Efficiency of airlines: Hub and Spoke versus Point-to-Point

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1. Introduction

Commercial aviation dates back to 1910 when DELAG began providing services linking eight German cities. Air transport was highly regulated by Governments, who controlled flight regularity, the type of aeroplane, the companies permitted to operate together with the routes they operated on. And these decisions were based more on political interests than the actual demand that existed in the market. Governments monopolised domestic flights, bilateral agreements existing for international flights. This scenario resulted in an uncomfortable and unsafe transport system, while rates were so high that only the best-off could afford to use it. In Europe, the creation of the European Economic Community in 1957 was considered the starting point for the deregulation of air transport. The first step was to commit to a joint market that facilitated free circulation and the implementation of common transport policy.

Air transport demand has increased remarkably over the last 100 years, mainly fuelled by the incorporation of new technologies and infrastructure that have resulted in improvements in safety, speed and comfort. This process has led to numerous airlines being set up, which in turn has permitted a gradual reduction in operating costs that, together with the huge development of the tourism industry, has converted their services into products of mass consumption.

In this new scenario, airlines must choose between two operating systems: *Hub & Spoke* (HS) or Point-to-Point (PP). The former concentrates its operations in certain traffic centres or hubs, where passengers are redistributed and sent to other destination airports. These companies cover a larger market with more regular flight frequency. Normally, transoceanic flights that operate in hubs are fed by other flights with less capacity operated by regional associates or franchises. At present, basically traditional airlines operate this way.

The success of this system lies in coordinating arrivals and departures to reduce the time interval between them and the choice of airport node (Martinez, 2003). According to Campa and Campa (2009), it is mainly characterized by the following: Maximize the number of markets served especially when managed properly flights to reduce waiting times in the hub; the occupancy rate is usually higher than concentrating traffic connection. Thus, the cost per passenger is better able to moderate the rates; requires a sophisticated management due to billing issues, connections, baggage, incidents, management of revenue and employment, etc.; The switching time largely depends on the efficiency of the infrastructure; a critical mass to operate is required; economies of scale are high if management is adequate.

However, not all are advantages. The possible congestion and resulting delays are common in the hubs as a result of increases in traffic and pressure on the air traffic control, causing the need for frequent investments in infrastructure to absorb growth. In addition, passengers are often required to perform more than one path, increasing the distance, take-offs and landings, which leads to higher fuel consumption per passenger and route, if the journey is short.

The PP system was initially used in air transport due to there not being sufficient flights to establish more complex operating networks. In this case, aeroplanes fly direct to their destination and, therefore, do not make stopovers at hubs. The highlights of this system are: The time required for the operations is reduced because there are no traffic of connections with luggage and passenger operations; normally it achieved more timeliness; elimination of value added services; reduced cost labor and operating because it fly to secondary airports.

This market includes companies ranging from charters to low-cost airlines and private flights demanded by executives to provide a specific service, which only operate on routes that are profitable and are not concerned about connectivity. These companies are smaller and some even have less than 10 employees. This research employs this classification and is presented to analyse the efficiency of the foremost Spanish airlines.

Airlines must define their growth strategy in accordance with an operating system in the search for maximum profitability. Alderighi et al (2005), performs a study within the framework of the Games Theory on choosing from three strategies: HS, PP and multi-*hub*, reaching the conclusion that domestic market size is the variable that determines the decision.

Researchers began to display interest in analysing the productivity of air operators more than two decades ago, which resulted in the publication of numerous articles, Caves et al. (1981) being one of the pioneers. In that paper, total factor productivity is determined in order to study the differences between various airlines. Hendricks et al. (1997) concluded that the hub operator can credibly threaten to maintain its presence in a spoke market even when it suffers losses in that market due to competition. As a result, regional carriers that do not have a cost advantage are forced to exit, and entry is deterred. The situation is more ambiguous when the regional carrier has a significant cost advantage. In that case, there are equilibrium in which the hub operator accommodates the lower-cost entrant and shares in the efficiency gains. More recently, Assaf and Josiassen (2012) use stochastic distance and the Malmquist Index to calculate the efficiency and productivity of European and American airlines over the period 2001-2008. Other papers seek to achieve greater productivity at the origin, that is, by proposing that airports should be better regulated (Garcia, 2005).

In this line of research, this paper focuses on analysing the efficiency and financial situation of airlines by comparing the ones that implement HS and PP. In order to do so, Data Envelopment Analysis (DEA) is used, as this method is backed by a great deal of literature on similar issues (Good et al., 1995, Coto-Millan et al., 1999, Assaf and Josiassen, 2011 and Zhang et al., 2012, among others). The results of this study will establish which of these two groups manages its resources better and, therefore, determine whether there are any differences in productivity between companies depending on which system they operate. The study makes a novel contribution to the literature, as there has been no research on Spanish airlines that compares the two types of operators discussed. The paper is organised as follows: in the first place, the methodology is explained briefly along with the sample used in the study. In the next section presents the results obtained and finally the fourth section discusses the main conclusions of the research.

2. Methodology: Data Envelopment Analysis (DEA)

Traditionally, the methods to measure efficiency in production can be divided into two groups: one is linear programming model such as DEA, and the other is stochastic frontier analysis using econometric regression. The principal advantage of the DEA approach is that it does not require the specification of a particular functional form for the technology, but it cannot measure the statistical noise. The principal advantage of the stochastic frontier analysis is that it considers the statistical noise and outliers, but it requires the assumed underlying technology and functional form. In addition, the non-parametric nature of the DEA approach makes it easy to handle multiple outputs and multiple inputs, but stochastic frontier analysis is limited by its assumed functional form and cannot be directly used for multi-output production analysis or multi-input cost analysis (Zhang and Garvey, 2008). So it has been decided to use DEA analysis.

DEA is a non parametric technique that makes it possible to measure the relative efficiency of homogenous units. This method is one of the most widely used when a study involves multiple inputs and outputs to determine which companies are the best by comparing each to all the possible linear combinations of the rest of the sample, which can later be used to define an empirical production frontier (1). In this sense, the efficiency of each unit analysed is measured in terms of its distance from that frontier.

Following the pioneer work by Farrell (1957), the DEA model was developed by Charnes, Cooper and Rhodes (1978) in order to find an optimum set of weightings that maximise the relative efficiency (h_0) of the company under analysis, which is defined as the coefficient between the weighted sum of outputs and inputs, subject to the restriction that no other company may have a higher efficiency score than one using the same weightings. More specifically, the original linear programming problem with constant returns to scale for inputs is as follows:

$$\mathrm{Max}_{u,v} h_0 = \frac{\sum_{r=1}^{s} u_r * y_{r0}}{\sum_{i=1}^{m} v_i * x_{i0}} \qquad (1)$$

$$\text{s.a. } \frac{\sum_{r=1}^{s} u_r * y_{rj}}{\sum_{i=1}^{m} v_i * x_{ij}} \leq 1$$

$$u_r,\ v_i \geq 0$$

where:

x_{ij}: amounts of inputs i (i=1,2,…..,m) used by the jth company

x_{i0}: amounts of inputs i used by the company analysed

y_{rj}: amounts of outputs r (r= 1,2,…,s) produced by the jth company

y_{r0}: amounts of outputs r produced by the company analysed

u_r: output weightings

v_i: input weightings

As regards the empirical part of this research, output refers to operating income and inputs to tangible and intangible assets, supplies and labour costs (Alarcon, 2008 and

Sellers and Mas, 2009). The last variable represents the labour factor in the production function and acts as a proxy for the level of professional qualification. All variables are expressed in euros and have been obtained from the SABI Database (Sistema de Analisis de Balances Ibericos) compiled by Bureau Van Dijk.

The model is applied bearing inputs in mind, so the results focus on minimising company consumption of resources to obtain a given level of income. The high degree of competition that exists in the sector makes it difficult for managers to modify prices, for which reason the input approach is considered the most appropriate for determining whether or not it is possible to save resources while achieving the desired results.

Bearing in mind that the measure of efficiency takes values between 0 and 1, it is interpreted as follows:

- If h_0=1, the company is efficient in relation to the others and, therefore, will be located on the production frontier.
- If h_0<1, another company is more efficient that the one being analysed.

The model by Charnes et al. (1978) is not linear, but can be linearised by modifying the restrictions of the original model. Taking into account that there are more restrictions than variables, the problem is solved by means of its corresponding dual model. This article follows the proposal made by Banker, Charnes and Cooper (1984), who considered a linear programming model with variable returns to scale and a convexity restriction.

However, DEA is not exempt of limitations. This technique is accused of not contemplating random errors in the data (database or random errors), any deviation from the optimum level is considered inefficiency. Furthermore, results can be affected by the presence of unusual observations (outliers), which on many occasions are due to database errors.

The empirical study focuses on analysing the efficiency (2) of 28 air passenger transport companies (Table 1): 5 operate from hubs and the remaining 23 operate PP flights (charters, exclusive private flights for executives, low-cost), using accounting information for 2010. Apart from "Iberia", the first group also includes regional associates or franchises, that is, flights with less capacity that feed hub traffic. For example, "Air Nostrum" and "Binter Canarias" operate as subsidiaries of "Iberia", and this also applies to "Air Europa" and "Spanair", which are part of large alliances (Star

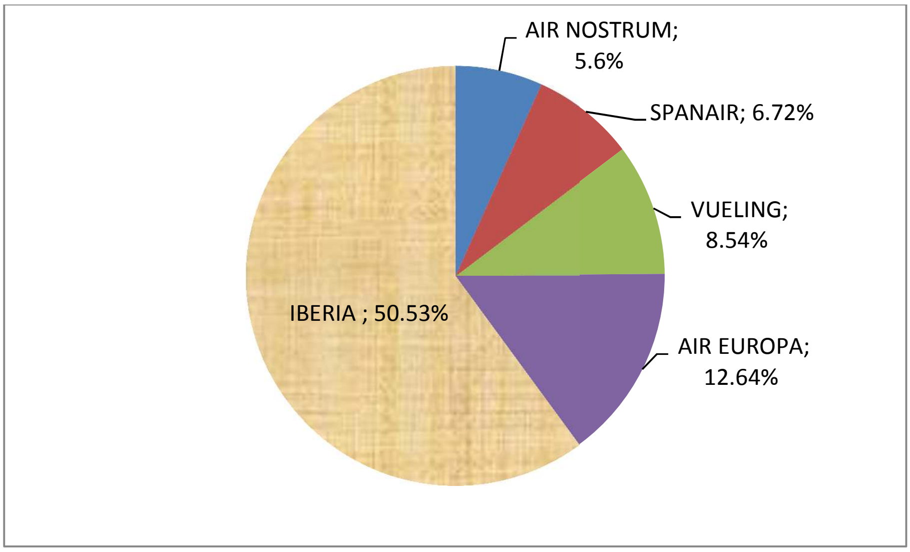
Alliance and Sky Team, respectively). The companies are classified into different groups in order to differentiate between the two operating systems employed. In the sample analysed, the only company that operates exclusively at hubs is Iberia, for which reason it is worth differentiating between the companies that only operate PP and those which combine both systems.

Table 1 reveals that most of the operators that manage PP flights have been created in the last decade and that 70% of them could be considered SMEs, due to the small number of people they employ. Meanwhile, the companies operating regular flights are older and would be considered medium-sized or large companies ("Iberia Líneas Aéreas de España" would be the largest with 21,500 employees). These differences between the two groups still elude the requisite for units to be homogenous in DEA analysis, as all the observations are considered to belong to one same economic activity fulfilling the common goal of air passenger transport.

Table 1

The observations in the sample belong to a sector characterised by a high degree of concentration. "Iberia Líneas Aéreas de España" alone accounts for 50.53% of total sales (Figure 1) and the 28 as a whole for 92.47%.

Figure 1. Share of sales of the top five companies



Source: Authors and SABI

3. Efficiency scores and economic and financial analysis of airlines

As can be observed in Table 2, the airlines that operate from hubs record lower efficiency scores than the ones operating PP flights, such that not one company in the first group is actually fully efficient.

Table 2

In specific terms, the five operators HS recorded an average efficiency score of 0.555, which is highly relevant as it implies that they could have obtained the same level of output (operating income) using 44.5% less resources. This result reveals that regular flight companies are considerably inefficient. Hubs emerged with the idea of taking advantage of the economies of scale that concentrating a large number of flights at one sole traffic centre would entail (high flight frequency, larger aeroplanes, better connection services, etc.). However, this system requires significant changes, as the results show there is room for improvement.

The efficient HS operator is “Binter Canarias”, which was named the best regular airline in Europe in 2010 by the European Regions Airline Association (ERA). In contrast, “Spanair” is the furthest from the efficient frontier. This indicates that the amounts of inputs used (labour costs, assets and supplies) have not been managed correctly bearing in mind the level of income achieved. These results made the subsequent closure of the company in 2011 due to its disastrous financial situation foreseeable. However, while a low level of efficiency does not result unavoidably in this outcome, as the case of “Spanair” involved additional circumstances that are not taken into account in this study, it can be considered an indicator, as it determines how to minimise resources to obtain a given amount of income.

Despite “Iberia” being the number one Spanish airline in terms of fleet size, efficiency is observed to be low in regard to the rest of companies. This could be due to the delicate economic situation the company endured, recording continuous losses during the period 2007-2009. In 2010, the company merged with “British Airways”, thereby improving its results despite still not optimising the management of its inputs and outputs.

As regards Scale Efficiency (SE), it is worth indicating that “Air Nostrum” aside, all the companies that operate from hubs are the correct size for the income they obtain. This circumstance highlights the fact that these companies need to profoundly restructure their inputs in order to enhance their productivity.

After analysing the efficiency scores recorded by the companies operating PP flights, the production frontier is found to be made up exclusively of such airlines, due to their being the only ones that register efficiency scores of one. This makes it possible to conduct a more extensive analysis in order to ascertain the real causes behind the fact that some companies use their resources better, such that these practices can be adopted and replicated by other companies in less favourable situation.

These companies recorded an average efficiency score of 0.628, 12 airlines being more efficient that the average, of which 50% were fully efficient and, therefore, located on the production frontier. The rest displayed high levels of efficiency, as was the case with “Vueling Airlines”, which is the third largest Spanish airline in terms of fleet (only behind “Iberia” and “Air Nostrum”) and number of passengers. According to some reports, “Vueling Airlines” estimates an increase in its capacity of between 20% and 25% in 2012, together with a 14.2 million euro reduction in costs through various measures. Moreover, the closure of “Spanair” has boosted the company’s demand by 25%, which will result in an increase in sales for the company.

The third column in Table 2 includes the results for SE. Once again, the inefficient airlines do not display any scale problems (with the exception of “Servicios aeronáuticos Costa Azahar”, “Sky service aviation” and “Wondair on demand aviation”). The companies that are fully efficient are also scale efficient.

Economic globalisation is forcing high level executives to visit increasingly faraway destinations, making specialised development of air transport necessary. In this context, ad hoc operators for executives have a favourable business outlook.

By analysing the companies that are located on the frontier, we can deduce that size is not a decisive factor when it comes to achieving maximum efficiency, as is the case with “Aerobalear”, “Medel Air” and “Let´s Fly”, which despite having very few employees, have managed to reach maximum levels of efficiency.

In order to complete the analysis, we have obtained the cash flow and debt ratios of the fully efficient companies to determine whether their financial situation backs up the efficiency results or whether they follow a common pattern (Table 3).

Table 3.

Efficient airlines in terms of cash flow and debt do not follow the theoretical patterns of an "ideal" situation from a financial perspective. Bearing in mind that the cash flow ratio of a company is acceptable when between 150% and 200%, all the aforementioned companies record values below optimum levels (except for "Aerobalear"). Notwithstanding, current assets outweigh current liabilities, but without achieving the established margin of safety.

As regards the debt ratio, "Aerobalear" is also the only airline to record a value between 40% and 60%, which is considered optimum. If the result of this ratio is lower than 40%, as in the case of "Medel Air", the company may have excess idle capital, which subsequently implies a loss of profitability ("Medel Air" displays negative economic and financial profitability). In contrast, if debt is greater than 60%, as in the case of "Corporatejets XXI", "Lets Fly", "Navegación y Servicios Aéreos Canarios" and "Tag Aviation España", it means that the company has excessive debt. However, and despite these financial imbalances, these six airlines have managed to be efficient as a result of optimally managing their costs in relation to their income through sales.

4. Conclusions

This paper analyses the efficiency and financial situation of 28 Spanish airlines, differentiating between those which use HS and PP operating systems. The empirical part of the research employed DEA in order to identify which operators best manage their economic resources.

The results obtained reveal that the largest companies such as "Iberia" (50.53% share of sales) and "Air Europa" (12.64% share of sales) that operate regular flights, are less efficient than small airlines like "Aerobalear", "Corporatejets XXI, SA" and "Medel Air", which provide flights for executives where exclusive service and transit time take precedence. However, the seven companies with worse inefficiency level belong to PP system, so it is not possible to generalize that the best are those of the system, but a subset thereof. In addition, SE makes it possible to conclude that scale is not a determinant factor of the levels of inefficiency registered by certain operators.

On a different note, the airlines that operate from hubs are less efficient, contradicting their initial reason for founding. Traffic centres emerged with the intention of taking advantage of the economies of scale provided by the use of larger aeroplanes, greater connectivity and departure frequency, etc. However, the analysis performed shows that there is no direct relationship to economic efficiency, quite the opposite in fact. Compared to an average efficiency score of 0.63 recorded by airlines specialised in direct flights, the companies that operate at hubs only scored 0.55. All the airlines that register an efficiency score of 1 use the PP system and the financial analysis reveals that none of them follow a theoretical pattern.

The existence of hubs mainly benefits airlines rather than consumers, that is, they increase flight departure frequency, but also real travel time due to the hours in transit between flights. Tourists are increasingly seeking out direct flights to avoid the crowds at transport centres where the lack of coordination occasionally causes delays and incidents that are not very common in direct flights. All of the above reflects a lack of coordination between the policies currently followed by hubs, deviating from the ultimate goal for which they were originally created.

Moreover, it is important to take into account that the hub system requires regular investments in infrastructure (terminals and runways) to absorb their continuous growth and avoid delays caused by the constant take-offs and landings and the pressures of controlling air traffic. It is necessary to redefine the Spanish airport model as this would significant benefit the development of airlines.

References

Ahmed, S.A., Adli, M. and Ahamad, TK.(2010), "An extended DEA windows analysis: Middle East and East African seaports". *Journal of Economic Studies*, Vol. 37 No. 2, pp.208 – 218.

Alarcón, S., (2008), "Endeudamientos y eficiencia en las empresas agrarias". *Revista Española de Financiación y Contabilidad* Vol 27, pp. 211-230.

Alderighi, M., Cento, A., Nijkamp, P. and Rietveld, P. (2005), "Network competition-the coexistence of hub-and-spoke and point-to-point systems". *Journal of Air Transport Management* Vol 11, pp. 328-334.

Assaf, A.G. and Josiassen, A. (2011), "The operational performance fo UK airlines; 2002-2007". *Journal of Economic Studies*, Vol 38, No.1, pp. 5-16.

Assaf, A.G. and Josiassen, A. (2012), "European vs. U.S. airlines: Performance comparison in a dynamic market". *Tourism Management*. Vol 33, pp. 317-326.

Banker, R.D., Charnes R.F. and Cooper W.W. (1984), "Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis". *Management Science* Vol 30, pp. 1078-1092.

Campa, F. and Campa R. (2009), "Estructuras de oferta en transporte aéreo: modelos punto a punto y de red". *Harvard Deusto business review*, No.179, pp. 42-50.

Caves, D.W., Christensen, L.R. and Tretheway, M.W. (1981), "U.S. trunk air airlines, 1972-1977: a multilateral comparison of total factor productivity", in Cowing, T.C., Stevenson, R.E. (Ed.), *Productivity Measurement in Regulated Industries*. New York. Academic Press, pp. 47-77.

Charnes, A., Cooper, WW. and Rhodes, E. (1978), "Measuring the efficiency of decision making units". *European Journal of Operation Research* Vol 2, pp. 429-444.

Coelli, T. (1996), A guide to deap Version 2.1: A data envelopment analysis (Computer) program. Cepa Working Paper 96/08.

Coto-Millán, P., Inglada, V. and Rodriguez-Alvarez, A. (1999), "Economic and technical efficiency in the world air industry". *International Journal of Transport Economics* Vol 26, pp. 119-235.

Farrell, M.J. (1957), "The measurement of productive efficiency". *Journal of Royal Statistical Society* Vol 120, pp. 253-281.

García, J. (2005), "El nuevo modelo aeroportuario europeo: más competencia, mejor regulación". *Universia Business Review* Vol 4, pp. 86-102.

Goncharuk, A.G. (2007), "Impact of political changes on industrial efficiency: a case of Ukraine". *Journal of Economic Studies*, Vol. 34 No 4, pp.324 - 340

Good, D.H., Röller, L.H. and Sickles, R.C. (1995), "Airline efficiency differences between Europe and the US: implications for the pace of EC integration and domestic regulation". *European Journal of Operational Research* Vol 80, pp. 508-518.

Hendricks, K., Piccione, M. and Guofu, T. (1997), "Entry and Exit in Hub-Spoke Networks". *The RAND Journal of Economics*, Vol 28, No. 2, pp. 291-303.

Martínez, R. (2003), Análisis de las operaciones Hub & Spoke en el transporte aéreo. Aplicación al aeropuerto de Barcelona. Tesina de especialidad.

Mulwa, M.R., Emrouznejad, A. and Murithi, F.M. (2009), "Impact of liberalization on efficiency and productivity of sugar industry in Kenya", *Journal of Economic Studies*, Vol. 36 No. 3, pp.250 – 264

Sellers, R. and Más F.J. (2009), "Determinantes de la eficiencia en el canal de distribución: análisis en agencias de viajes". *Revista Española de Investigación de Marketing ESIC* Vol 13, pp. 97-115.

Zhang, T. and Garvey, E. (2008), "A comparative analysis of multi-output frontier models". *Journal of Zhejiang University SCIENCE A*. Vol 9, No. 10, pp. 1426-1436.

Zhang, B., Wang, J., Liu, C. and Zhao, Y. (2012), "Evaluating the technical efficiency of Chinese airport airside activities". *Journal of Air Transport Management*. Vol 20, pp. 23-27.

Endnotes

(1) In the literature we can found Goncharuk (2007); Mulwa et al. (2009); Ahmed et al. (2010).

(2) DEAP (2.0) software developed and published by Coelli (1996) was used.

Table 1. Airline Characteristics

Operating System	Airlines	Type	Employees
HUBS	AIR EUROPA LINEAS AEREAS SA	Regular	2,865
	AIR NOSTRUM LINEAS AEREAS DEL MEDITERRANEO SA		1,801
	BINTER CANARIAS SA		500
	IBERIA LINEAS AEREAS DE ESPAÑA		21,500
	SPANAIR SA		2,075
Point to point	AEROBALEAR SA	Charter and Business aviation	2
	AEROBROKER SERVICIOS AEREOS SL		3
	AIR TAXI & CHARTER INTERNATIONAL SL		4
	CORPORATEJETS XXI, SA		29
	SERVICIOS AERONAUTICOS COSTA AZAHAR SL		3
	ATLAS EXECUTIVE AIR SA	Charter	NA
	CANARY FLY SL		28
	IBERWORLD AIRLINES SA		500
	LET'S FLY SL		4
	PRIVILEGE STYLE SA		67
	PULLMANTUR AIR SA		209
	SKY SERVICE AVIATION SL		7
	SUR AVIATION SL		2
	TAG AVIATION ESPAÑA SL		114
	BM JET AVIACION PRIVADA DEL MEDITERRANEO OCCIDENTAL SL	Business aviation	10
	CLIPPER NATIONAL AIR SA		9
	EXECUTIVE AIRLINES SL		113
	MEDEL AIR SL		1
	NORDJET AIRLINES SL		5
	WONDAIR ON DEMAND AVIATION SL		6
	ISLAS AIRWAYS	Interisland flights	236
	NAVEGACION Y SERVICIOS AEREOS CANARIOS SA		200
	VUELING AIRLINES, SA	Low cost	1,200

Source: Authors and SABI

Table 2. Efficiency of the companies that operate in 2010

Company name	System	Efficiency	Scale Efficiency
Aerobalear Sa	PP	1.00	1.00
Corporatejets Xxi, Sa	PP	1.00	1.00
Let's Fly Sl	PP	1.00	1.00
Tag Aviation España Sl	PP	1.00	1.00
Medel Air Sl	PP	1.00	1.00
Navegacion Y Servicios Aereos Canarios Sa	PP	1.00	1.00
Binter Canarias Sa	HS	0.973	0.973
Atlas Executive Air Sa	PP	0.918	0.955
Vueling Airlines, Sa	PP	0.851	0.851
Iberworld Airlines Sa	PP	0.846	0.846
Aerobroker Servicios Aereos Sl	PP	0.822	0.822
Sur Aviation Sl	PP	0.728	0.929
Privilege Style Sa	PP	0.713	0.882
Pullmantur Air Sa	PP	0.539	0.892
Air Europa Lineas Aereas Sa	HS	0.537	0.945
Air Nostrum Lineas Aereas Del Mediterraneo Sa	HS	0.519	0.519
Islas Airways	PP	0.476	0.838
Air Taxi & Charter International Sl	PP	0.473	0.992
Executive Airlines Sl	PP	0.442	0.996
Iberia Lineas Aereas De España	HS	0.381	0.996
Spanair Sa	HS	0.365	0.999
Canary Fly Sl	PP	0.361	0.987
Clipper National Air Sa	PP	0.337	1
Nordjet Airlines Sl	PP	0.256	0.987
Sky Service Aviation Sl	PP	0.214	0.36
Servicios Aeronauticos Costa Azahar Sl	PP	0.177	0.253
Wondair On Demand Aviation Sl	PP	0.152	0.601
Bm Jet Aviacion Privada Del Mediterraneo Occid.	PP	0.137	0.996

Source: Authors

Table 3. Cash flow and debt situation of efficient airlines

	Cash flow ratio	Debt ratio
AEROBALEAR SA	203.68%	49.09%
CORPORATEJETS XXI, SA	33.97%	102.88%
LET'S FLY SL	132.47%	82.13%
MEDEL AIR SL	128.33%	29.11%
NAVEGACION Y SERVICIOS AEREOS CANARIOS SA	118.75%	96.6%.
TAG AVIATION ESPAÑA SL	99.20%	91.28%

Source: Authors