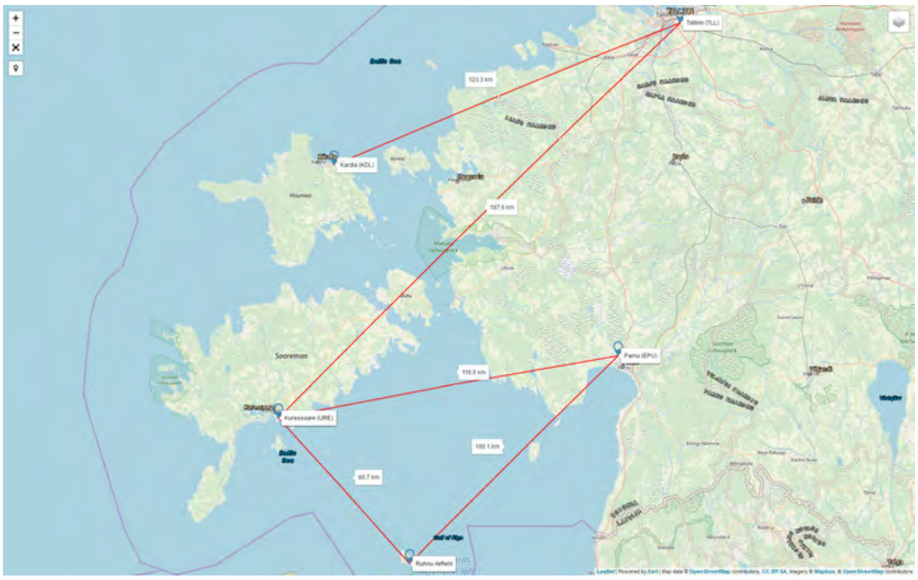


PSOs imposed by each EU Member State

	Airport	Airport	Status	PSO type	PSO compensation (€/PAX)	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
EE-01	EEKE	EETN	Contract until 31/05/2024	3	162.0	NYXAIR	P, D, T
EE-02	EEKA	EETN	Contract until 31/05/2024	3	105.9	TRANSAVIABALTIKA	P, D, T
EE-03	EEKE	EEPU EERU	Contract until 31/05/2024	3	287.3	DIAMOND SKY	P, D, T

Source: Own preparation based on data from DG MOVE, as well as corresponding national CAA and public bodies.

PSOs imposed by each EU Member State

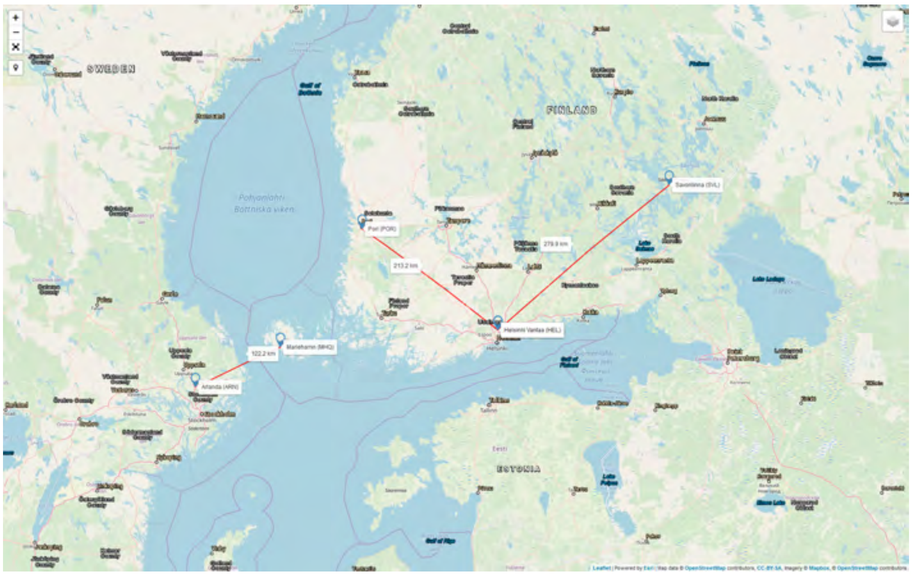


PSOs imposed by each EU Member State

	Airport	Airport	Status	PSO type	PSO compensation (€/PAX)	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
FI-01	EFHK	EFPO	Contract until 23/12/2022	3	N/A	BAS	T
FI-02	EFHK	EFSA	Contract until 18/12/2020	3	287.28	BAS	D, T
FI-03	EFMA	ESSA	Contract until 29/02/2020	3	77.80	DAT	T

Source: Own preparation based on data from DG MOVE, as well as corresponding national CAA and public bodies.

PSOs imposed by each EU Member State



PSOs imposed by each EU Member State

	Airport	Airport	Status	PSO type	PSO compensation (€/PAX)	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
FR-01	LFRB	LFEC	Contract until 31/03/2020	3	234.20	Finistair	P, D, T
FR-02	SOCA	SOGS	indefinite duration	1	n/a	AIR GUYANE	P, D, T
FR-03	SOCA	SOOA	indefinite duration	1	n/a	AIR GUYANE	P, D, T
FR-04	SOCA	SOOS	indefinite duration	1	n/a	AIR GUYANE	P, D, T
FR-05	SOOM	SOGS	indefinite duration	1	n/a	AIR GUYANE	P, D, T
FR-06	SOOM	SOOA	indefinite duration	1	n/a	AIR GUYANE	P, D, T
FR-07	LFBH LFLL LFBI	LFLL LFBI LFBH	Contract until 31/10/2023	3	61.47	CHALAIR AVIATION	D, T

PSOs imposed by each EU Member State

	Airport	Airport	Status	PSO type	PSO compensation (€/PAX)	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
FR-08	TFFR	LFPO	indefinite duration	1	n/a	AIRFRANCE, LEVEL, CORSAIR, AIRCARAÏBES	P, D
FR-09	SOCA	LFPO	indefinite duration	1	n/a	AIRFRANCE, AIRCARAÏBES	P, D
FR-10	TFFF	LFPO	indefinite duration	1	n/a	AIRFRANCE, LEVEL, CORSAIR, AIRCARAÏBES	P, D
FR-11	FMEE	LFPO	indefinite duration	1	n/a	AIRFRANCE, LEVEL, CORSAIR, AIRCARAÏBES	P, D
FR-12	LFBA	LFPO	Contract until 06/01/2023	3	83.43	CHALAIR AVIATION	P, D, T
FR-13	LFLW	LFPO	Contract until 31/05/2023	3	37.00	AIRFRANCE	P, D, T
FR-14	LFSL	LFPO	Contract until 04/01/2022	3	55.19	AIRFRANCE HOP	P, D, T

PSOs imposed by each EU Member State

	Airport	Airport	Status	PSO type	PSO compensation (€/PAX)	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
FR-15	LFCK	LFPO	Contract until 31/03/2023	3	76.54	AIRFRANCE	D, T
FR-16	LFBT	LFPO	Contract until 31/05/2022	3	16.48	AIRFRANCE HOP	P, D
FR-17	LFHP	LFPO	Contract until 13/01/2013	3	71.67	TWIN JET	P, D, T
FR-18	LFBL	LFPO	Contract until 03/03/2023	3	N/A	CHALAIR AVIATION	P, T
FR-19	LFBL	LFLL	Contract until 31/03/2023	3	N/A	CHALAIR AVIATION	P, T
FR-20	LFRQ	LFPO	Contract until 24/11/2023	3	N/A	CHALAIR AVIATION	P
FR-21	LFCR	LFPO	Contract until 29/01/2020	3	9.87	Eastern airways	P, D, T

PSOs imposed by each EU Member State

	Airport	Airport	Status	PSO type	PSO compensation (€/PAX)	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
FR-22	LFST	EHAM	Contract until 08/04/2022	3	22.07	AIRFRANCE	T
FR-23	LFST	LEMD	Contract until 08/04/2022	3	89.73	IBERIA REGIONAL AIRNOSTRUM	T
FR-24	LFST	LKPR	Contract until 08/04/2019	3	39.24	discontinued	T
FR-25	LFST	EDDM	Contract until 08/04/2022	3	N/A	Lufthansa	T
FR-26	LFKJ	LFML	Contract until 24/03/2020	3	9.45	AIR CORSICA	P, D
FR-27	LFKF	LFML	Contract until 24/03/2020	3	9.45	AIR CORSICA	P, D
FR-28	LFKJ	LFMN	Contract until 24/03/2020	3	9.45	AIR CORSICA	P, D

PSOs imposed by each EU Member State

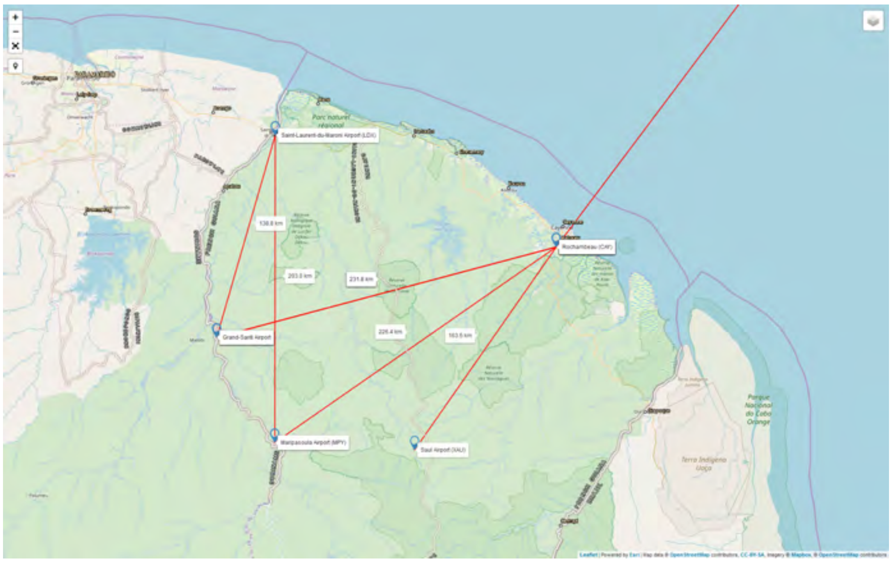
	Airport	Airport	Status	PSO type	PSO compensation (€/PAX)	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
FR-29	LFKF	LFMN	Contract until 24/03/2020	3	9.45	AIR CORSICA	P, D
FR-30	LFKB	LFML	Contract until 24/03/2020	3	11.01	AIR CORSICA	P, D
FR-31	LFKC	LFML	Contract until 24/03/2020	3	11.01	AIR CORSICA	P, D
FR-32	LFKB	LFMN	Contract until 24/03/2020	3	11.01	AIR CORSICA	P, D
FR-33	LFKC	LFMN	Contract until 24/03/2020	3	11.01	AIR CORSICA	P, D
FR-34	LFKJ	LFPO	Contract until 24/03/2020	3	13.35	AIR CORSICA, AIRFRANCE HOP	P, D
FR-35	LFKF	LFPO	Contract until 24/03/2020	3	10.73	AIR CORSICA, AIRFRANCE HOP	P, D

PSOs imposed by each EU Member State

	Airport	Airport	Status	PSO type	PSO compensation (€/PAX)	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
FR-36	LFKB	LFPO	Contract until 24/03/2020	3	13.35	AIR CORSICA, AIRFRANCE HOP	P, D
FR-37	LFKC	LFPO	Contract until 24/03/2020	3	13.35	AIR CORSICA, AIRFRANCE HOP	P, D

Source: Own preparation based on data from DG MOVE, as well as corresponding national CAA and public bodies.

PSOs imposed by each EU Member State



PSOs imposed by each EU Member State

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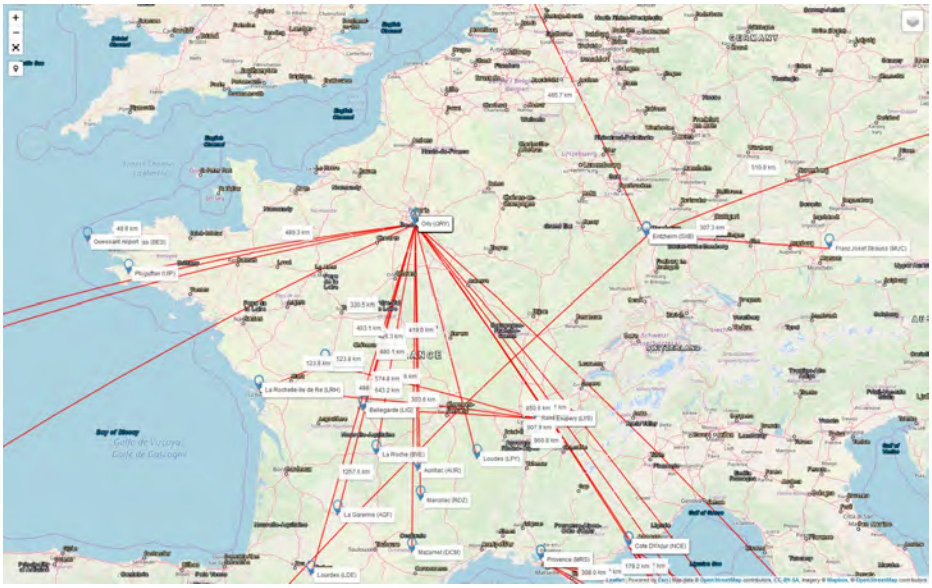
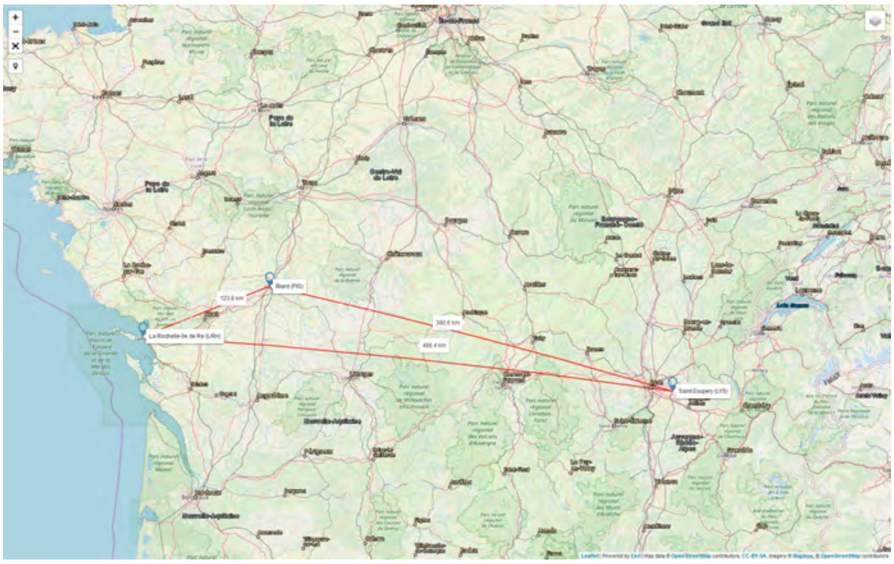


PSOs imposed by each EU Member State



PSOs imposed by each EU Member State

PSOs imposed by each EU Member State

	Airport	Airport	Status	PSO type	PSO compensation (€/PAX)	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
GR-01	LGAL	LGST	Contract until 30/09/2021	3	640.66	sky express	P, D, T
GR-02	LGAV	LGPL	Contract until 30/09/2020	3	118.43	sky express	P, D, T
GR-03	LGAV	LGIK	indefinite duration	1	n/a	sky express, Olympic	P, D, T
GR-04	LGAV	LGKY	Contract until 30/09/2020	3	156.35	sky express	P, D, T
GR-05	LGAV	LGKP	indefinite duration	1	n/a	sky express, Olympic	P, D, T
GR-06	LGAV	LGKC	indefinite duration	1	n/a	sky express, Olympic	P, D, T
GR-07	LGAV LGKZ	LGKZ LGKA	Contract until 30/08/2021	3	151.10	Astra Airlines	P, D, T

PSOs imposed by each EU Member State

	Airport	Airport	Status	PSO type	PSO compensation (€/PAX)	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
GR-08	LGAV	LGLE	Contract until 30/09/2020	2	n/a	Olympic	P, D, T
GR-09	LGAV	LGML	indefinite	1	n/a	sky express, Olympic	P, D
GR-10	LGAV	LGNX	indefinite	1	n/a	sky express, Olympic	P, D, T
GR-11	LGAV	LGPA	indefinite	1	n/a	sky express, Olympic	P, D
GR-12	LGAV	LGST	indefinite	1	n/a	Olympic	P, D, T
GR-13	LGAV	LGSK	indefinite	1	n/a	sky express, Olympic	P, D, T
GR-14	LGAV	LGSY	Contract until 30/09/2020	3	67.36	Olympic	P, D, T

PSOs imposed by each EU Member State

	Airport	Airport	Status	PSO type	PSO compensation (€/PAX)	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
GR-15	LGAV	LGSO	Contract until 30/09/2020	2	n/a	sky express	P, D, T
GR-16	LGAV	LGZA	indefinite duration	1	n/a	sky express, OLYMPIC	P, D, T
GR-17	LGPZ	LGST	Contract until 30/09/2021	3	1493.32	sky express	P, D, T
GR-18	LGKR LGPZ LGKF	LGPZ LGKF LGZA	Contract until 31/03/2021	3	2204.52	sky express	P, D, T
GR-19	LGLM LGMT LGHI LGSM	LGMT LGHI LGSM LGRP	Contract until 31/03/2021	3	1322.97	sky express	P, D, T
GR-20	LGRP LGKP	LGKP LGKS	Contract until 30/09/2020	3	1003.13	sky express	P, D, T
GR-21	LGRP	LGKJ	Contract until 30/09/2020	3	301.86	OLYMPIC	P, D, T

PSOs imposed by each EU Member State

	Airport	Airport	Status	PSO type	PSO compensation (€/PAX)	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
GR-22	LGRP LGKO LGKY LGLE	LGKO LGKY LGLE LGPL	Contract until 30/09/2021	3	2566.33	sky express	P, D, T
GR-23	LGTS	LGKR	Contract until 31/03/2021	3	625.87	sky express	P, D, T
GR-24	LGTS LGLM	LGLM LGIK	Contract until 30/09/2020	3	300.19	ASTRA	P, D
GR-25	LGTS	LGSM	indefinite duration	1	n/a	ASTRA, sky express, OLYMPIC	P, D
GR-26	LGTS	LGSY	Contract until 31/03/2021	3	3532.80	sky express	P, D, T
GR-27	LGTS	LGHI	indefinite duration	1	n/a	ASTRA, sky express, OLYMPIC	P, D
GR-28	LGTS	LGKL	Contract until 30/09/2020	2	n/a	OLYMPIC	P, D

PSOs imposed by each EU Member State

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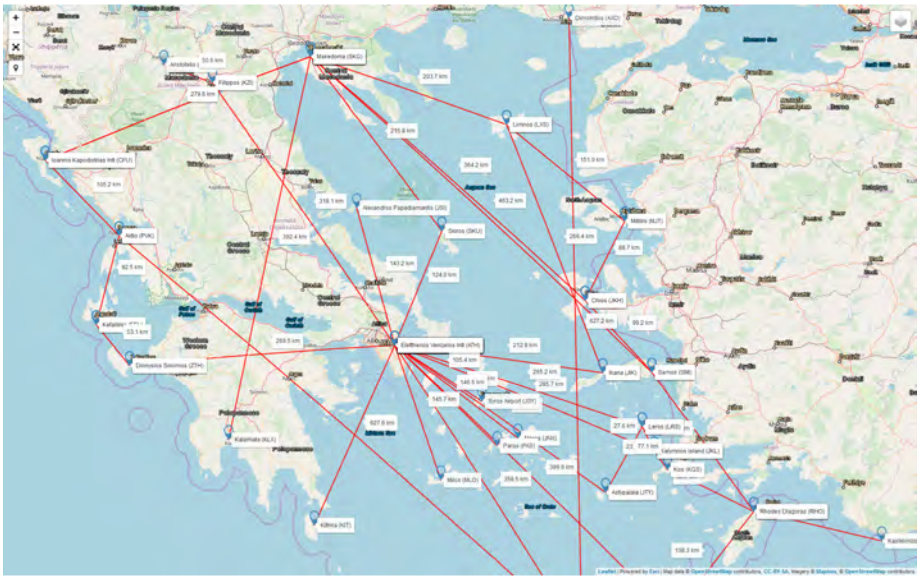

PSOs imposed by each EU Member State

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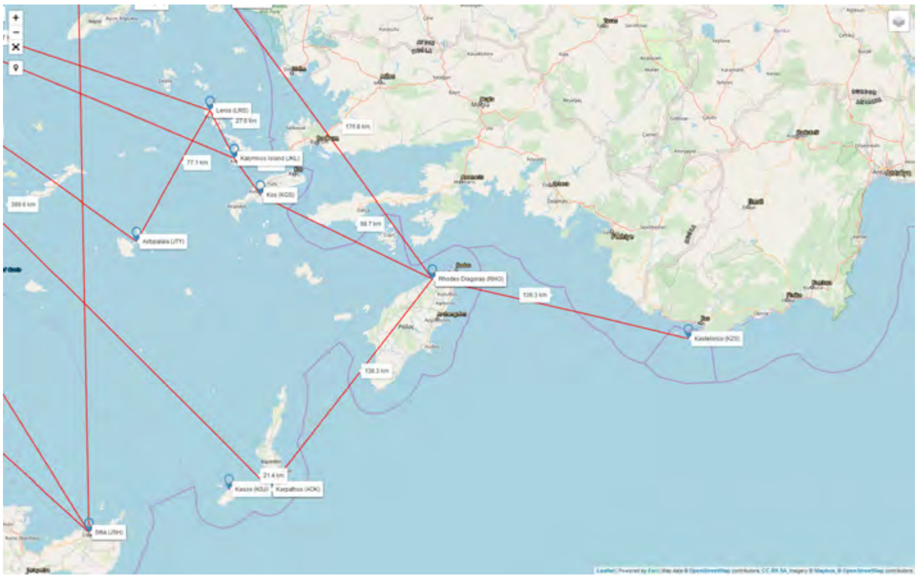
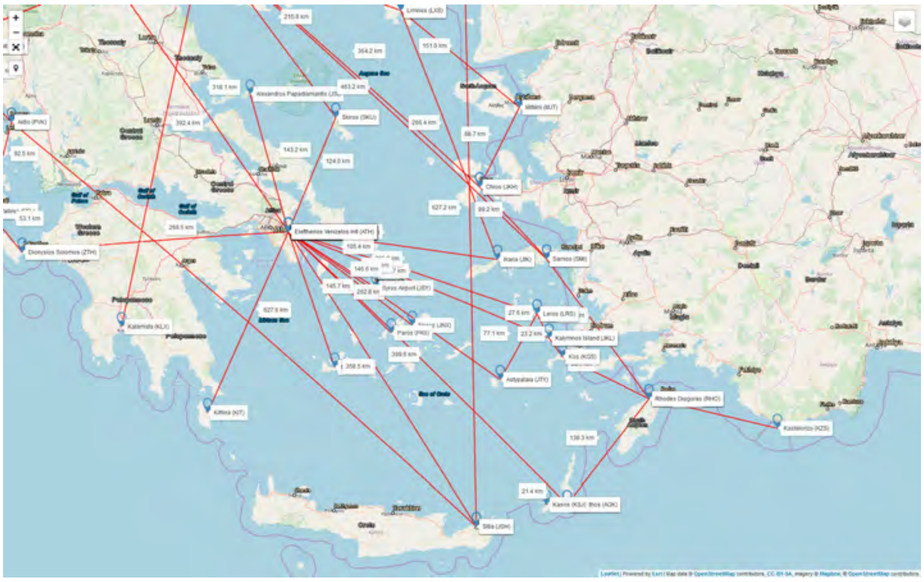


PSOs imposed by each EU Member State

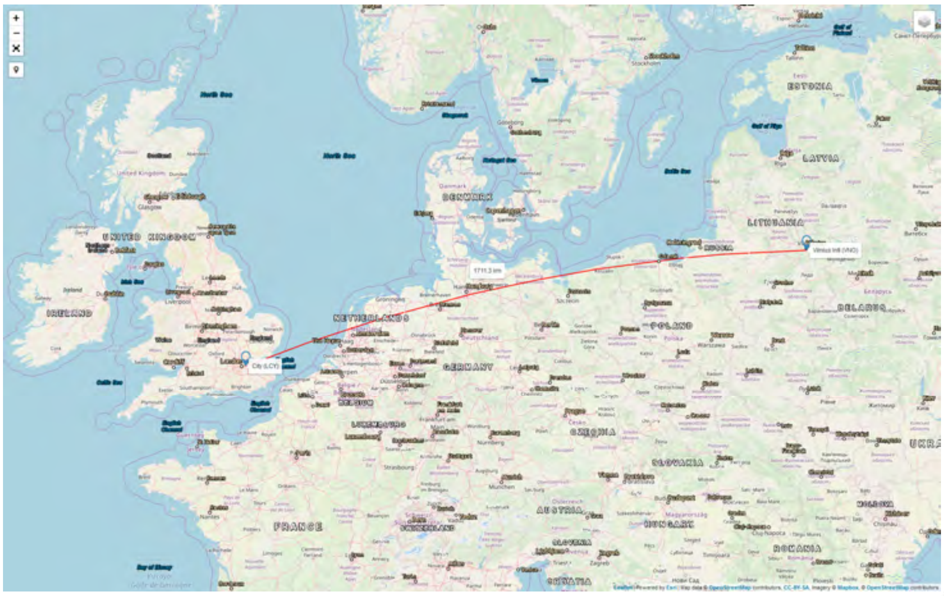


PSOs imposed by each EU Member State

	Airport	Airport	Status	PSO type	PSO compensation in 2018 (€/PAX)	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
LT-01	EYVI	EGLC	Contract until 30/04/2023	3	N/A New route	POLISH AIRLINES LOT	P, D

Source: Own preparation based on data from DG MOVE, as well as corresponding national CAA and public bodies.

PSOs imposed by each EU Member State



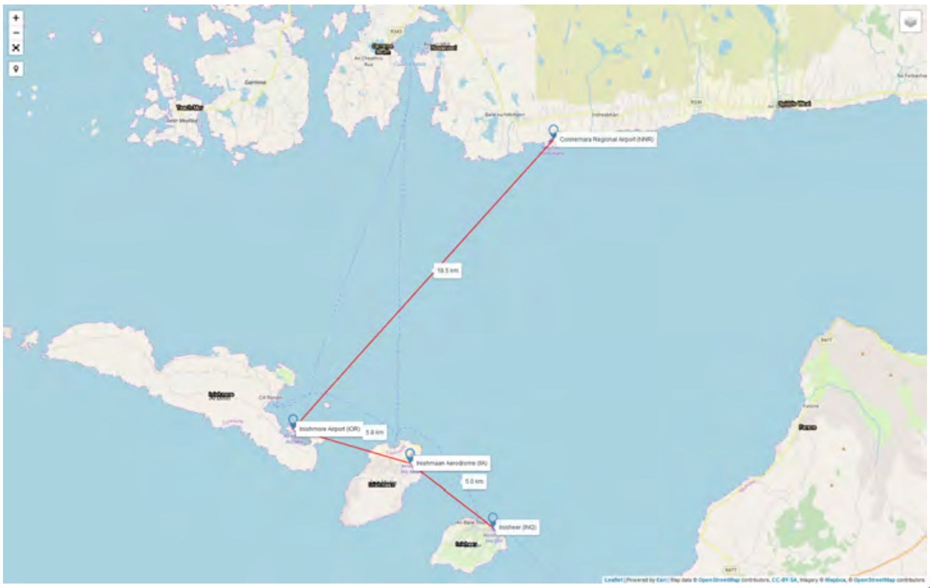
PSOs imposed by each EU Member State

	Airport	Airport	Status	PSO type	PSO compensation in 2018 (€/PAX)	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
IE-01	EIDW	EIFL	Contract until 31/01/2022	3	105.86	Stobart Air	P, D
IE-02	EIDW	EIKY	Contract until 31/01/2022	3	56.71	Stobart Air	P, D
IE-03	EICA EIIM EIMN	EIIM EIMN EIIR	Expired on 30/09/2019	3	38.18	aer arann islands	P, D

Source: Own preparation based on data from DG MOVE, as well as corresponding national CAA and public bodies.

PSOs imposed by each EU Member State

PSOs imposed by each EU Member State



PSOs imposed by each EU Member State

	Airport	Airport	Status	PSO type	PSO compensation in 2018 (€/PAX)	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
IT-01	LIEA	LIML	new tender pending	3	12.77	Alitalia	P, D
IT-02	LIEA	LIRF	new tender pending	3	16.50	Alitalia	P, D
IT-03	LIEO	LIML	new tender pending	2 (3)	7.76	AIRITALY Alitalia	P, D
IT-04	LIEO	LIRF	new tender pending	2 (3)	7.45	AIRITALY Alitalia	P, D
IT-05	LIEE	LIML	new tender pending	3	20.60	Alitalia	P, D
IT-06	LIEE	LIRF	new tender pending	3	13.32	Alitalia	P, D
IT-07	LICD	LICC	Contract until 30/06/2021	3	58.42	DAT	P, D, T

PSOs imposed by each EU Member State

	Airport	Airport	Status	PSO type	PSO compensation in 2018 (€/PAX)	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
IT-08	LICD	LICJ	Contract until 30/06/2021	3	58.42	DAT	P, D, T
IT-09	LICG	LICJ	Contract until 30/06/2021	3	58.42	DAT	P, D, T
IT-10	LICG	LICT	Contract until 30/06/2021	3	58.42	DAT	P, D, T
IT-11	LICG	LICC	Contract until 30/06/2021	3	58.42	DAT	P, D, T

Source: Own preparation based on data from DG MOVE, as well as corresponding national CAA and public bodies.

PSOs imposed by each EU Member State

PSOs imposed by each EU Member State

PSOs imposed by each EU Member State

	Airport	Airport	Status	PSO type	PSO compensation in 2018 (€/PAX)	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
PT-01	LPBG LPVR LPVZ LPCS	LPVR LPVZ LPCS LPPM	Contract until 23/12/2022 (expected)	3	188.94	SEVENAIR	D
PT-02	LPMA	LPPD	indefinite duration	1	n/a	sata	P
PT-03	LPMA	LPPS	Contract until 05/06/2021	3	70.19	Binter	P
PT-04	LPPT	LPHR	indefinite duration	1	n/a	sata	P
PT-05	LPPT	LPPI	indefinite duration	1	n/a	sata	P
PT-06	LPPT	LPAZ	indefinite duration	1	n/a	sata	P
PT-07	LPCR	LPFL	Contract until 30/09/2020	3	36.25	azores airlines	P

PSOs imposed by each EU Member State

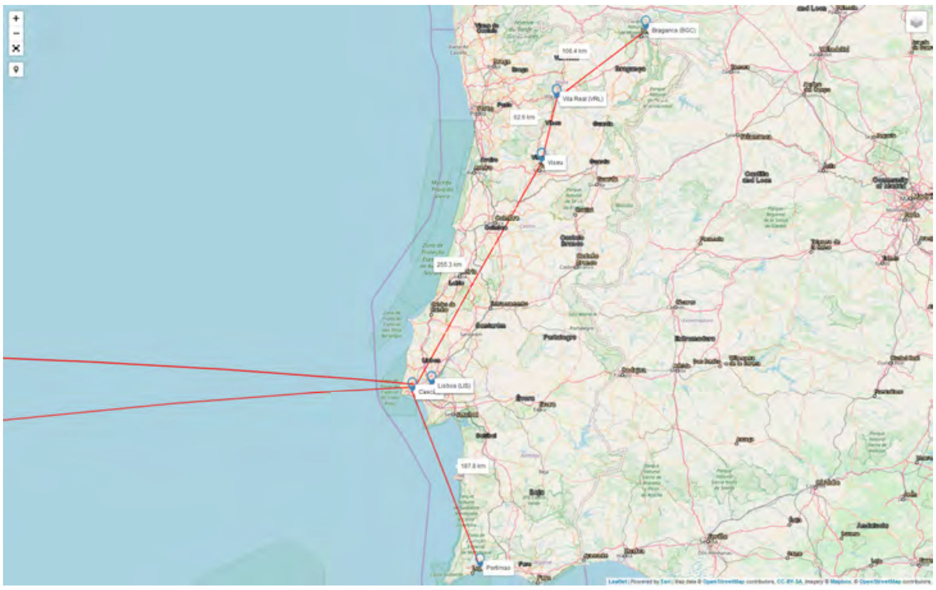
	Airport	Airport	Status	PSO type	PSO compensation in 2018 (€/PAX)	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
PT-08	LPHR	LPCR	Contract until 30/09/2020	3	36.25	azores airlines	P
PT-09	LPHR	LPFL	Contract until 30/09/2020	3	36.25	azores airlines	P
PT-10	LPPD	LPFL	Contract until 30/09/2020	3	36.25	azores airlines	P
PT-11	LPPD	LPHR	Contract until 30/09/2020	3	36.25	azores airlines	P
PT-12	LPPD	LPPI	Contract until 30/09/2020	3	36.25	azores airlines	P
PT-13	LPPD	LPAZ	Contract until 30/09/2020	3	36.25	azores airlines	P
PT-14	LPPD	LPSJ	Contract until 30/09/2020	3	36.25	azores airlines	P

PSOs imposed by each EU Member State

	Airport	Airport	Status	PSO type	PSO compensation in 2018 (€/PAX)	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
PT-15	LPPD	LPLA	Contract until 30/09/2020	3	36.25	azores airlines	P
PT-16	LPLA	LPFL	Contract until 30/09/2020	3	36.25	azores airlines	P
PT-17	LPLA	LPGR	Contract until 30/09/2020	3	36.25	azores airlines	P
PT-18	LPLA	LPHR	Contract until 30/09/2020	3	36.25	azores airlines	P
PT-19	LPLA	LPPI	Contract until 30/09/2020	3	36.25	azores airlines	P
PT-20	LPLA	LPSJ	Contract until 30/09/2020	3	36.25	azores airlines	P

Source: Own preparation based on data from DG MOVE, as well as corresponding national CAA and national bodies.

PSOs imposed by each EU Member State



PSOs imposed by each EU Member State

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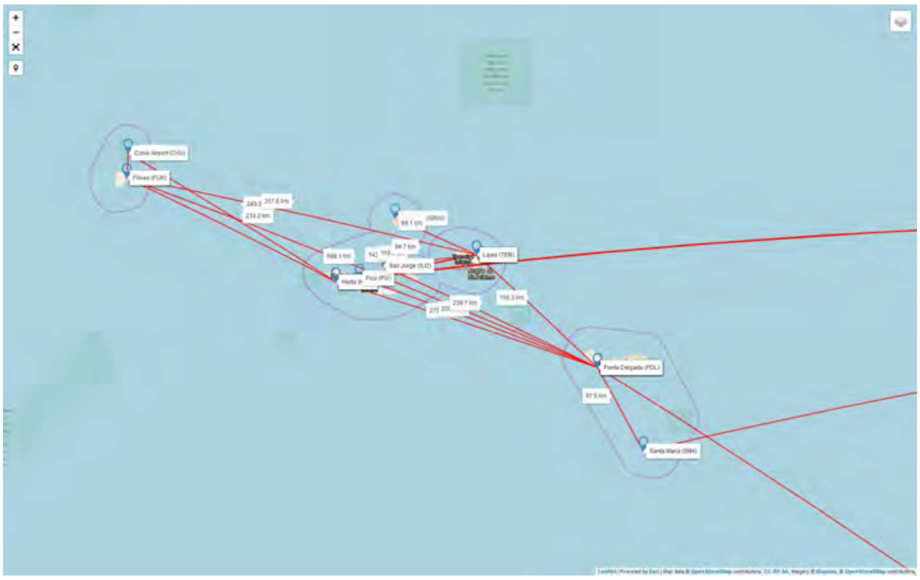

EQUIS AMBA

PSOs imposed by each EU Member State

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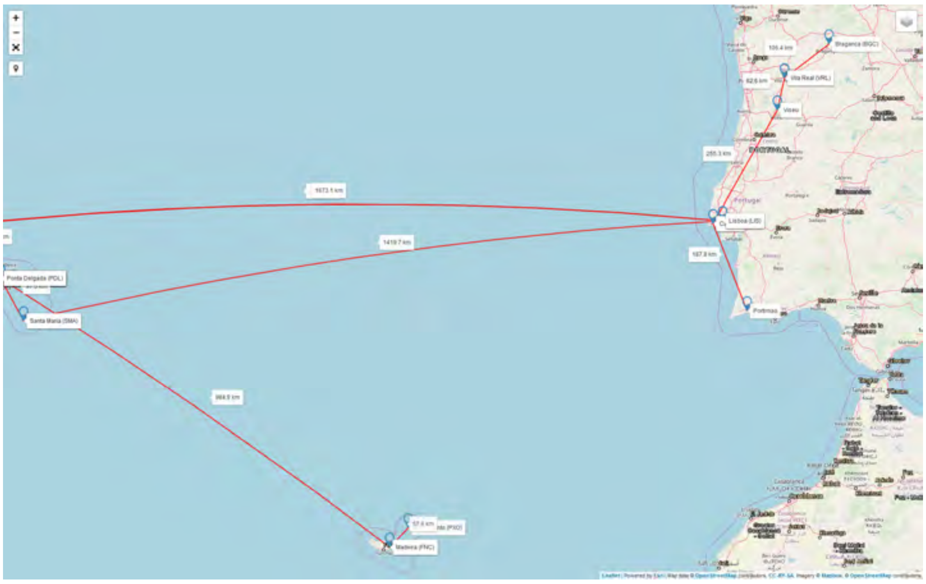


EQUIS AMBA

PSOs imposed by each EU Member State

	Airport	Airport	Status	PSO type	PSO compensation in 2019 (€/PAX) *	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
ES-01	LEAM	LEZL	Contract until 31/07/2022	3	85.44	IBERIA REGIONAL AIRNOSTRUM	P, D
ES-02	LEMH	LEIB	n/a	1	n/a	IBERIA REGIONAL AIRNOSTRUM, AirEuropa	P, D
ES-03	LEMH	LEMD	Contract until 30/04/2021	3	2.49	IBERIA REGIONAL AIRNOSTRUM	P, D
ES-04	LEPA	LEIB	n/a	1	n/a	IBERIA REGIONAL AIRNOSTRUM, AirEuropa	P, D
ES-05	LEPA	LEMH	n/a	1	n/a	Binter, canaryfly	P, D
ES-06	GCLP	GCHI	n/a	1	6.36	Binter, canaryfly	P, D
ES-07	GCLP	GCTS	n/a	1	1.95	Binter	P, D

PSOs imposed by each EU Member State

	Airport	Airport	Status	PSO type	PSO compensation in 2019 (€/PAX) *	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
ES-08	GCLP	GCFV	n/a	1	n/a	AirEuropa, Binter, canaryfly	P, D
ES-09	GCLP	GCRR	n/a	1	n/a	AirEuropa, Binter, canaryfly	P, D
ES-10	GCLP	GCRR	n/a	1	n/a	AirEuropa, Binter, canaryfly	P, D
ES-11	GCLP	GCLA	n/a	1	n/a	Binter	P, D
ES-12	GCGM	GCLP	Contract until 31/07/2021	3	55.10	Binter	P, D
ES-13	GCGM	GCXO	Contract until 31/07/2021	3	15.31	Binter	P, D
ES-14	GCLA	GCRR	n/a	1	n/a	AirEuropa, Binter, canaryfly	P, D

PSOs imposed by each EU Member State

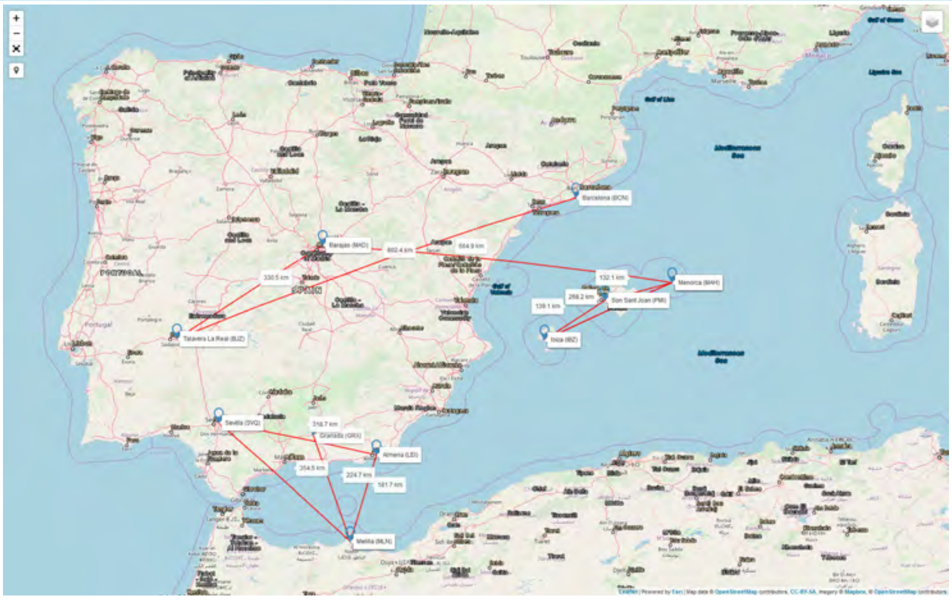
	Airport	Airport	Status	PSO type	PSO compensation in 2019 (€/PAX) *	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
ES-15	GCXO	GCHI	n/a	1	n/a	Binter canaryfly	P, D
ES-16	GCXO	GCFV	n/a	1	n/a	AirEuropa Binter canaryfly	P, D
ES-17	GCXO	GCRR	n/a	1	n/a	AirEuropa Binter canaryfly	P, D
ES-18	GCXO	GCLA	n/a	1	n/a	AirEuropa Binter canaryfly	P, D
ES-19	LEBZ	LEMD	Contract until 28/10/2021	3	11.21	IBERIA REGIONAL AIRNOSTRUM	D, T
ES-20	LEBZ	LEBL	Contract until 31/12/2019	3	10.44	IBERIA REGIONAL AIRNOSTRUM	D, T
ES-21	GEML	LEAM	Contract until 31/12/2019	3	1.81	IBERIA REGIONAL AIRNOSTRUM	D, T

PSOs imposed by each EU Member State

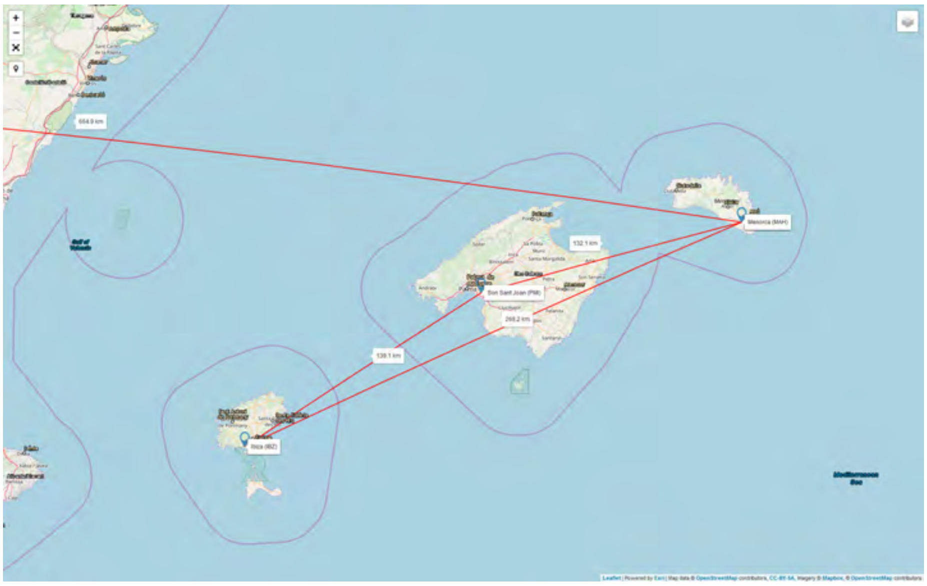
	Airport	Airport	Status	PSO type	PSO compensation in 2019 (€/PAX) *	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
ES-22	GEML	LEGR	Contract until 31/12/2019	3	2.16	IBERIA REGIONAL AIRNOSTRUM	D, T
ES-23	GEML	LEZL	Contract until 31/12/2019	3	22.79	IBERIA REGIONAL AIRNOSTRUM	D, T

Source: Own preparation based on data from DG MOVE, as well as corresponding national CAA and national bodies.
(*) Own calculation (as of 2019)

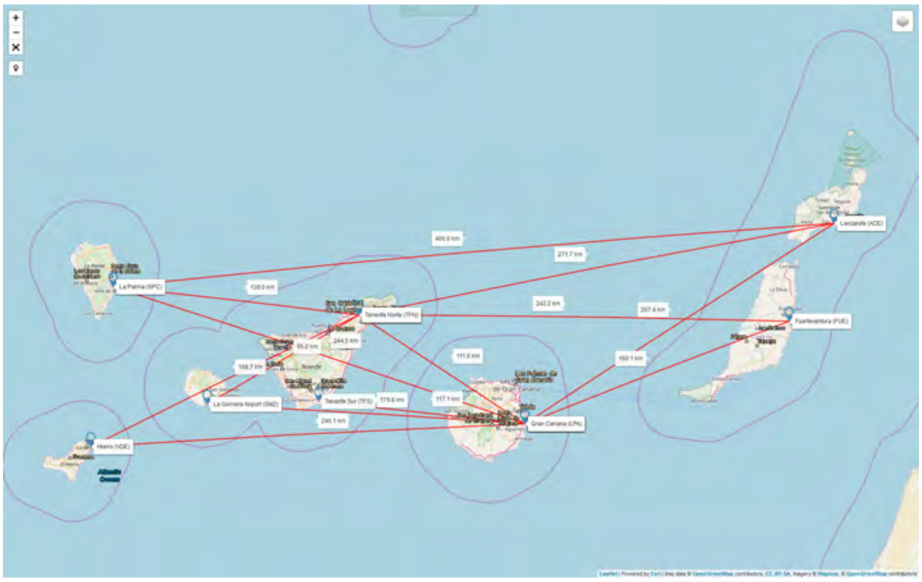
PSOs imposed by each EU Member State



PSOs imposed by each EU Member State



PSOs imposed by each EU Member State



PSOs imposed by each EU Member State

	Airport	Airport	Status	PSO type	PSO compensation in 2018 (€/PAX)	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
SE-01	ESNX	ESSA	Contract until 26/10/2019	3	N/A	AMAPOLA FLYG AB	P, D, T
SE-02	ESNG	ESSA	Contract until 26/10/2019	3	N/A	AMAPOLA FLYG AB	P, D, T
SE-03	ESNL	ESSA	Contract until 26/10/2019	3	142.37	AMAPOLA FLYG AB	P, D
SE-04	ESNV	ESSA	Contract until 26/10/2019	3	175.16	FLEXFLIGHT	P, D
SE-05	ESUT	ESSA	Contract until 26/10/2019	3	311.31	FLEXFLIGHT	P, D, T
SE-06	ESND	ESSA	Contract until 26/10/2019	3	283.24	FLEXFLIGHT	P, D
SE-07	ESST	ESSA	Contract until 26/10/2019	3	279.02	FLEXFLIGHT	P, D

PSOs imposed by each EU Member State

	Airport	Airport	Status	PSO type	PSO compensation in 2018 (€/PAX)	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
SE-08	ESOH	ESSA	Contract until 26/10/2019	3	254.81	FLEXFLIGHT	P, T
SE-09	ESUP	ESPA	Contract until 26/10/2019	3	439.80	JONAIR BUSINESS FLIGHT SERVICE	P, T
SE-10	ESNZ	ESNU	Contract until 26/10/2019	3	145.91	FLEXFLIGHT	P, T
SE-11	ESNK	ESSA	Contract on 27/10/2023	3	N/A	N/A	P, T

Source: Own preparation based on data from DG MOVE, as well as corresponding national CAA and national bodies.

PSOs imposed by each EU Member State

PSOs imposed by each EU Member State

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	Airport	Airport	Status	PSO type	PSO compensation in 2018 (€/PAX)	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
GB-01	EGFF	EGOV	Contract until 18/02/2023	3	114.28	Eastern airways	P, T
GB-02	EGPF	EGBR	Contract until 24/10/2019	3	122.81	Loganair Scotland's Airline	P, T
GB-03	EGPF	EGEC	Contract until 24/10/2019	3	148.90	Loganair Scotland's Airline	P, T
GB-04	EGPF	EGPU	Contract until 24/10/2019	3	161.41	Loganair Scotland's Airline	P, T
GB-05	EGPA	EGEN	Contract until 31/03/2021	3	58.67	Loganair Scotland's Airline	P, T
GB-06	EGPA	EGEP	Contract until 31/03/2021	3	58.67	Loganair Scotland's Airline	P, T
GB-07	EGPA	EGED	Contract until 31/03/2021	3	58.67	Loganair Scotland's Airline	P, T

EQUIS AMBA

PSOs imposed by each EU Member State

WU WIRTSCHAFTS UNIVERSITÄT WIEN VIENNA UNIVERSITY OF ECONOMICS AND BUSINESS

	Airport	Airport	Status	PSO type	PSO compensation in 2018 (€/PAX)	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
GB-08	EGPA	EGES	Contract until 31/03/2021	3	58.67	Loganair Scotland's Airline	P, T
GB-09	EGPA	EGER	Contract until 31/03/2021	3	58.67	Loganair Scotland's Airline	P, T
GB-10	EGPA	EGEW	Contract until 31/03/2021	3	58.67	Loganair Scotland's Airline	P, T
GB-11	EGEO	EGEL	Contract until 15/09/2023	3	989.44	Airtask	P, T
GB-12	EGEO	EGEY	Contract until 15/09/2023	3	989.44	Airtask	P, T
GB-13	EGEO	EGPU	Contract until 15/09/2023	3	989.44	Airtask	P, T
GB-14	EGEL	EGPU	Contract until 15/09/2023	3	989.44	Airtask	P, T

EQUIS AMBA

PSOs imposed by each EU Member State

WU WIRTSCHAFTSUNIVERSITÄT WIEN VIENNA UNIVERSITY OF ECONOMICS AND BUSINESS

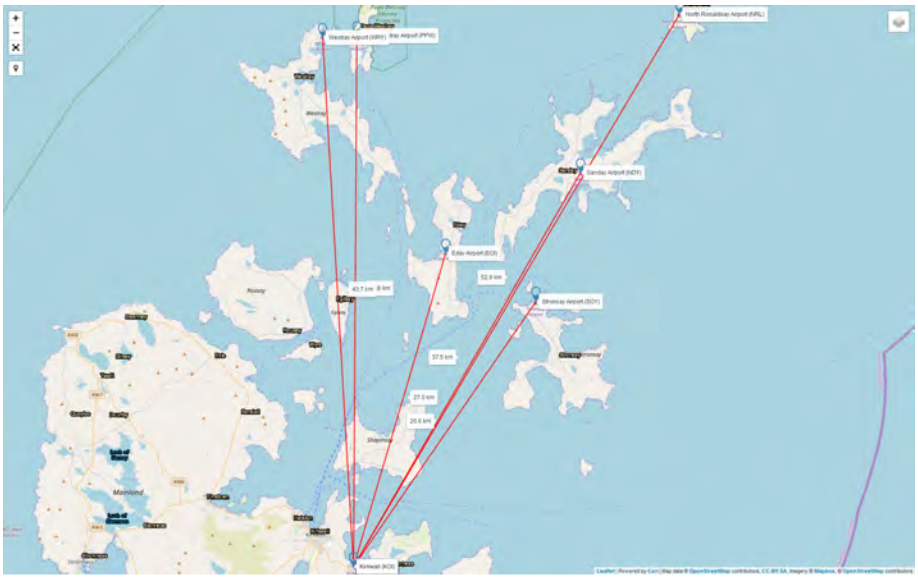
	Airport	Airport	Status	PSO type	PSO compensation in 2018 (€/PAX)	Airlines operating	PSO justification (Peripheral, Development region, Thin route)
GB-15	EGPO	EGPL	Contract until 31/03/2021	3	46.28	Loganair Scotland's Airline	P, T
GB-16	EGET	EGEF	Contract until 31/03/2020	3	1056.51	Airtask	P, T
GB-17	EGET	EGFO	Contract until 31/03/2020	3	1056.51	Airtask	P, T
GB-18	EGET	EGOU	Contract until 31/03/2020	3	1056.51	Airtask	P, T
GB-19	EGET	EGSZ	Contract until 31/03/2020	3	1056.51	Airtask	P, T
GB-20	EGHQ	EGLL	Contract until 25/10/2022	3	4.09	flybe.	P
GB-21	EGPN	EGSS	Contract until 29/10/2019	3	97.02	Loganair Scotland's Airline	P, T
GB-22	EGAE	EGSS	Contract until 30/09/2019	3	49.10	Loganair Scotland's Airline	P, D

Source: Own preparation based on data from DG MOVE, as well as corresponding national CAA and national bodies.

EQUIS AMBA

PSOs imposed by each EU Member State

WU WIRTSCHAFTSUNIVERSITÄT WIEN VIENNA UNIVERSITY OF ECONOMICS AND BUSINESS



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PSOs imposed by each EU Member State

PSOs imposed by each EU Member State

PSOs imposed by each EU Member State

Public transport system connecting Almeria and Seville

Case Study No. 1

A case of PSO imposition (type 3) on peripheral territory in the mainland of an EU Member State, even when alternative means of public transport exist

Case Study No. 1
Location

Source: Prepared by the author, based on information provided by Ministry of Public Works and Transport

Key	Civil airport facility (no airfield included) owned by
● (purple)	private equity firm (commercial airport)
● (dark blue)	private equity firm (industrial airport)
✈	public business body answerable to the National Government
● (red)	public business body answerable to Regional Government

Case Study No. 1
Airports

LEZL / SVQ Aeropuerto de **Sevilla**	LEAM / LEI Aeropuerto de **Almería**
	

Case Study
Transportation system

Carrier on the route SVQ-LEI	Means of transport	Travel distance (km.)	Travel time (h.)	Intermediate stops	Daily frequencies per leg	Base price (2018)
IBERIA REGIONAL AIRNOSTRUM		319	0:55	0	2	130 € (maximum fare)
renfe		456.70	6:48 - 07:10	1 - 5	4	42.2 €
ALSA		429	5:30 - 8:30	1 - 19	4	37.76 €

Case Study No. 1
Equipment

Photo by courtesy of Air Nostrum

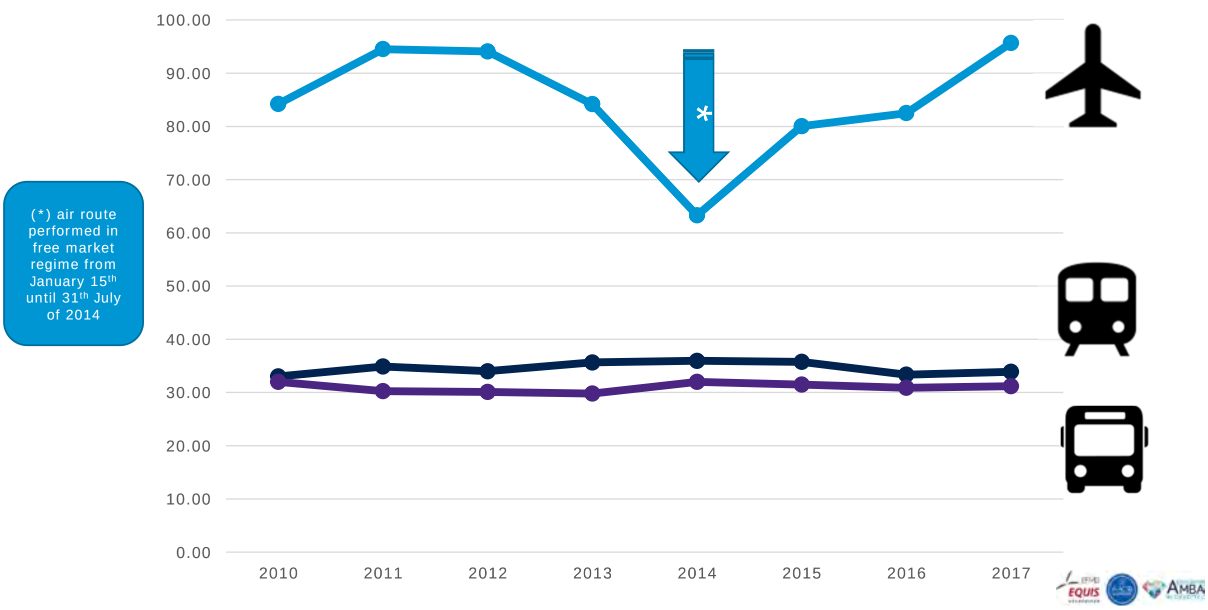
Photo by courtesy of ALSA

Photo by courtesy of RENFE

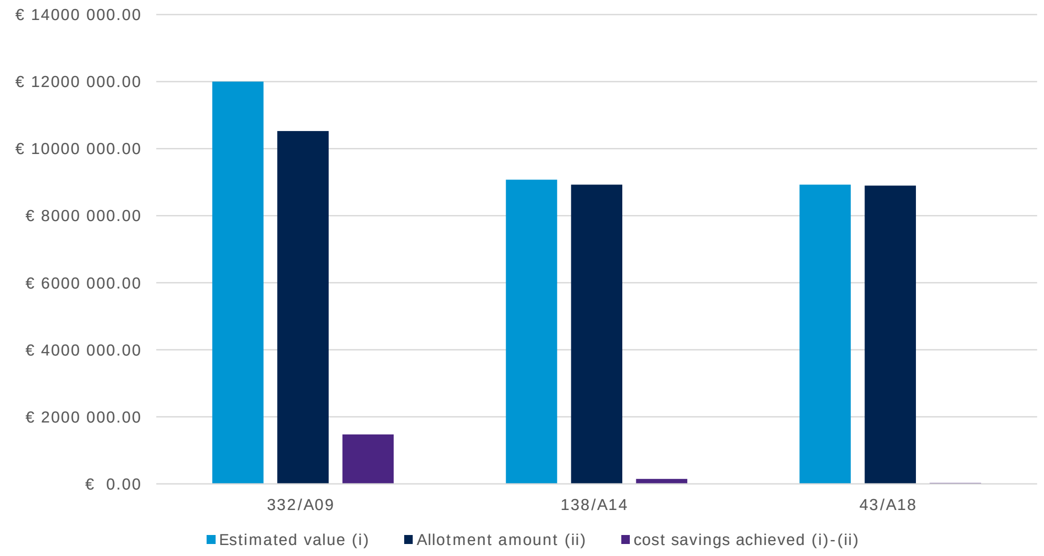
Case Study No. 1
Carriers

Operating company	Type of legal entity	Parent / undertaking Company	Operation License
IBERIA REGIONAL AIRNOSTRUM	private equity firm	AIR NOSTRUM	
renfe	public business body answerable to the Spanish Ministry of Public Works	GOBIERNO DE ESPAÑA MINISTERIO DE FOMENTO	
ALSA	private equity firm	national express	

Case Study No. 1
Passenger Load Factor (PLF)

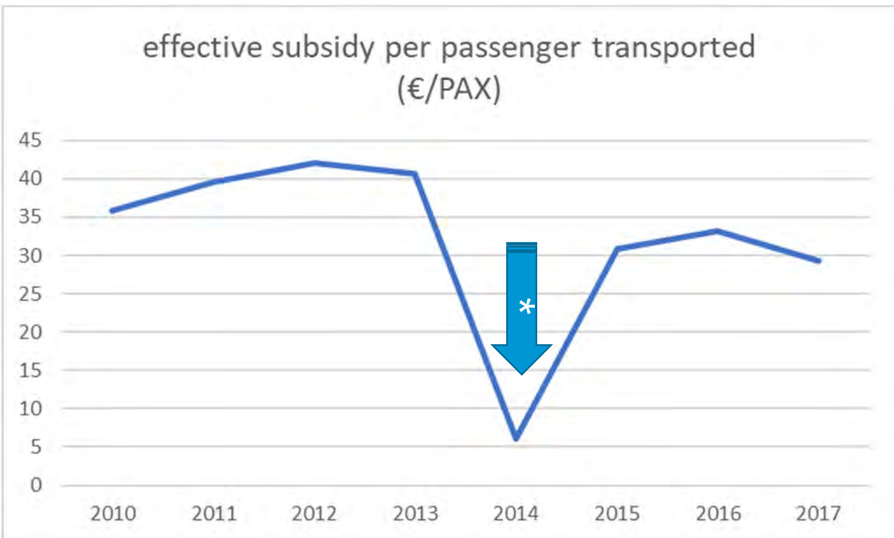


Case Study No. 1
Evolution of the tender process

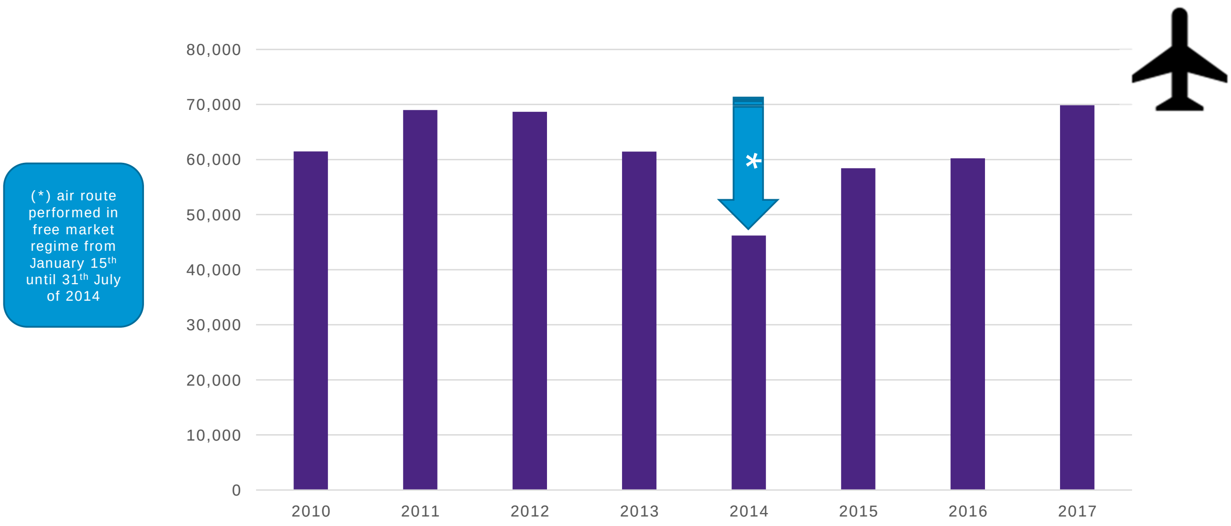


Case Study No. 1
PSO Subsidy

(*) air route performed in free market regime from January 15th until 31th July of 2014



Case Study No. 1
Carried passengers from 2010 to 2017



Case Study No. 1
Emissions

Means of transport	Standard equipment (most used on route)	Engines	Fuel Burn/ journey	Emissions CO_2/journey	Emissions CO_2/journey per passenger*
	Bombardier CRJ-200ER	2 x General Electric CF34-3B1 turbofans	1,540.05 liters (Jet A1) **	4,475 kg.	89.5 kg. / PAX
	CAF RENFE599	Diesel, 4 x MAN D2876 LUE623	908.83 liters (Diesel)	1,175.09 kg.	6.22 kg. / PAX
	Setra S 417 HDH	MB OM 457 LA, Euro V, BlueTec®	119.56 liters (Diesel)	301.30 kg.	6.03 kg. / PAX

(*) When the seating capacity is fully occupied (PLF=100%); (**) At ISA (15° C), the Jet A1 density is 0.804 kg/l, when the aircraft fuel burn is 1,238.20 kg. *Source: author original*

Public transport system connecting Badajoz and Madrid (Spain)

Case Study No. 2

WIRTSCHAFTS UNIVERSITÄT WIEN VIENNA UNIVERSITY OF ECONOMICS AND BUSINESS

A case of PSO imposition (type 3) on peripheral territory in the mainland of an EU Member State, even when alternative means of public transport exist

EFMD EQUIS ACCREDITED · AACSB ACCREDITED · AMBA ACCREDITED

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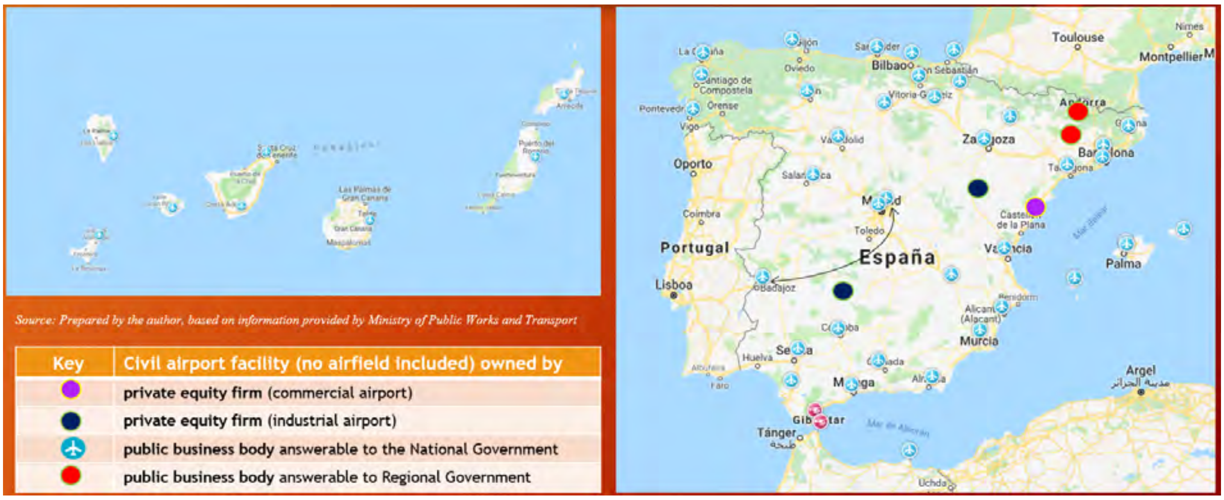
Case Study No. 2
Location

WIRTSCHAFTS UNIVERSITÄT WIEN VIENNA UNIVERSITY OF ECONOMICS AND BUSINESS



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Case Study No. 2
Airports

LEBZ / BJZ Aeropuerto de **Badajoz**	LEMD / MAD Aeropuerto **Adolfo Suárez Madrid-Barajas**
	

Case Study No. 2
Transportation system

Carriers on the route BJZ-MAD	Means of transport	Travel distance (km.)	Travel time (h.)	Intermediate stops	Daily frequencies per leg	Maximum / Minimum Fare (€)
IBERIA REGIONAL AIRNOSTRUM		331.5	1:00	0	2	90 / 25
renfe		458.1	5:08 - 5:53	12-16	2	41.90 / 25.15
avanza MOBILITY ADO		399.1	4:40 - 5:50	2 - 34	8	44.90 / 31.83

Case Study No. 2
Equipment

Photo by courtesy of Air Nostrum

Photo credit: AVANZA

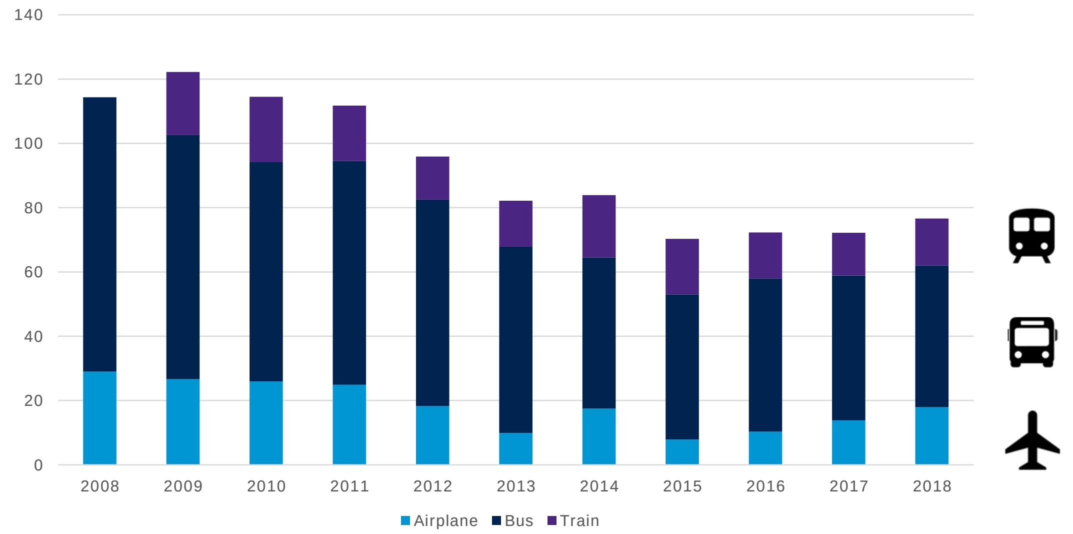
Photo by courtesy of RENFE

Case Study No. 2
Carriers

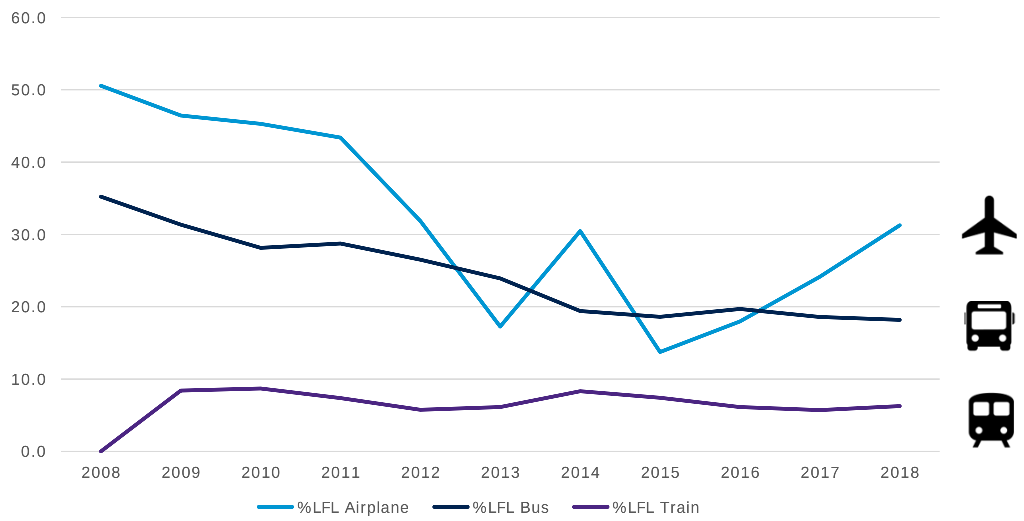
Operating company	Type of legal entity	Parent / undertaking Company	Operation License
IBERIA REGIONAL AIRNOSTRUM	private equity firm	AIR NOSTRUM	
renfe	public business body answerable to the Spanish Ministry of Public Works	GOBIERNO DE ESPAÑA MINISTERIO DE FOMENTO	
avanza MOBILITY ADO	private equity firm	ADO	

Source: authors' compilation

Case Study No. 2
Thousands of passengers carried (2008-2018)



Case Study No. 2
Yearly PLF (%) from 2008 t0 2008



Case Study No. 2
Emissions

Means of transport	Standard equipment (most used on route)	Engines	Fuel Burn/ journey	Emissions CO_2/journey	Emissions CO_2/journey per passenger*
(airplane)	Bombardier CRJ-200ER	2 x General Electric CF34-3B1 turbofans	1,600.39 liters (Jet A1) **	4,650 kg.	93.0 kg. / PAX
(train)	CAF RENFE598	Diesel, 4 x MAN D2876 LUE605	1007.82 liters (Diesel)	2,593.12 kg.	14.01 kg. / PAX
(bus)	IRIZAR i6	DAF MX340, Euro V	119.73 liters (Diesel)	301.30 kg.	6.55 kg. / PAX

(*) When the seating capacity is fully occupied (PLF=100%); (**) At ISA (15°C), the Jet A1 density is 0.804 kg/l, when the aircraft fuel burn is 1,238.20 kg.

Source: author original

Final comment: Optimal aircraft on this PSO route

ATR 72-600 (72-212A)

CRJ-200ER (CL-600-2B19)

Final comment: Turboprop vs Turbofan

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Aircraft	Config	Trip time [hh:mm]	CO_2 Emissions [kg]	Emissions CO_2/PAX [kg]
ATR72-600	Y72	1:05	2612	36.3
CRJ-200	Y50	0:45	4778	95.6

Assumptions: Orthodromic distance as of 354 km; Jet A1 density as of 0.804 kg/l (ISA).
CO_2 emissions: 3.15 kg of CO_2 per kg of Jet A1.
En-route assumptions: Max. Payload, No Wind, ISA, JAR / EASA.

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Acknowledgments

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ALSA

BOMBARDIER

ATR

renfe

aena

JUNTA DE EXTREMADURA

European Commission

GOBIERNO DE ESPAÑA

MINISTERIO DE FOMENTO

JUNTA DE ANDALUCIA

CONSEJERÍA DE FOMENTO Y VIVIENDA

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Appendix 5.3

A CASE STUDY OF A PSO IMPOSED ON A THIN ROUTE FOR DEVELOPMENT PURPOSES

How do Public Service Obligations affect transportation for less developed regions of the European Union: The case of scheduled air services between Badajoz and Barcelona

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How do Public Service Obligations affect transportation for less developed regions of the European Union: The case of scheduled air services between Badajoz and Barcelona

Speaker: Antonio Martínez Raya

UNED Facultad de Ciencias Económicas y Empresariales

Version 1.0

1

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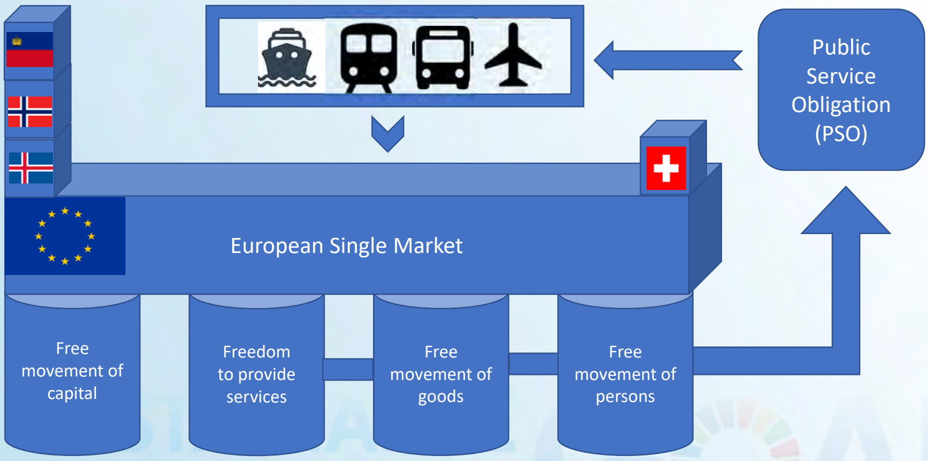
Introduction: The four cornerstones of the European Single Market



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Source: Own elaboration

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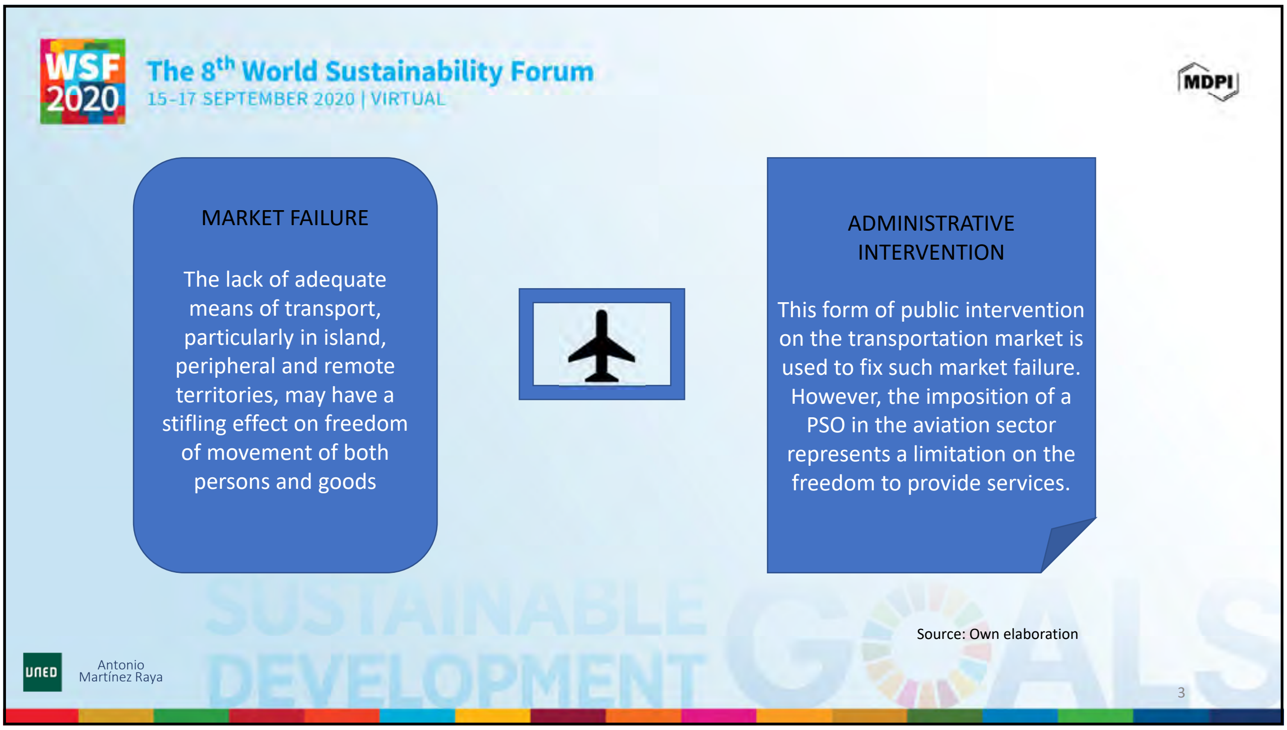
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MARKET FAILURE
The lack of adequate means of transport, particularly in island, peripheral and remote territories, may have a stifling effect on freedom of movement of both persons and goods
ADMINISTRATIVE INTERVENTION
This form of public intervention on the transportation market is used to fix such market failure. However, the imposition of a PSO in the aviation sector represents a limitation on the freedom to provide services.
Source: Own elaboration
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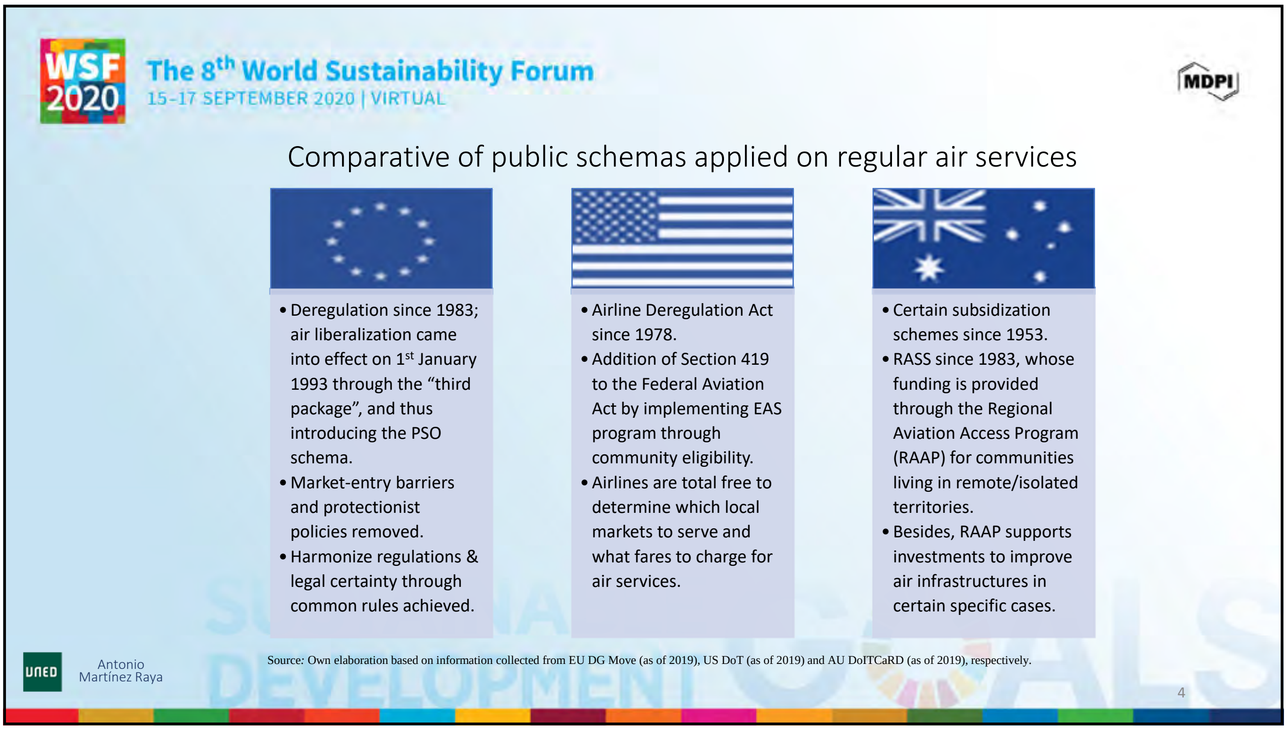
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Comparative of public schemas applied on regular air services
• Deregulation since 1983; air liberalization came into effect on 1st January 1993 through the "third package", and thus introducing the PSO schema.
• Market-entry barriers and protectionist policies removed.
• Harmonize regulations & legal certainty through common rules achieved.
• Airline Deregulation Act since 1978.
• Addition of Section 419 to the Federal Aviation Act by implementing EAS program through community eligibility.
• Airlines are total free to determine which local markets to serve and what fares to charge for air services.
• Certain subsidization schemes since 1953.
• RASS since 1983, whose funding is provided through the Regional Aviation Access Program (RAAP) for communities living in remote/isolated territories.
• Besides, RAAP supports investments to improve air infrastructures in certain specific cases.
Source: Own elaboration based on information collected from EU DG Move (as of 2019), US DoT (as of 2019) and AU DoITCaRD (as of 2019), respectively.
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Background: Similar schemes in other areas

Subsidy schemes of regular air transport	Public Service Obligations (PSO)	Essential Air Service (EAS)	Remote Air Services Subsidy (RASS)
Scope of application			
Additional scope		n/a	n/a
Air routes served	176 in 14 EU Member States as of Sept. 18, 2019	111 communities in 35 States and 63 communities in Alaska as of Sept. 1, 2018	372 communities in 10 regions as of Sept. 17, 2017
Eligible air services	Peripheral or development region, or even thin route	Peripheral region and small communities	Communities in remote and isolated areas
Main purpose	Transportation of passengers through the imposition of PSO on scheduled air services	Transportation of passengers on EAS communities	Transportation of passengers and delivery of essential supplies on RASS communities
Funding	244 in millions of EUR as of Sept. 27, 2018	288 in millions of USD as of Sept. 1, 2018	18 in millions of AUD as of Sept. 17, 2017
Contract duration	Limited to 4 (or 5) years, without any extension	Up to 2 or 4 years	2 years with possible extension to 2 years
Ultimate authority	European Commission on behalf of EU Member States	US Department of Transport	AU Department of Infrastructure, Transport, Cities and Regional Development

Source: Own elaboration based on data collected from EU DG Move (as of 2019), US DoT (as of 2019) and AU DoITCaRD (as of 2019), respectively.

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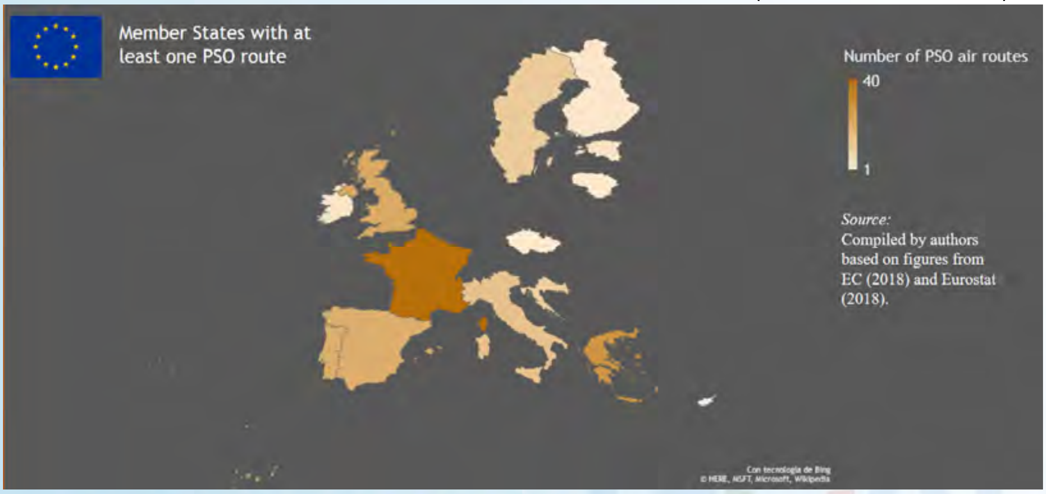
PSO schema: Overview (as of 27/09/2018)



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Background: PSO schema in the EU Single Market

Free market regime (type 0)	Open PSO with certain limitations (type 1)	Closed PSO without any compensation (type 2)	Closed PSO with compensation (type 3)
• Freedom to operate flights on regular routes within internal market on basis of slot coordination (EU AOC carrier only)	• No barrier to entry on the routes concerned • Maximum fares • Minimum No. of frequencies, and of annual seats required	• Exclusivity to a single operator • No subsidy • Maximum fares • Minimum No. of frequencies, and annual seats required	• Exclusivity to a single operator • Subsidy to compensate the operating costs • Maximum fares (typically) • Minimum No. of frequencies, and annual seats required

In all cases, the imposition and design of a PSO must meet the criteria set out in Art. 16-18 of the Regulation (EC) N° 1008/2008

Source: Own elaboration

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PSO schema in the EU Single Market

176 PSO air routes	open PSO with certain limitations (type 1)	closed PSO without any compensation (type 2)	closed PSO with economic compensation (type 3)
France (37)	9	0	28
Greece (28)	11	3	14
United Kingdom (22) [a]	0	0	22
Portugal (20)	4	0	16
Spain (23)	14	0	9
Italy (11)	0	2	9
Sweden (11)	0	0	11
Croatia (10)	0	0	10
Estonia (3)	0	0	3
Ireland (3)	0	0	3
Finland (3)	0	0	3
Cyprus (1)	1	0	0
Czech Republic (3)	3	0	0
Lithuania (1)	0	0	1

Source: Own elaboration based on data from DG MOVE (as of September 2019). Note: a) The UK ceased to be a member of the EU on 31/1/2020.

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PSO system: Funding for the EU schema (as of 27.09.2018)

Country	PSO impositions	Unsuccessful tender (U) / Not operated (N) / Cancelled (C)	PSO routes as restricted to one carrier (type 2 & 3)	Total amount (€) of annual compensation
France	40	5 (N)	25	94,094,094.32
Greece	28	none	17	8,419,886.75
United Kingdom	22	none	22	14,476,746.30
Portugal	20	none	16	29,756,961.20
Spain	20	none	9	3,950,956.50
Italy	14	3 (U)	14	52,082,826.55
Sweden	11	none	11	13,674,266.00
Croatia	10	none	10	12,589,832.08
Ireland	3	none	3	8,028,034.00
Estonia	3	none	3	2,601,766.00
Finland	2	none	2	3,223,268.67
Cyprus	1	none	n/a	n/a
Czech Republic	1	1 (C)	1	1,486,480.00
Lithuania	1	none	1	N/A
TOTAL EU	176	9	132	244,385,118.37

Source: Authors, based on information from DG MOVE (as of September 2018)

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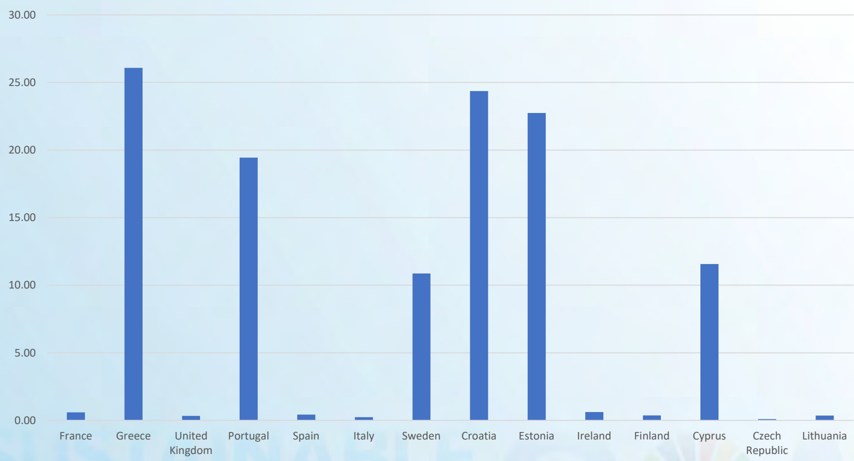
PSO system: Number of PSO air routes per million inhabitants (as of 27/09/2018)



Source: Own elaboration based on data provided from DG MOVE (2018) and Eurostat (2018)

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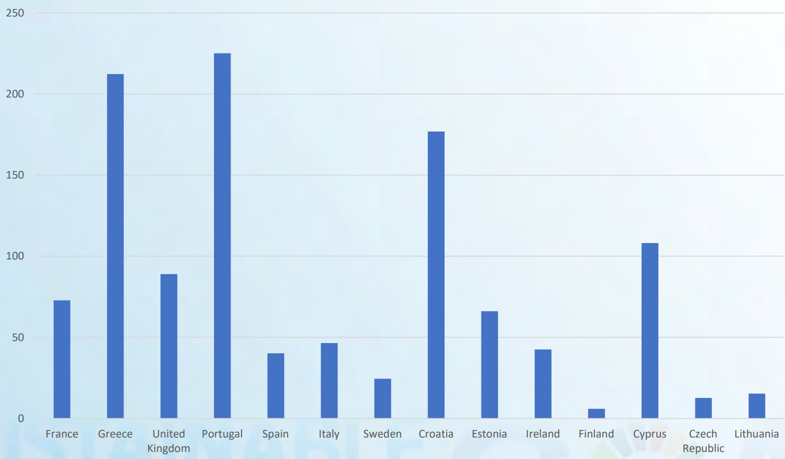
PSO system: Number of PSO air routes per total area [Mm2] (as of 27/09/2018)



Source: Own elaboration based on data provided from DG MOVE (2018) and Eurostat (2018)

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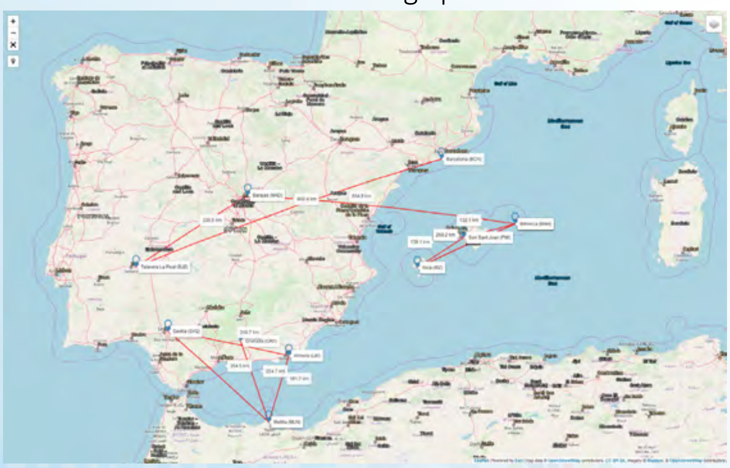
PSO schema imposed on scheduled air services serving Spanish Mainland



Source: Authors, based on information from DG MOVE (as of 2019) and MITMA (as of 2019). Prepared with FreeMapTools.com

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PSO schema imposed on scheduled air services serving the Balearic Islands (Spain)

Source: Authors, based on information from DG MOVE (as of 2019) and MITMA (as of 2019). Prepared with FreeMapTools.com

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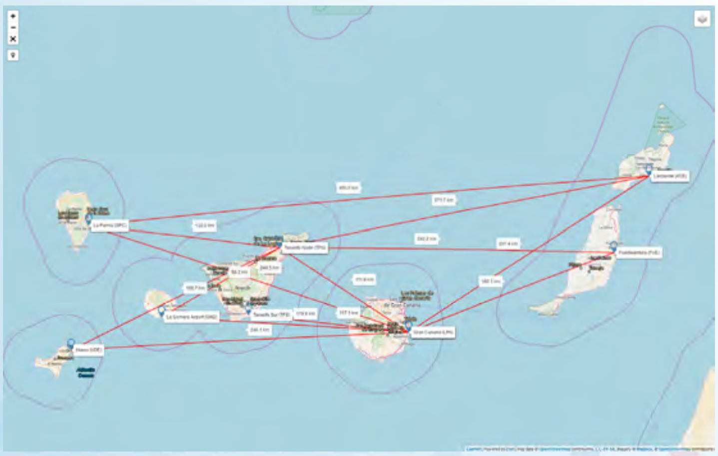
PSO schema imposed on scheduled air routes serving the Canary Islands (Spain)



Source: Authors, based on information from DG MOVE (as of 2019) and MITMA (as of 2019). Prepared with FreeMapTools.com

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PSO imposition on regular air route BJZ-BCN

Source: Own work based on information provided by airport authorities operating in Spain

Key	Air facilities whose passenger operations are managed by
	a public equity firm (heliport)
	a private equity firm (airport)
	a public business body answerable to the National Government (airport)
	a public business body answerable to a regional government (airport)

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DEVELOPMENT GOALS

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Case study: Means of public transport linking Badajoz with Barcelona

Aircraft type, CRJ200, primarily operated on air route Badajoz-Barcelona as of 2019 (photo courtesy of Air Nostrum)

Bus type, Irizar i6, primarily operated on express bus service Badajoz-Barcelona as of 2019 (photo courtesy of Avanza)

Train type, RENFE599, primarily operated on rail route Badajoz-Barcelona as of 2019 (photo courtesy of RENFE)

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DEVELOPMENT GOALS

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Carrier	Type of legal entity	Parent / undertaking company	Operation License
IBERIA REGIONAL AIRNOSTRUM	private equity firm	AIR NOSTRUM	
renfe	**public business body** answerable to the Spanish Ministry of Transport, Mobility and Urban Agenda (MITMA)	GOBIERNO DE ESPAÑA MINISTERIO DE TRANSPORTES, MOVILIDAD Y AGENDA URBANA	
avanza MOBILITY ADO	private equity firm	MOBILITY ADO	

Source: Own elaboration

Comparison chart between two Spanish regions

Airport (IATA code) [ICAO code]	Catchment Area [as of 2019]	Population concerned [as of 2019]	GDP (€) per capita [2019 (P)]	Activity rate [2019]	Area (km²)
Badajoz (BJZ) [LEBZ]	Extremadura region *	1,062,797 inhabitants	19,432	55.7	41,634
Barcelona (BCN) [LEBL]	Catalonian region	7,609,499 inhabitants	31,110	61.4	32,108

(*) As its GDP per inhabitant was less than 75 % of the EU average (as of 2019), Extremadura has been considered a less developed region in the EU.

Source: Compiled by authors based on figures from INE and AENA (as of December 2019).

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Case study: Scheduled transport services on air route BJZ-BCN

Airline	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
YW		●	●	●	●	●	●	●					●	●	●	○	○	○
UX										●[b]	●	●						
H9									●	●[a]								

Source: Own work. Explanatory note: Black circle "●" denotes the existence of a free regime market with only one carrier operating scheduled passenger transport services on air route BJZ-BCN, while black circle "o" indicates the existence of a PSO under type 3 imposed on air route concerned. Additional notes: a) Removed on 11 February 2013; b) Launched on 1 July 2013. Airline Designator IATA codes: **AIR NOSTRUM** LÍNEAS AÉREAS DEL MEDITERRÁNEO, S.A.U. (YW); **AIR EUROPA** LÍNEAS AÉREAS, S.A.U. (UX); **Helitt** Líneas Aéreas S.A., in liquidation since 2014 (formerly H9).

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Summary of public contracts for passenger air services serving the Badajoz airport since 2004

Key	Contract reference	Airline operating	Contract purpose	Tender budget	Award amount	Contract duration
α	06PR0409	YW	Advertising	€3,200,000	€3,196,000	1.5 years
β	PRI0410048	YW	Advertising	€4,100,000	€4,096,634	1.5 years
γ	PRI0512009	H9	Advertising	€4,096,000	€1,800,000	1 year [b]
δ	SER0313063	UX	Advertising	€4,200,000	€4,000,000	2 years
ε	1516SE1CA711	YW	Advertising	€2,420,000	€2,117,500	1 year
ζ	1881SE1CA070	YW	Advertising	€2,468,400	€2,468,400	1 year
η	123A18 [a]	YW	PSO	€14,000,000	€10,500,000	3 years [c]

Source: Own work based on information collected from tender dossiers concerned. Explanatory note: a) Only applicable in regular services relating to PSO air routes ES19 and ES20; b) Although the contract had originally been awarded for 2 years, the failure of certain contractual service obligations from the airline operating resulted in early termination of the contract from the regional government according to article 49 of the Spanish Public Sector Contracts Law; c) Ongoing contract (as of September 2020).

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Operating regime of scheduled air services on air route BJZ-BCN since 2004

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2004	●	●	●	●	●	●	●	●	●	●	●	●
2005	●	●	●	●	●	●	●	●	●	●	●	●
2006	●	●	●	●	●	α	α	α	α	α	α	α
2007	α	α	α	α	α	α	α	α	α	α	α	α
2008	●	●	●	●	●	●	●	●	●	●	●	●
2009	●	●	●	●	●	●	●	●	●	●	●	●
2010	●	●	●	●	●	β	β	β	β	β	β	β
2011	β	β	β	β	β	β	β	β	β	β	β	β
2012	●	■	●	●	●	γ	γ	γ	γ	γ	γ	γ
2013	γ	γ	γ■	γ■	γ■	γ■	●	δ	δ	δ	δ	δ
2014	δ	δ	δ	δ	δ	δ	δ	δ	δ	δ	δ	δ
2015	δ	δ	δ	δ	δ	δ	δ	■	■	■	■	■
2016	■	●	●	●	●	ε	ε	ε	ε	ε	ε	ε
2017	ε	ε	ε	ε	ε	ε	●	●	●	●	●	●
2018	●	●	●	ζ	ζ	ζ	ζ	ζ	ζ	ζ, η	ζ, η	ζ, η
2019	ζ, η	ζ, η	ζ, η	ζ, η	η	η	η	η	η	η	η	η
2020	η	η	η	η	η	η	η	η	η	η	η	η
2021	η	η	η	η	η	η	η	η	η	η		

Source: Own work based on information collected from AENA database and tender dossiers concerned. Explanatory note: Black circle "●" denotes the presence of a free regime market with at least one air carrier operating without any public contract, while black square "■" indicates the absence of air carriers concerning regular air services.

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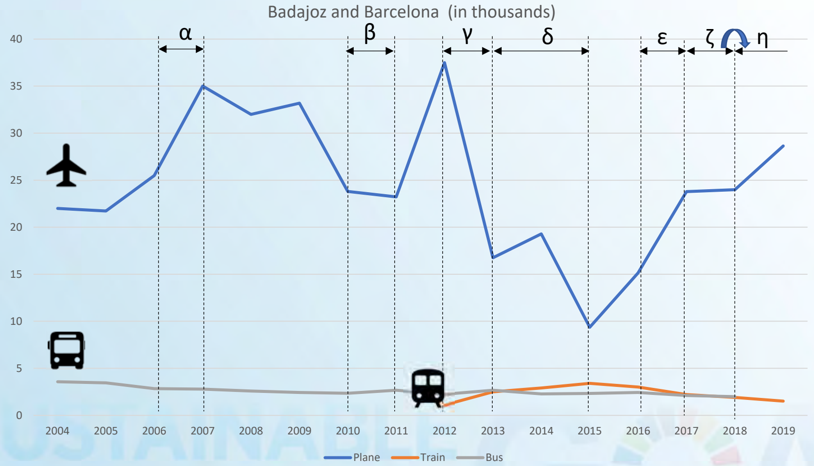
MDPI

Annual number of passengers carried on scheduled transport services between Badajoz and Barcelona (in thousands)



Source: Own elaboration based on data provided, among others, by RENFE, AENA, and MITMA. Note: No data available for rail transport in the period 2004-2011. No data available for bus transport in 2019

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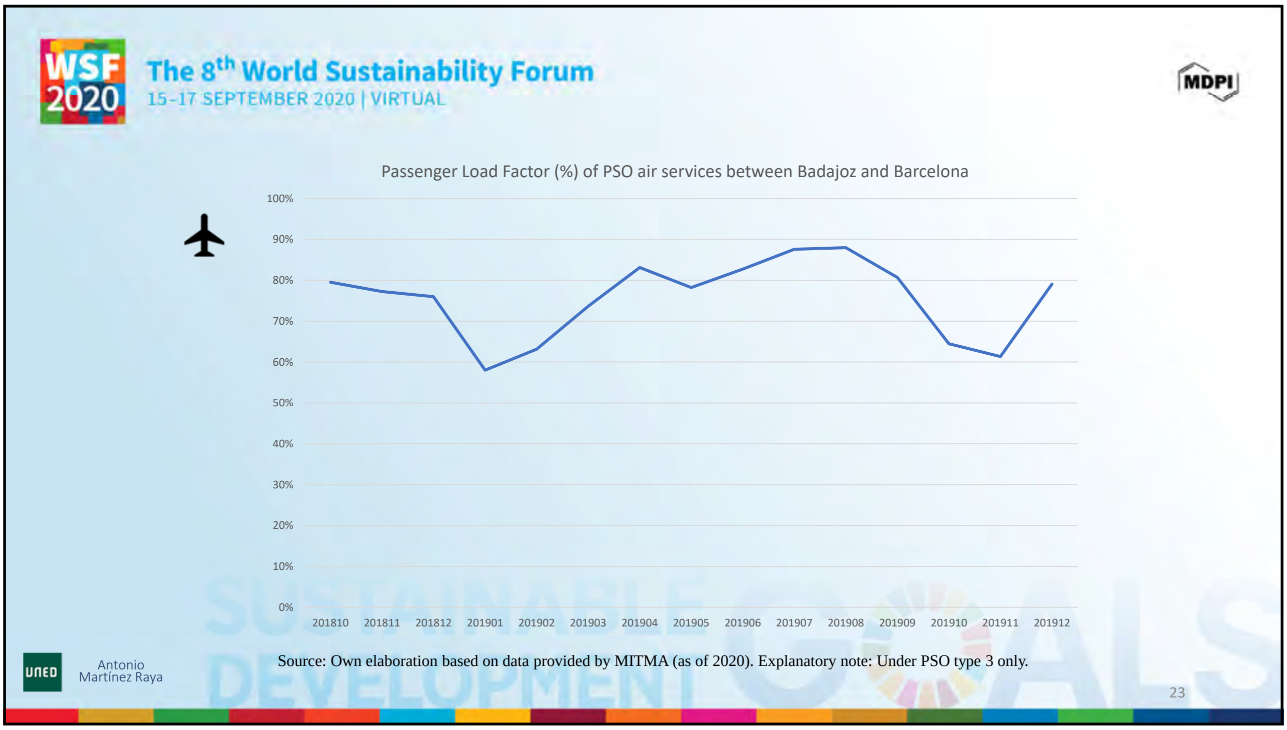
WSF 2020
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MDPI
Passenger Load Factor (%) of PSO air services between Badajoz and Barcelona
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
201810 201811 201812 201901 201902 201903 201904 201905 201906 201907 201908 201909 201910 201911 201912
Source: Own elaboration based on data provided by MITMA (as of 2020). Explanatory note: Under PSO type 3 only.
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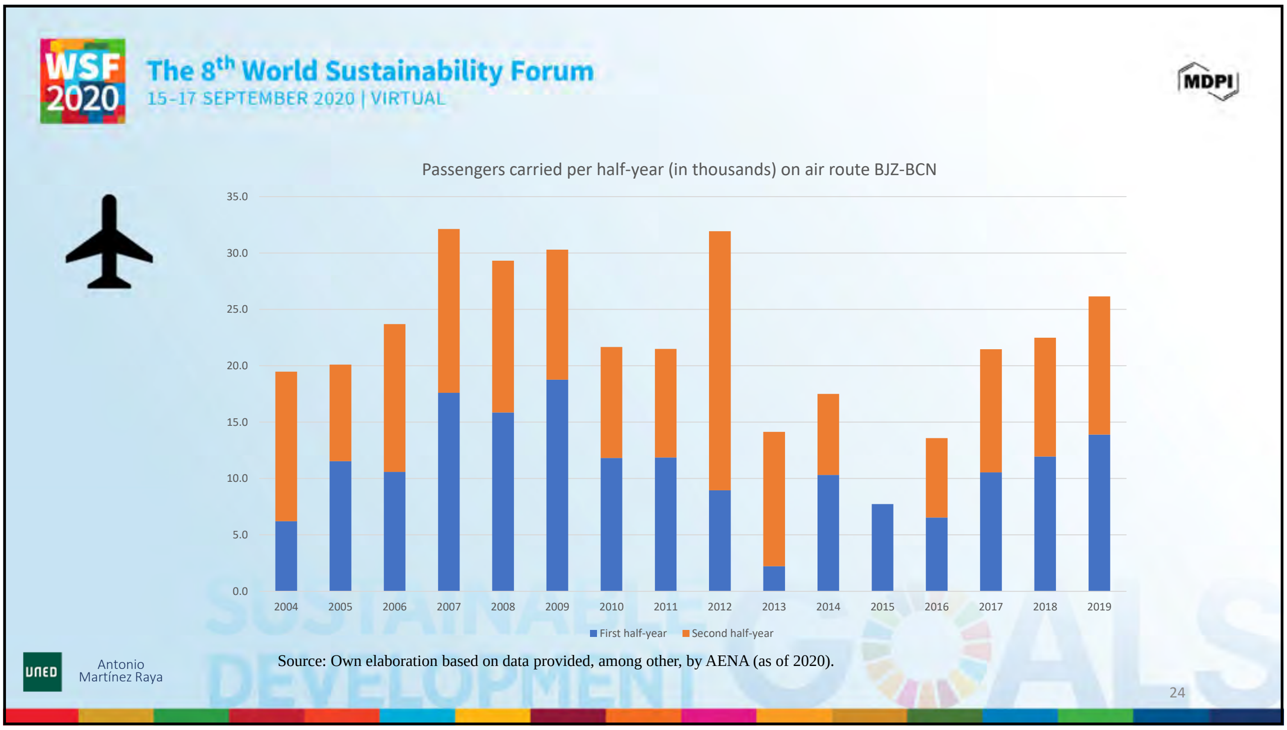
WSF 2020
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MDPI
Passengers carried per half-year (in thousands) on air route BJZ-BCN
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
First half-year
Second half-year
Source: Own elaboration based on data provided, among other, by AENA (as of 2020).
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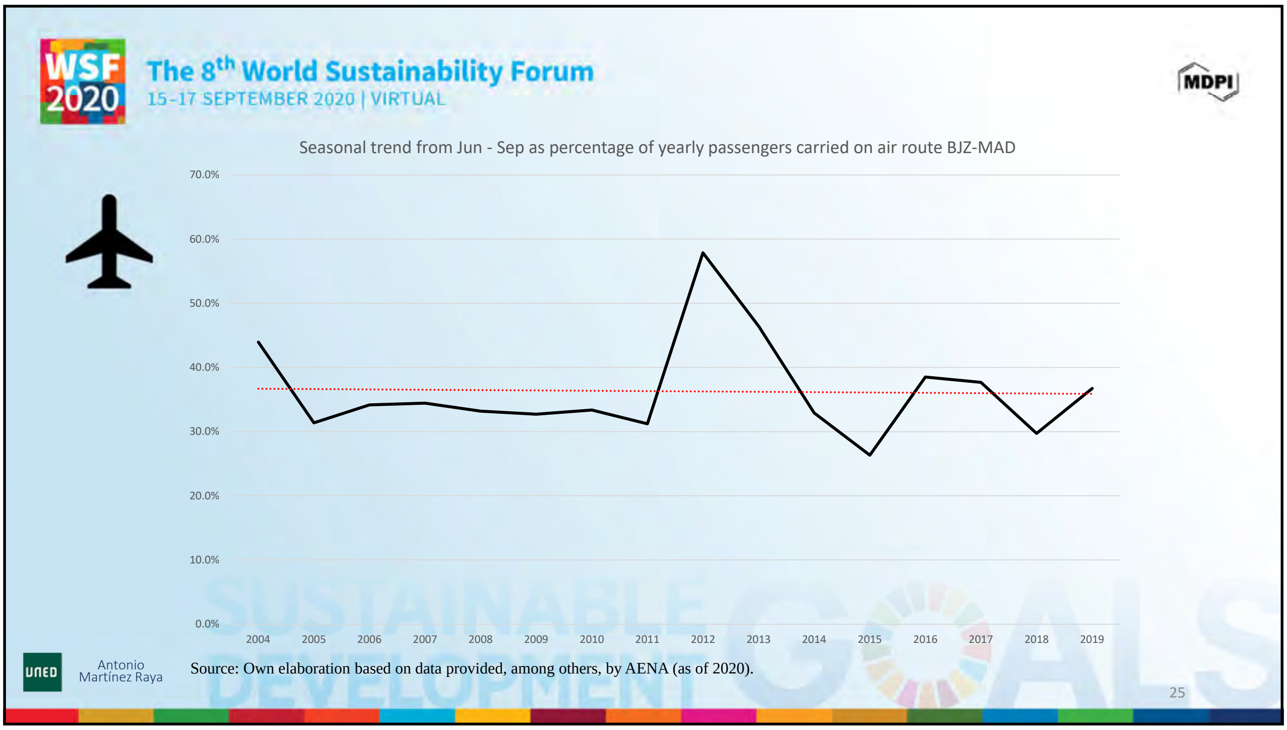
WSF 2020
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MDPI
Seasonal trend from Jun - Sep as percentage of yearly passengers carried on air route BJZ-MAD
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
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Source: Own elaboration based on data provided, among others, by AENA (as of 2020).
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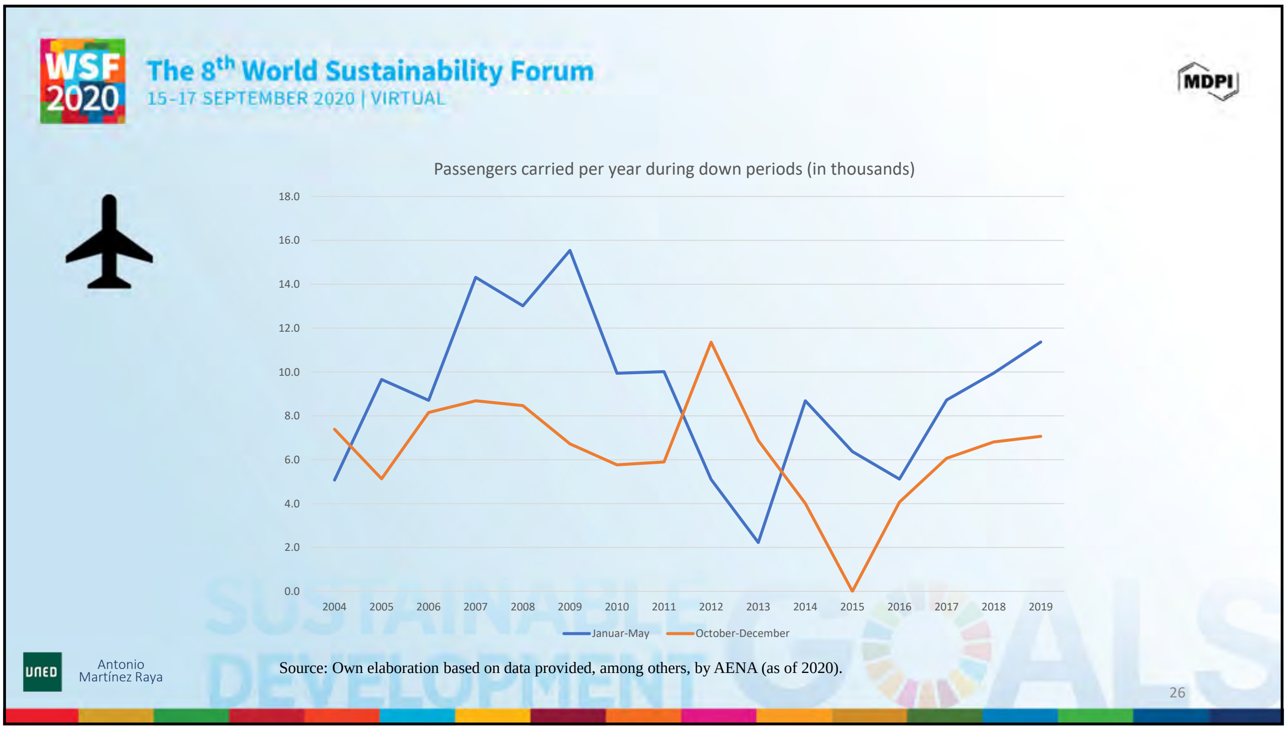
WSF 2020
The 8th World Sustainability Forum
15-17 SEPTEMBER 2020 | VIRTUAL
MDPI
Passengers carried per year during down periods (in thousands)
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
Januar-May
October-December
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Source: Own elaboration based on data provided, among others, by AENA (as of 2020).
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Source: Own elaboration based on data provided, among others, by AENA (as of 2020).

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Means of transport	Standard equipment mostly operated on route	Engines	Block fuel/ journey	Emissions CO_2/journey	Emissions CO_2/journey per passenger
	Mitsubishi (formerly Bombardier) CRJ-200ER	2 General Electric CF34-3B1 turbofans	3,873.78 liters [ii] (Jet A1)	9,810.73 kg.	196.21 kg. / PAX
1st leg	CAF RENFE S599	4 MAN D2876 LUE623	908.83 liters (Diesel)	1,175.09 kg.	6.22 kg. / PAX
2nd leg	Talgo/Bombardier RENFE S102/112	8 phase asynchronous motors 1.000 kW	0 (Electric drive)	n/a	11.18 kg / PAX *
	SCANIA Irizar i6	DAF MX340, Euro V	307.65 liters (Diesel)	821.43 kg.	17.11 kg. / PAX

Source: Own calculation based on data provided, among others, by RENFE and MITMA. Assumption: As PLF of 100% except in *. Note: Since 1 March 2018 there is a daily transport service operated with TALGO VI. (*): Whereas the total power consumption of the train, concerning average value of PLF on high speed railway Madrid-Barcelona in 2018.

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Mode of Transport	Route type (IATA code, if applicable)	Path	Features
Air	Orthodromic airway: Badajoz (BJZ) – Barcelona (BCN)	804 km, 68° (ENE)	BJZ: 13/31 (runway) BCN: 07L/25R, 07R/25L, 02/20 (runways)
Rail 1st leg	Conventional railway: Badajoz (BQZ) – Madrid Atocha (XOC)	458.10 km	not electrified, 1,668 mm (gauge)
Rail 2nd leg	High-speed railway: Madrid Atocha (XOC) – Barcelona Sants (YJB)	649 km	25 kV AC, 1,435 mm (gauge)
Road	Highway: Badajoz – Barcelona (XJB)	1,025.5 km	A-5 and A-2 (belonging to E90)

Source: Own elaboration

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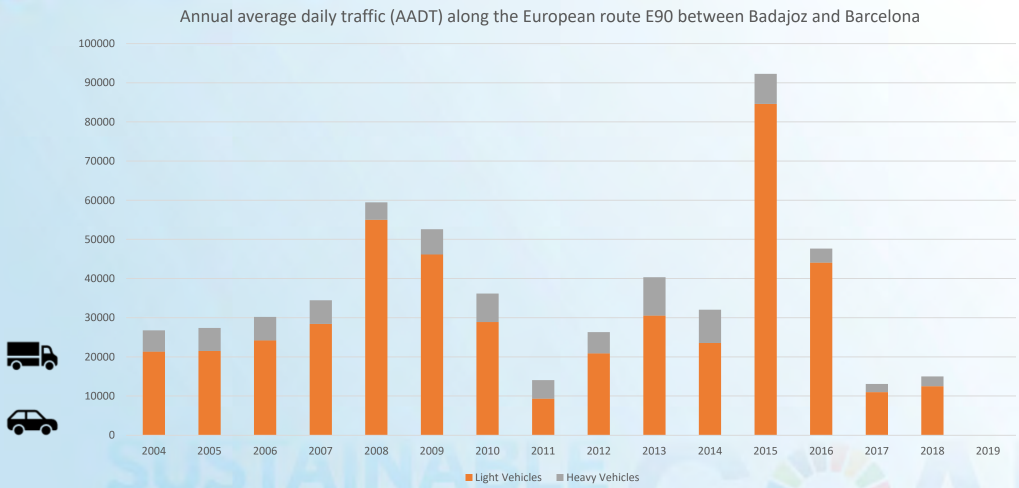

Source: Own elaboration based on data expressly provided by the MITMA for research purposes. Explanatory notes: The route between Badajoz and Barcelona comprises two national highways in Spain, Badajoz-Madrid and Madrid-Barcelona (A-5 and A-2, respectively). No data were received for 2019.

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Features	Average diesel car	Average petrol car	Average petrol hybrid car
Seats	5	5	5
Travel time	9:36	9:36	9:36
Travel distance (km) [1]	1029	1029	1029
Total fuel consumption (l) [2]	57.62	57.62	49.72
Fuel cost of a trip (€) [3]	59.83	65.69	56.68
Fuel cost per person (€) [4]	14.96	16.42	14.17
CO_2 Emissions (kg) [5]	173.32	179.35	118.93
CO_2 Emissions (kg/pax) [6]	43.25	44.83	29.73
CO_2 Emissions (kg/pax) [7]	128.38	132.85	88.09

[1] On road route along national highways A5 and A-2, which are part of the European highway E90. [2] As 5 liters of fuel burned per each 100km; no jams; average fuel cost (as of August 2020) of 1.0382€/l and 1.1400 €/l for petrol A and unleaded petrol - 95 octane, respectively (Source: BBVA). [3] As two stops for refueling per trip. [4 6] As 4 people with luggage. [5] Calculation based on average values (as of 2019) for diesel car, petrol car, and petrol hybrid car, whose CO_2 emissions are 168.44 g/km, 174.3 g/km, and 115.8 g/km, respectively (Source: CarbonFootprint.com). [7] As average occupation ratio of 1.35 people per vehicle (as of 2019 in Spain).

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Optimal aircraft on PSO air route BJZ-BCN in terms of sustainability: Which one?

ATR 72-600 (72-212A)

(photo courtesy of Air Nostrum)

CRJ-1000 (CL-600-2E25)

(photo courtesy of Air Nostrum)

CRJ-200ER (CL-600-2B19)

(photo courtesy of Air Nostrum)

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Aircraft (IATA code)	Config	Block time [hh:mm]	Block fuel [l]	CO2 Emissions [kg]	CO2 Emissions [kg] per PAX (PLF=100%)	CO2 Emissions [kg] per PAX (PLF=75%) *
ATR72-600 [a] (AT7)	Y72	1:55	1,537.00	3,893.00	54.00	72.09
CRJ-200ER [b] (CR2)	Y50	1:16	3,873.78	9,810.73	196.21	261.61
CRJ-1000 [c] (CRK)	Y100	1:16	3,041.20 [d]	13,808.8	138.10	184.11

[a b c] Assumptions: Orthodromic distance as of 434 nm with heading of 68° (ENE); Jet A1 density as of 0.804 kg/l (ISA). CO_2 emissions: 3.15 kg of CO_2 per kg of Jet A1.
[a] On-route assumptions: Max. Payload, No Wind, ISA, JAR / EASA. On pace. Calculation based on data provided from a study done by the manufacturer (ATR).
[b c] Calculation based on figures from ICAO Carbon Emissions Calculator (as of September 2020).
[c] Currently, a CRK is being operated on the route BJZ-BCN, as weekly frequency has been reduced on such air route due to a drop in demand under COVID-19 pandemic.
[d] Aircraft Fuel Burn per leg.
(*) Extrapolated calculation to the PLF average value in 2019 on PSO air route BJZ-BCN.

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Conclusion

Advantages

- PSO impositions enhance transportation in the absence of adequate means of transport, even when these routes are not commercially viable.
- The imposition of PSO is a growing instrument in which there is a room for medium-sized air carriers, even for entrepreneurial companies.
- PSO schema may stimulate demand for domestic routes, but also considered vital for the economic development in peripheral or isolated areas.

Disadvantages

- PSO policies may ultimately be ineffective in controlling airfares.
- Neither low-cost carriers nor charter air carriers have traditionally been interested in taking part in PSO bidding procedures.
- A low number of air carriers have been submitting bids for PSO call-for-tenders.
- The uncoordinated application of this instrument led to imbalances in the level and provision of air services in small and remote areas.

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Acknowledgments

renfe
aena
ATR
JUNTA DE EXTREMADURA
GOBIERNO DE ESPAÑA
MINISTERIO DE TRANSPORTES, MOVILIDAD Y AGENDA URBANA
European Commission

Thanks for your attention

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Thanks for your attention!

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Appendix 5.4

A CASE STUDY OF A PSO IMPOSED ON A PERIPHERAL ROUTE FOR DEVELOPMENT PURPOSES

Efficiency and Sustainability of Public Service Obligations (PSO) on Scheduled Air Services Between Almeria and Seville

EFFICIENCY AND SUSTAINABILITY OF PUBLIC SERVICE OBLIGATIONS (PSO) ON SCHEDULED AIR SERVICES BETWEEN ALMERIA AND SEVILLE

Facultad de Ciencias Económicas y Empresariales

Speaker: Antonio Martínez Raya

amartinez@cee.uned.es

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1. Introduction
1.1 EU Single Market in aviation

High degree of assurance on aviation safety and airworthiness

High level of liberalization

Credit: https://ec.europa.eu/transport

Low market-entry barriers

Harmonize regulations & legal certainty through common rules

2

1. Introduction
1.2 Preliminary considerations (I)

- This research aims to take a particular approach by studying various means of transport, such train, bus and air services, depending on the distance to be covered, as key players in resolving certain weaknesses of the transport market.

- Unfortunately, it has not been possible to introduce the concept of intermodal transport on this issue.

1. Introduction
1.3 Preliminary considerations (II)

- This research considers that intermodal transport, such train, bus and air transportation, depending on the distance to be covered, take a particular role as key players in resolving such weaknesses of the transport market.

- In this connection, there are two ways to address the issue of mobility in those remote departments and territories not sufficiently served by scheduled air services: **resident subsidy** and **imposition of PSO**.

1. Introduction
1.4 Particular approach on the topic

- In regard to PSO air routes, there are currently 176 routes (as of 27.9.2018) within the EU single Market in aviation.
- In the Spanish case, **RD 1316/2001**, of 30 November, regulates those subsidies for transport fares on the scheduled shipping and air transportation services for those citizens living in island regions such as Canarias and Balearic, as well as both Autonomous Cities of Ceuta and Melilla.
- Needless to say, this respect has not actually been considered in the present study because there are not similar constraints of insularity.

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1. Introduction
1.5 Key facts

- Spain has placed an important emphasis on promotion towards heavy investment in implementing high-speed railway infrastructures as a way to promote a very fast form of transport.
- Considering the length of high-speed railways, Spain occupies the first place for the whole of the EU with 3,100 kilometers, and the second largest in world after China with 19,369 kilometers.
- However, this fact is part of current negative externalities, since there is no enough capillarity of the transport network to cover a very large of populated areas. This is particularly true for the present case between **Seville and Almeria.**

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1. Introduction
1.6 Overview about the case study

Legende	Airport owned by
(purple dot)	**private equity firm**
(dark blue dot)	**private equity firm** (inactive)
(airport icon)	**public business body** answerable to the National Government
(red dot)	**public business body** answerable to Regional Government

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2. Background
2.1 Legal Framework

- Those air routes declared as PSO on the territory of the European Union must be established and operated pursuant the abovementioned **Regulation (EC) No 1008/2008**, especially as regards Articles 16 and 18 thereof.
- While it is true that the Regulation (EC) No 1008/2008 imposes common rules for the operation of air services in the EU single market, its Member States reserve the right to restrict the freedom of access to the market in certain cases covered by above-mentioned regulation. Sure enough, among other relevant facts, PSO services are included.

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2. Background
2.1 Market Framework (I)

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EU Member States with PSO routes (as of 27.09.2018)	Number of PSO air routes per million inhabitants
France (40)	0.5950
Greece (28)	26.074
United Kingdom (22)	0.3321
Portugal (20)	19.434
Spain (20)	0.4286
Italy (14)	0.2315
Sweden (11)	10.869
Croatia (10)	24.358
Estonia (3)	22.742
Ireland (3)	0.6201
Finland (2)	0.3628
Cyprus (1)	11.571
Czech Republic (1)	0.0943
Lithuania (1)	0.3560

Source: Compiled by authors based on figures from EC (2018) and Eurostat (2018).

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2. Background
2.1 Market Framework (II)

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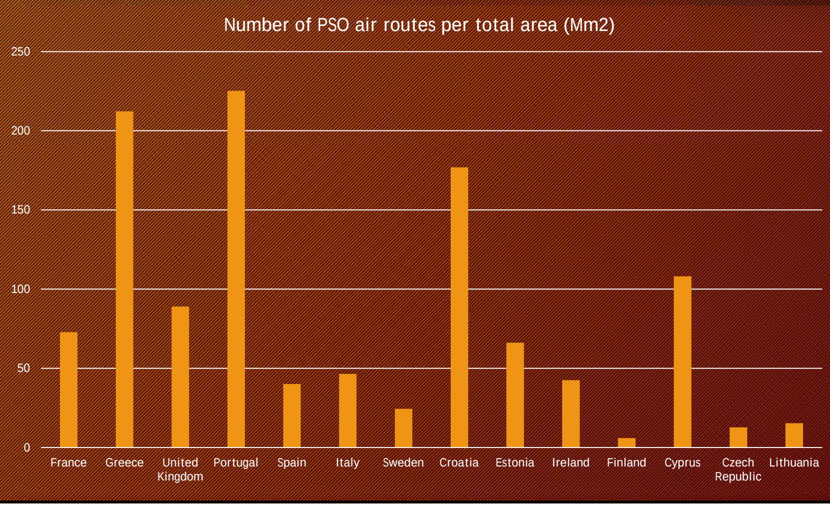

Source: Compiled by authors based on figures from EC (2018) and Eurostat (2018).

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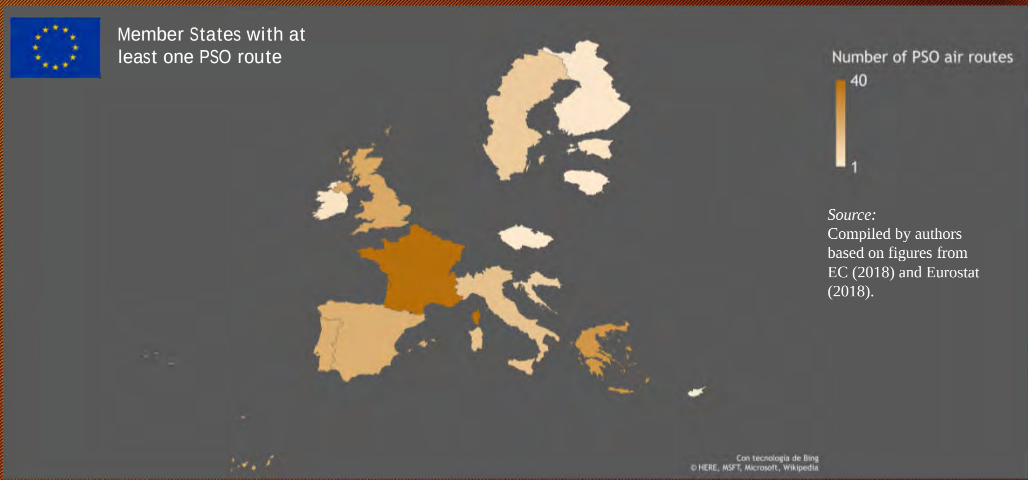
2. Background
2.2 Market Framework (III)



3. Case Study
3.1 Some figures corresponding to both cities

Province / provincial capital (IATA code)	Population [2018]	GDP (€) per capita [2016 (P)]	Activity rate [2019T1]	Area (km2)
Almeria / Almeria (LEI)	709,340	19,097	59.33	8,775
Seville / Seville (SVQ)	1,939,887	19,011	58.75	14,036

Source: Compiled by authors based on figures from INE (as of 12.2018)

3. Case Study
3.2 Key figures about related means of transport

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Carrier on the route SVQ-LEI	Means of transport	Travel distance (km.)	Travel time (h.)	Intermediate stops	Daily frequencies per leg	Base price (2018)
IBERIA REGIONAL AIRNOSTRUM		319	0:55	0	2	130 € (maximum fare)
renfe		456.70	6:48 - 07:10	1 - 5	4	42.2 €
ALSA		429	5:30 - 8:30	1 - 19	4	37.76 €

3. Case Study
3.3 Situational panorama of carriers

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Operating company	Type of legal entity	Parent / undertaking Company	Operation License
IBERIA REGIONAL AIRNOSTRUM	**private equity firm**	AIR NOSTRUM	
renfe	**public business body** answerable to the Spanish Ministry of Public Works	GOBIERNO DE ESPAÑA MINISTERIO DE FOMENTO	
ALSA	**private equity firm**	national express	

3. Case Study
3.4 Timeline of the tendering procedure

EA / YW = YW

YW = YW

YW = YW

15.10.2010 → **332/A09** → 14.01.2014 → **138/A14** → 01.08.2018 → **43/A18** → 01.10.2022

12,000,000 € / 10,525,898 €

9,074,050 € / 8,925,000 €

8,925,000 € / 8,898,226 €

Remarks: Competitive bids = successful submission

Estimated value of the contract (€) / Allotment amount [€]

Source: authors, using data from the Spanish Ministry of Public Works and Transport:

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4. Data and Analysis
4.1 Passenger Load Factor (PLF)

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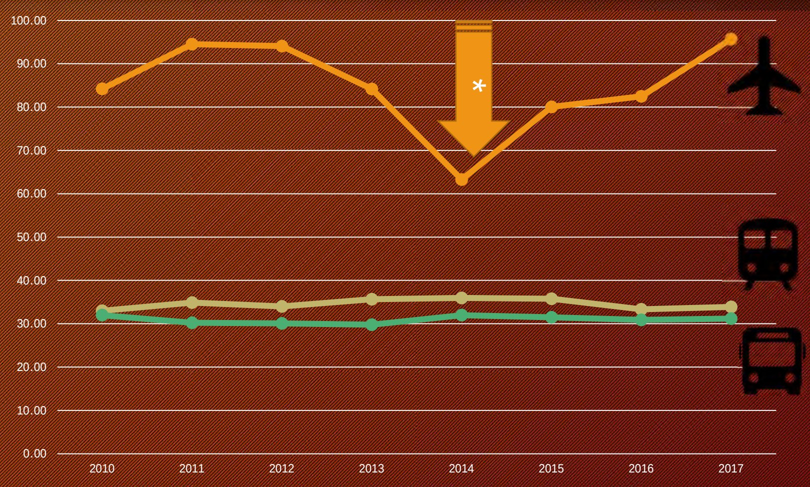
(*) air route performed in free market regime from January 15th until 31th July of 2014



Source: Own elaboration.

4. Data and Analysis
4.2 PAX per year on the route LEI-SVQ-LEI

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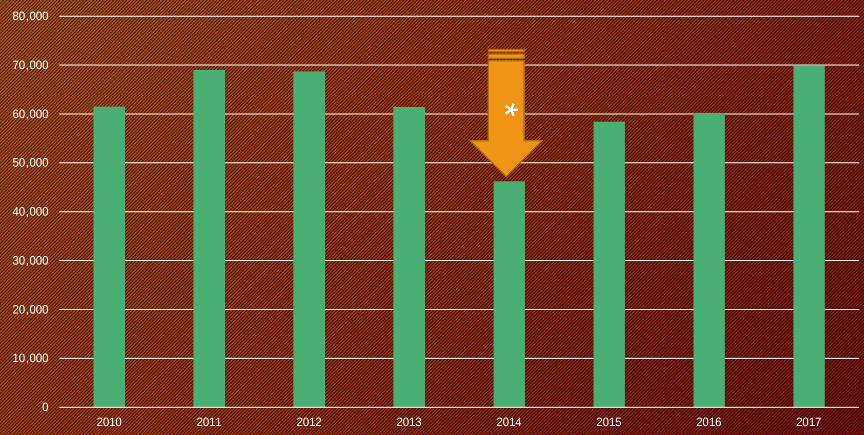
(*) air route performed in free market regime from January 15th until 31th July of 2014



Source: Elaborated by the authors from air traffic data provided by AENA (2018).

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4. Data and Analysis
4.3 Impact of subsidy on the route sustainability

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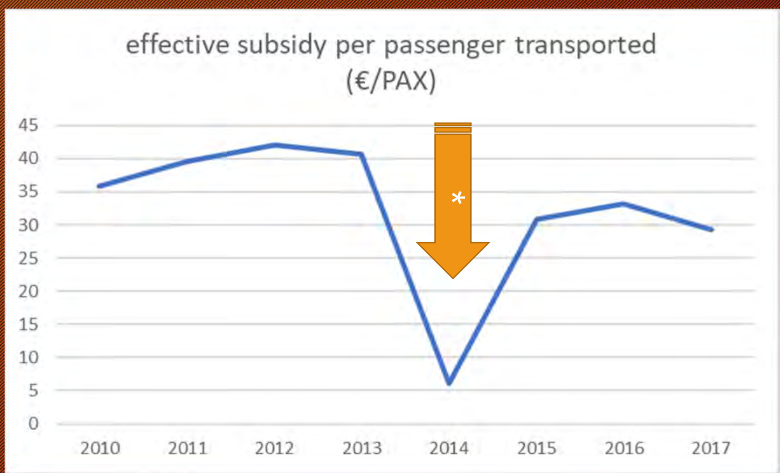
(*) air route performed in free market regime from January 15th until 31th July of 2014



Source: Compiled by authors based on air traffic data provided by AENA (2018) and by the Junta de Andalucía from request No. EXP-2018/00001153-PID@.

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4. Data and Analysis
4.4 Emissions figures

Means of transport	Standard equipment (most used on route)	Engines [d]	Fuel Burn/ journey	Emissions CO_2/journey	Emissions CO_2/journey per passenger*
	Bombardier CRJ-200ER	2 x General Electric CF34-3B1 turbofans	1,540.05 liters [ii] (Jet A1)	4,475 kg.	89.5 kg. / PAX
	CAF RENFE599	Diesel, 4 x MAN D2876 LUE623	908.83 liters (Diesel)	1,175.09 kg.	6.22 kg. / PAX
	Setra S 417 HDH	MB OM 457 LA, Euro V, BlueTec®	119.56 liters (Diesel)	301.30 kg.	6.03 kg. / PAX

(*) Whereas the equipment capacity is fully occupied (PLF=100%).

Source: Own authors

5. Conclusions
5.1 Major findings

Findings

1. PSO are habitually focused on responding to population needs in terms of transportation.
2. Certain EU Member States have embraced the opportunity to give the issue an approach more oriented to provide the territory with a huge infrastructure investment that aims at offering full range of transportation for serving citizens, and even, in the last resort by awarding exclusive rights to operate scheduled services, with or without compensation, but not always oriented toward efficiency in economic terms of the transport system.

5. Conclusions
5.2 Minor findings

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Findings

i) The imposition of this PSO seems to have stimulated a latent demand of air scheduled services between SVQ and LEI.
ii) Thus, this imposition appears to act as a generator of demand for air services on this route.
iii) In addition, it seems not to arise from the other means of public transport such train or bus, but rather from private car.
iv) The most likely reason is that potential users of means of transport between both cities, despite high price sensitivity,
v) Apparently, the decision-making criteria is not only based upon economic, but it is also based on other aspects such as timetables and particularly journey times.

6. Future researches

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Possible topics on which future researches could be focused

1. How long-term sustainability of PSO should require maintaining the balance between subsidy and efficiency in economic terms.
2. How surveys may assist in identifying possible inefficiencies of those routes on exclusive basis such as PSO.
3. How market studies help to discern any requirements not sufficiently covered within the transport system.
4. How corresponding bidding process can be improved. This may also include a methodology for establishing a cost-benefit analysis of new impositions of PSO for selected air routes.

7. Acknowledgments

Appendix 5.5

SOME CONSIDERATIONS ON THE UK'S WITHDRAWAL FROM THE EU CONCERNING THE AIR TRANSPORT INDUSTRY

An approach to legal consequences of the Brexit on European Single Aviation Market

An approach to legal consequences of the Brexit on European Single Aviation Market

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Erasmus+
Funded by the European Union

Antonio Martínez Raya
PhD Candidate
Frankfurt, January 2018

1

I. PRELIMINARY CONSIDERATIONS

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- The present topic of discussion will be embedded as part of my doctoral dissertation, which revolves around consolidation of the EU single market in air transport from a economic and legal perspective.
- Because of Brexit negotiations are currently ongoing, and the invocation of Article 50 of the Treaty of Lisbon (2007) by the United Kingdom of Great Britain and Northern Ireland is an unprecedented event within the EU, and in spite of a growing bibliography, the access to primary sources is one of the main problems facing my research on the topic.
- In addition, because this is a living process, it is not easy to guess its aftermath based on previous experiences.

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II. HISTORICAL CONSIDERATIONS (1 of 2)

Das europäische Gleichweit (Zasche, T.; 1914) KS16320477 © Österreichische Nationalbibliothek (ÖNB)

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III. HISTORICAL CONSIDERATIONS (2 of 2)

Signature of Treaty of Rome (1957) © Getty Images

Signature of Treaty or Lisboa (2007) © Getty Images

4

IV. CONCEPTUAL FRAMEWORK

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"Air transport, which needs a liberalization process that incurs worldwide globalization, has been playing a key role in the consolidation of the single European market. Thus, facilitating two of the four freedoms of the same (free movement of people and goods). This has led to a remarkable expansion of the aviation sector, which is but a result of the passage of an airport services market subject to the rigidity of planned economies, and strongly regulated by the EU-Nation States, to another that is based on market economy, and ultimately overseen by supranational entities." [Excerpt from my draft thesis]

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V. LEGAL FRAMEWORK

UNED

Freedoms of Air → Treaty on Open Skies

Bilateral Agreements | Multilateral Agreements

Picture source: © 2009 - 2011,
Gaceta Aeronáutica (Buenos Aires)

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VI. ESTABLISHMENT

UNED

Relevant Agencies	Membership	Mandate
ICAO · OACI · ИКАО	With the exception of	The International Civil Aviation Organization (ICAO) is an UN specialized agency to manage the administration and governance of the Convention on International Civil Aviation (Chicago, 1944), which is also the basis of Public International Air Law.
EASA European Aviation Safety Agency		This is an agency of the EU that, among other tasks, ensures the highest common level of safety/environmental protection for EU citizens, and whose technical regulation becomes compulsory for all member States.
EUROCONTROL		The European Organization for the Safety of Air Navigation (EUROCONTROL) is an intergovernmental organization that is committed to manage a legislative framework for European aviation through the Single European Sky (SES), which has been launched by the European Commission in order to meet future capacity and safety needs in its Air Traffic Management (ATM).

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VII. CHALLENGES (1 of 5)

UNED

- If no aviation agreement is signed before leaving the EU, which is set for March 29, 2019, the air transport industry find itselves in a "no rights" situation.
- Furthermore, this might lead to restrict the freedom to operate flights between UK and EU-27, and ultimately the suspension of direct flights between both of them.

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VIII. CHALLENGES (2 of 5)

- In order to avoid subsequent problems after Brexit, airlines operating with AOCs issued by UK Civil Aviation Authority is going to register subsidiary companies in member states of the EU-27.
- They can, therefore, obtain an AOC from another national authority within the EU. This enables them to keep their flights under EU law irrespective of the outcome of Brexit negotiations.

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IX. CHALLENGES (3 of 5)

- Because there is a transatlantic Open Aviation Area*, it still remains to be seen whether a extra agreement, similar to that of the "second-stage agreement" for Iceland and Norway, which may include the UK in the US-EU "Open Skies".

* See "Decision 2007/339/EC on the Air Transport Agreement between the EU and its Member States and the United States of America"

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X. CHALLENGES (4 of 5)

- If no aviation agreement is signed before leaving the EU, which is set for March 29, 2019, the air transport industry find itselves in a "no rights" situation. Therefore, this might lead to restrict the freedom to operate flights between UK and EU-27, and ultimately the suspension of direct flights between both of them.

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XI. CHALLENGES (5 of 5)

- In order to avoid subsequent problems after Brexit, airlines operating with AOCs issued by UK Civil Aviation Authority is going to register subsidiary companies in member states of the EU-27. They can, therefore, obtain an AOC from another national authority within the EU. This enables them to keep their flights under EU law irrespective of the outcome of Brexit negotiations.

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XII. PRE-BREXIT SCENARIO

- The aeronautical industry, which includes airlines, airports and plane manufacturers, has enjoyed complete freedom of operations within the single EU aviation market under a common regime to protect the interest of customers and users.
- The EU aviation, British airlines included, due to the common European Single Market, has achieved a prosperous development.
- EASA ensures uniformity in the application of common technical requirements to continuing airworthiness of aeronautical.
- EUROCONTROL, as Network Manager of European ATM, conducts the performance of the European aviation network.
- All current legislation is harmonized within the EU and the air law, therefore, is applied by all EU Member States in their territories.

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XIII. POST-BREXIT SCENARIOS (1 of 3)

- Hard scenario:

If it is not possible to reach an agreement with UK, then the European Commission makes the decision to ensure all the advances into the Single European Skies thanks to SES1 (2004) and SES2 (2009) initiatives, and the SES2+ proposal [see COM(2013) 409 amending Regulation (EC) No 216/2008] as well.

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XIV. POST-BREXIT SCENARIOS (2 of 3)

- Medium scenario:

A compromise solution is arranged through which UK shall continue to assume the current EU legislation, as well as its jurisdiction in the field of aviation, until UK is able to reach their own bilateral agreements based on "Freedoms of the Air" [see *Manual on the Regulation of International Air Transport* (Doc 9626, Part 4)].

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XV. POST-BREXIT SCENARIOS (3 of 3)

- Soft scenario:

UK negotiators, because time to reach an agreement with EU has elapsed or pure pragmatism, arrange the present legislative package related to the single European aviation market, as well as external agreements made by the EU.

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XVI. POST-BREXIT SCENARIOS (Bonus)

- Brexit Over (!):

UK stops the Brexit negotiations, because this is not a viable economic option for any British Government, and therefore, they remain in the EU but probably on worse terms than in the previous situation.

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XVIII. QUESTIONS & FINAL

"History is the sum total of things that could have been avoided"

„Die Weltgeschichte ist auch die Summe dessen, was vermeidbar gewesen wäre", **Konrad Adenauer (1876-1967).**

Thanks for you attention!

CHAPTER 6: COMPLETE BIBLIOGRAPHY

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