Quantifying the net impact and redistribution effects of airlines' exits on passenger traffic

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Abstract

This paper studies the impact of airlines' exits on passenger traffic. In this regard, univariate and multivariate structural time series have been applied. They have proved useful to quantify the net impact on passenger traffic and redistribution effects among incumbent airlines. As an application, a natural experiment is studied, in which two relevant airlines filed for bankruptcy in different periods. In the first, policymakers employed a *laissez faire* strategy, whereas in the second, they applied an incentive scheme programme. The programme was based on the support of destination promotion, tax and tariff discounts. Overall, the paper shows that under *laissez faire*, the incumbent airlines did not take over the passenger traffic left by the airline that exited the route. However, in the second case, following approval of the incentive scheme, the loss of passengers was mitigated by the incumbent airlines.

Keywords

Structural Time Series, Thomas Cook, Monarch, Airlines, Exit, Bankruptcy

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1. Introduction

Airline traffic has proved to be a source of economic development (Campante and Yanagizawa-Drott, 2018). It leads to higher employment (Button and Taylor, 2000; Albalate and Fageda, 2016), not only in the region where the airport is located, but also in the surrounding regions (Percoco, 2010). Additionally, it may increase average wages (Bilotkach, 2015) and exports (Alderighi and Gaggero, 2017). Nevertheless, it should be noted that it is of critical importance for remote locations (Fageda Fageda *et al*., 2018), and especially for tourism destinations. The success of any tourism destination relies on good transport infrastructure (Khadaroo and Seetanah, 2008) and connectivity (Njoya, Semeyutin and Hubbard, 2020). Air transport connectivity is even more important when the destination is far from source markets, and/or is physically isolated (e.g. in the case of islands, Papatheodorou, 2001; Seetanah and Khadaroo, 2009). Governments have encouraged air connectivity through various mechanisms, such as policies related to routes, passengers, airlines or airports (Fageda *et al*. 2018). Amongst the most popular policies are the introduction of public service obligations, airport grants, state-owned airlines or discounts to residents. These policies have achieved higher frequency of flights, but they also involve public expenditure that need to be assessed (Fageda *et al*., 2019). Policies are not only oriented towards growth but also to sustain current traffic, which can be threatened by airline exit or bankruptcy.

After the exit or bankruptcy of a relevant airline, a new market equilibrium should emerge. The resulting equilibrium can shift gradually depending on market size, the number of incumbent airlines, time scope, and whether the impact is due to an exit or bankruptcy. A market exit has a local impact, while a bankruptcy implies a multi-market phenomenon. The former case is commonplace and the incumbents may take over the total, partial or none of the traffic left after the exit. However, in the latter case, it is more difficult for the incumbent airlines to take over because a bankruptcy implies a drop in many routes simultaneously. The incumbents need to choose which routes they are interested in taking over, since the short run capacity constraint is ruling their decision (Jorge-Calderón, 1997). Hence, after a bankruptcy, the net number of passengers is more likely to be reduced than after a common exit. An ex-ante assessment of such policies therefore requires an understanding of airlines' responses after a competitor's exit or bankruptcy. Decision-makers need to anticipate the potential new market equilibrium, so that timely and effective policies can be applied, if required.

To illustrate the methodology, this paper draws on the bankruptcies of leisure charter carriers. In particular, it studies two traditional and large leisure British charter airlines, namely Monarch and Thomas Cook, which filed for bankruptcy on 2nd October 2017 and 23rd September 2019, respectively. The paper focuses on several routes between the United Kingdom and the Canary Islands and how the incumbent airlines reacted after the bankruptcy. This case study is of interest because it consists of a natural experiment where policymakers took two contrary actions. On the one hand, policymakers employed a *laissez faire* strategy after the Monarch exit, while on the other, they applied an incentive scheme programme.

The bankruptcy of leisure charter airlines in remote tourism destinations is a matter of concern for tourism destination policymakers. If the number of passengers falls significantly, the same happens with tourism expenditure, and hence, with gross domestic product and employment. Policymakers are concerned with several questions such as: i) how many passengers can be serviced by the incumbent airlines? ii) can new airlines enter the market to maintain or surpass the previous supply level? iii) is it necessary to create incentives to encourage new entrants or strengthen incumbents' market position? iv) which incentives are most effective?

The purpose of this paper is twofold. Firstly, it aims to improve understanding of the impact of these airlines' bankruptcies in terms of passengers. Secondly, it studies the redistribution and net loss of passengers. In doing so, it assesses whether the incentives policy made a difference in incumbents' decision-making. The methodology applied is univariate structural time series for estimating the net impact, whereas multivariate structural time series is employed for estimating the redistribution effects. Level interventions are established in order to estimate the shift on passengers after each exit. This allows the impact on the whole market to be measured, as well as on each incumbent airline. As far as we know, this issue has not yet been addressed in the literature, and this paper represents a first approach to quantify these kinds of impacts.

2. Theoretical framework

2.1 The market implications of airline exits

In this study, an airline market refers to the transportation service between an origin and destination airport, which conforms an air route (Ciliberto and Tamer, 2009). Thus, large airports may serve multiple routes and markets, which may be very competitive; while other markets or routes may be served by only one airline, in a monopoly. The market structure of most routes are oligopolies or monopolies (Peteraf, 1995) that are subjected to contestable markets (Starkie and Starrs, 1984; Butler and Huston, 1989), i.e. incumbent airlines define their airfares, depending on the threat of entrance of new competitors (Goolsbee and Syverson, 2008), which prevents monopolistic behaviour.

According to Ethiraj and Zhou (2019) airlines engage in competition through price-cutting, capacity expansion, and quality differentiation. Moreover, they state that 'entry deterrence' occurs due to a situation of excess capacity, as long as airports are not congested (Kappes and Merkert, 2013; Valido *et al*., 2020). However, such capacity can be reversed, since incumbent airlines operate on multiple heterogeneous routes. Route equilibrium cannot be understood in isolation to incumbents' other routes. Thus, rather than consider one independent equilibrium the routes, taken together, respond to decisions based on multiple equilibria optimization (Ciliberto and Tamer, 2009). In this sense, the optimization of aircraft utilization and crew availability play a relevant role when airlines must choose which routes to operate (Lohmann and Vianna, 2016).

Therefore, following an airline exit from the market, the remaining incumbent airlines may absorb the demand, depending on several issues. The degree of severity of the impact varies if it concerns an airline's exit, an airline's bankruptcy (Borenstein and Rose, 2003), or a leisure charter bankruptcy. As said, an airline's exit is a local phenomenon that affects a particular route or airport, whereas a bankruptcy is global and implies a simultaneous exit in multiple markets. In the short run, an incumbent's best response depends on its capacity (Strassmann, 1990; Lohmann and Vianna, 2016), the degree of market competition (Lijesen and Behrens, 2017) and its multi-market optimum equilibria.

The literature has also studied the determinants of ceasing operations in routes. The length of the route is a key determinant. If the route distance is short, there is higher inter-modal competition and it is more likely to be dropped than routes with larger distances. Nevertheless, it happens as long as the destination is not remote (Manello *et al*., 2021).

Moreover, the routes feeding a hub-and-spoke system of a major carrier tend to survive more compared with point-to-point routes. Finally, routes served under monopoly or very low market share are more likely to be dropped (De Wit and Zuidberg, 2016). When a leading airline exits a market, incumbent airlines may become dominant (Grosche *et al*., 2020). This new position can increase their bargaining power with respect to destination and airport managers (Halpern *et al*., 2016), who can entice them by introducing incentives on running costs, especially those related with airport landing; co-op marketing; or tax discounts (Graham *et al*., 2008). This relationship can commonly be seen at secondary airports used by low-cost carriers (LCCs.) These airports are highly dependent on such LCCs, and in fact a tourism industry often develops due to their presence.

Specifically, this paper tests the following hypotheses:

H1: In the short run, following an airline's exit, passenger traffic remains unaffected.

H2: In the short run, following an airline's exit, incumbent airlines take over part of the passenger traffic, without the need for any government intervention.

H3: In the short run, following an airline's exit, incumbent airlines take over part of the passenger traffic after a government intervention.

There is little relevant literature on quantifying the impacts of airline exits. Joskow *et al*. (1994) study the consequences of exits on 27 city pairs in the United States with descriptive analysis. They show that after exits, on average, the incumbents' increased their traffic by about 24.9%. Despite such an increase, the average effects of exits led to a decrease in the number of passengers by about 12.9%. Grosche *et al*. (2020) explored how market concentration in German air transport was impacted after the bankruptcy of LCC Air Berlin. They employed the Herfindhal-Hirschman Index to show that such market concentration increased more significantly in the domestic rather than international market. Fageda *et al*. (2017) analyzed the impact of the FSC Spanair bankruptcy on Spanish air transport with differences in differences. They found that it led to a reduction in prices on those routes where its services were replaced by LCCs. However, they did not find a significant reduction in frequencies.

None of the papers in the literature has tested the supply redistribution effect after exits, nor the efficacy of government policies to persuade incumbents to take over the traffic. Both of these issues are considered in this paper by the employment of univariate and multivariate structural time series modelling, as shown below.

2.2 Quantifying the net and redistribution effects with structural time series modelling

The use of the structural time series model (STSM) for forecasting air passengers' series was suggested by Harvey (1989). Since then, this approach has been widely employed in the literature (see for instance: Eugenio-Martin *et al*., 2005; Blake *et al*., 2006; Eugenio-Martin and Perez-Granja, 2021). This paper applies STSM to quantify the impact of airlines' exits. The advantage of this methodology is that it decomposes the series into unobserved components, so that an intervention on the level can provide an estimate of the shift of the series ex-post of the exit. The problem with employing standard comparative statistics is that the trend of the series and the seasonality at the moment of the exit need to be taken into account. STSM decomposes the series, so that the trend and seasonality can be identified, and the measurement of the level shift is therefore better controlled.

STSM works by decomposing a time series into the following unobserved components: level, slope, seasonal, cycle and irregular components. This decomposition allows for a better understanding of the time series. The components may be either fixed or stochastic (Commandeur and Koopman, 2007) and they are linked to a set of time varying parameters (Song *et al*., 2011). One of the advantages of STSM is its ability to contemplate interventions on the components (Harvey and Durbin, 1986). Thus, it provides a deeper understanding of the impact of a particular event (Eugenio-Martin, 2016). Finally, it should be noted that this methodology does not require the series to be stationary, since the slope is also a relevant component to be estimated. STSM facilitates and enhances interpretation of the results.

Two kinds of methods are applied. Firstly, a univariate time series analysis of the whole market is undertaken, which allows a comprehensive result to be obtained. Secondly, a multivariate time series analysis of every airline is applied. This allows the impact on each airline to be understood by employing a simultaneous estimation, so that the variance-covariance error structure can be modelled. Consequently, the airlines are not treated independently of each other, which may be a wrong assumption. The model can be represented by the notation employed in several seminal books such as Harvey (1989), Commandeur and Koopman (2007) or Durbin and Koopman (2012). According to these authors, the model can be represented as follows:

$$\boldsymbol{y_t} = \boldsymbol{\mu_t} + \boldsymbol{\gamma_t} + \boldsymbol{\varepsilon_t}, \qquad \boldsymbol{\varepsilon_t} \sim \mathrm{NID}(\boldsymbol{0}, \boldsymbol{\Sigma_\varepsilon}) \qquad (1)$$

Equation (1) denotes the measurement equation, where $\boldsymbol{y_t}$ denotes the $N\times1$ vector of passenger traffic, where N represents the number of airlines included in the model where N=1 for univariate models, $\boldsymbol{\varepsilon_t}$ represents an error normally and identically distributed with zero mean and $\boldsymbol{\Sigma_\varepsilon}$ as the variance and covariance matrix, and $\boldsymbol{\mu_t}$ denotes the $N\times1$ vector of the stochastic level component. This component is modeled by the transition equation (2) as follows:

$$\boldsymbol{\mu_t} = \boldsymbol{\mu_{t-1}} + \boldsymbol{\beta_{t-1}} + \boldsymbol{\eta_t}, \qquad \boldsymbol{\eta_t} \sim \mathrm{NID}(\boldsymbol{0}, \boldsymbol{\Sigma_\eta}) \qquad (2)$$

where $\boldsymbol{\eta_t}$ denotes the error of this transition equation which is normally and identically distributed with zero mean and a matrix of variance and covariances $\boldsymbol{\Sigma_\eta}$. The $\boldsymbol{\beta}$ component of equation (2) denotes the stochastic slope component, which may also be modeled by its own transition equation (3):

$$\boldsymbol{\beta_t} = \boldsymbol{\beta_{t-1}} + \boldsymbol{\zeta_t}, \qquad \boldsymbol{\zeta_t} \sim \mathrm{NID}(\boldsymbol{0}, \boldsymbol{\Sigma_\zeta}) \qquad (3)$$

where $\boldsymbol{\zeta_t}$ represents an error term that is normally and identically distributed with zero mean and a matrix of variance and covariance $\boldsymbol{\Sigma_\zeta}$.

$\boldsymbol{\gamma_t}$ component of equation (1) denotes the $N\times1$ vector of seasonal components. The stochastic seasonal component is obtained according to the following trigonometric seasonal form:

$$\boldsymbol{\gamma_t} = \sum_{j=1}^{[s/2]} \boldsymbol{\gamma_{j,t}}$$

$$\begin{bmatrix} \boldsymbol{\gamma_{j,t}} \\ \boldsymbol{\gamma^*_{j,t}} \end{bmatrix} = \left\{ \begin{bmatrix} cos\lambda_j & sin\lambda_j \\ -sin\lambda_j & cos\lambda_j \end{bmatrix} \otimes \boldsymbol{I_N} \right\} \begin{bmatrix} \boldsymbol{\gamma_{j,t-1}} \\ \boldsymbol{\gamma^*_{j,t-1}} \end{bmatrix} + \begin{bmatrix} \boldsymbol{\omega_{j,t-1}} \\ \boldsymbol{\omega^*_{j,t-1}} \end{bmatrix}, \qquad \begin{matrix} j = 1, \dots, [\frac{s}{2}] \\ t = 1, \dots, T \end{matrix}$$

where $\boldsymbol{\omega_{j,t}}, \boldsymbol{\omega^*_{j,t}} \sim \mathrm{NID}(\boldsymbol{0}, \boldsymbol{\Sigma_\omega})$ and $\lambda_j = 2\pi j/s$ is the frequency in radians.

Finally, we include interventions to the model in order to analyze the impacts of the events. These interventions can be introduced in the model as follows:

$$\boldsymbol{y_t} = \boldsymbol{\mu_t} + \boldsymbol{\gamma_t} + \boldsymbol{\Lambda w_t} + \boldsymbol{\varepsilon_t}, \qquad \boldsymbol{\varepsilon_t} \sim \text{NID}(\boldsymbol{0}, \boldsymbol{\Sigma_\varepsilon}) \tag{4}$$

where $\boldsymbol{w_t}$ denotes $K\times1$ vector of interventions associated with $\boldsymbol{\Lambda}$ parameters matrices.

One of the key features of the multivariate structural time series model (MSTSM) is the ability to deal with the relationship among the different time series. Such relationship is modelled through the employment of the correlations of the error terms of the components of each series. For these reasons, these models are also called *seemingly unrelated time series equations* (Commandeur and Koopman, 2007). All these variances and covariances are located in the component disturbance variance-covariance matrix, which is crucial when analyzing MSTSM. When the disturbance of the level components of two series is uncorrelated ($corr(\eta^{airline\ i}, \eta^{airline\ j}) = 0$), the level components of the two time series are independent. However, if the correlation exists, this means that there is a relationship between the level components of these airlines. An extreme case occurs when the correlation is near 1, as in these cases the time series share a common trend. The presence of a common trend is equivalent to the presence of cointegration in the classic time series analysis. The disturbance variance-covariance matrix takes the following form:

$$\boldsymbol{\Sigma}_\eta = \begin{bmatrix} \sigma^2_{\eta^{airline\ 1}} & \cdots & cov(\eta^{airline\ 1}, \eta^{airline\ N}) \\ \vdots & \ddots & \vdots \\ cov(\eta^{airline\ N}, \eta^{airline\ 1}) & \cdots & \sigma^2_{\eta^{airline\ N}} \end{bmatrix}$$

And the correlation coefficient is calculated through the Pearson correlation, so that:

$$corr(\eta^{airline\ i}, \eta^{airline\ j}) = \frac{\text{cov}(\eta^{airline\ i}, \eta^{airline\ j})}{\sqrt{\sigma^2_{airline\ i}\sigma^2_{airline\ j}}} \text{ where } i \text{ and } j = (1, \dots, N)$$

3. Case study

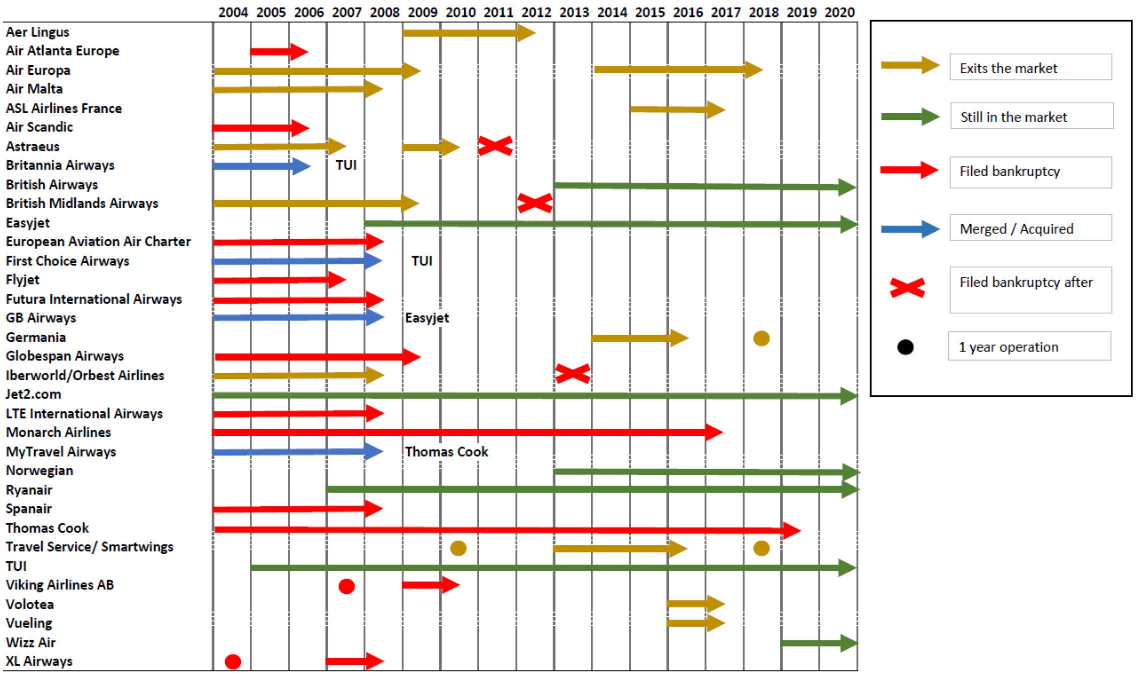
The routes between the UK and the leading Canary Island tourist destinations are chosen for analysis in this paper. The reasons for selecting these routes are due to the scale of the traffic. Firstly, Monarch and Thomas Cook were large charter companies (CC) based in the UK, so we consider the air traffic coming from all British airports. Secondly, Spain is the tourism destination that is most in demand from the UK. According to the Office for National Statistics' travel trends (2020), in 2019, 46% of the British outbound market was to Spain. According to the National Institute of Statistics of Spain (INE, 2020), the regions most in demand by British tourists in Spain are: the Canary Islands (4,879,855); the Balearic Islands (3,688,520); Andalusia (2,808,049); the Comunidad Valenciana (2,763,134); and Catalunya (1,893,504).

This air traffic is very important for Spain. According to FRONTUR statistics obtained from INE (2020), the British market was the most important for Spain in 2019, with an average international market share of 25.32%. This dependency on British tourism is even higher for sun and beach destinations. In particular, the market shares are: 37.17% in the Canary Islands, 27.11% in the Balearic Islands, 28.74% in Andalusia, 36.44% in the Comunidad Valenciana and 13.48% in Catalunya.

Specifically, Thomas Cook had established routes with the islands and a few with Alicante, but next to nothing with the rest of Spain. Furthermore, the time of the year when both companies exited the market was in October (for Monarch) and September (for Thomas Cook). The Balearic Islands closes its season around these months, whereas the peak season for the Canary Islands is just starting. For this reason, an analysis of the Canary Islands make sense and, in particular, the most popular islands of Tenerife, Gran Canaria, Fuerteventura and Lanzarote.

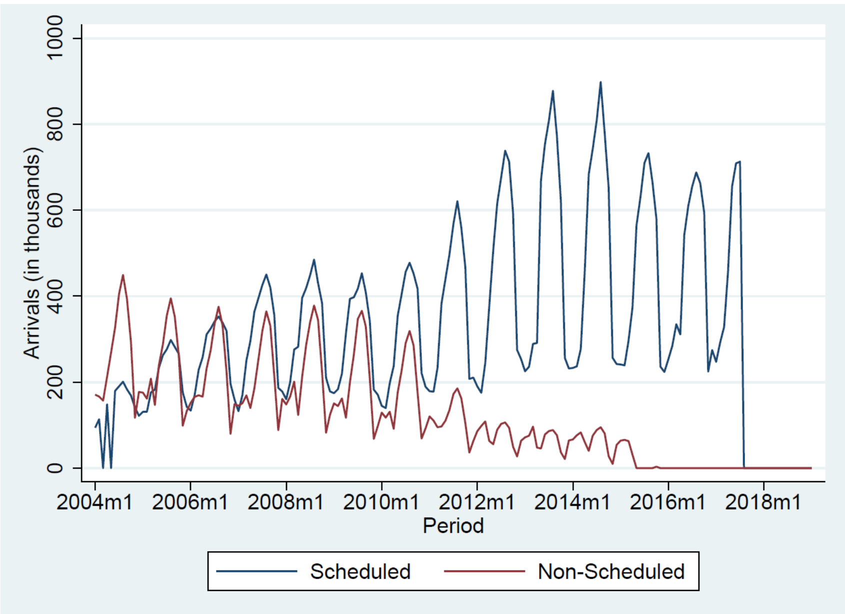
The market structure of air transport routes between the UK and the Canary Islands has changed significantly from the situation existing in the early 2000's. This can be seen in Figure 1 which summarizes the entries, exits, merges and bankruptcies of all airlines operating the routes since 2004. Overall, the figure shows that the role of tour operators has been decreasing significantly over time, especially after the financial crisis between 2008 and 2009. Large tour operators merged or acquired smaller ones, such as Britannia, First Choice, GB and MyTravel. Other airlines exited or filed for bankruptcy; mostly following the global economic crisis in 2008. Other airlines entered and exited the market without consolidating: for example, Aer Lingus, Air Europa, Germania, and Vueling.

Figure 1. Market entries, exits, bankruptcies and merges in the routes



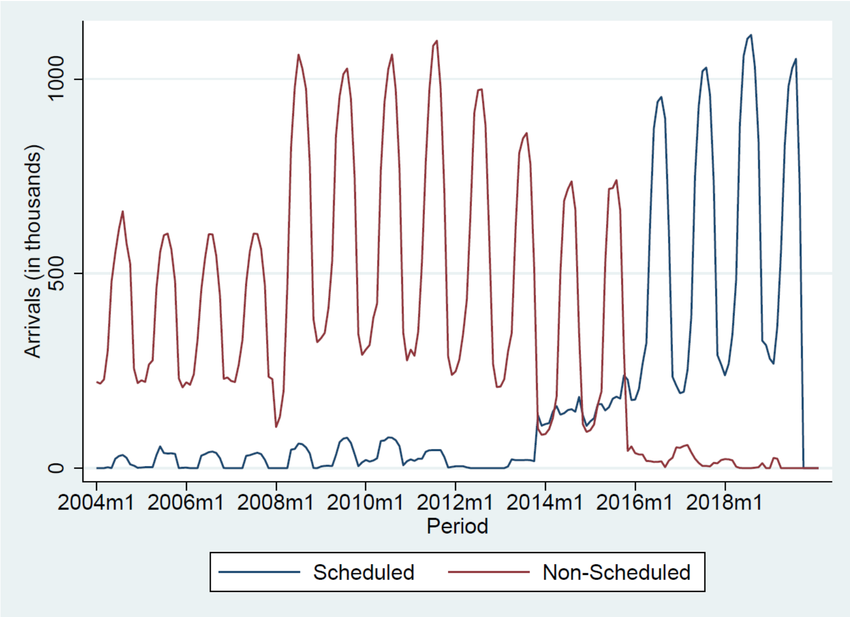
Own elaboration. Source: AENA, OAG

Figure 2. Evolution of scheduled and non-scheduled passengers of Monarch Airlines (2004-2017)



Own elaboration. Source: UK Civil Aviation Association

Figure 3. Evolution of Scheduled and non-scheduled passengers of Thomas Cook airline (2004-2019)



Own elaboration. Source: UK Civil Aviation Association

Large tour operator airlines such as TUI, Monarch and Thomas Cook survived the crisis together with LCCs such as easyJet, Ryanair and hybrid Jet2. Once the market recovered after the economic shock, FSC British Airways and LCC Norwegian entered the market. Figure 2 shows the evolution of scheduled and non-scheduled passengers carried by Monarch Airlines between 2004 and 2017. It shows that the year 2006 represented an inflection point in the strategy of the airline. Before that year, most operations were non-scheduled, whereas between 2005 and 2010 a hybrid model was in place, and after 2010, the airline moved towards scheduled. The same strategy was followed by Thomas Cook, lagged over time (see Figure 3). Until 2013, the airline ran non-scheduled operations, and between 2014 and 2015 scheduled operations gained relevance; but since 2016 most operations have been scheduled.

After Monarch airlines declared bankruptcy on 2nd October 2017, Spanish policymakers decided not to intervene in the market, opting for a *laissez faire* strategy. Monarch airlines had a significant presence in the leading Spanish sun and beach destinations. It should be noted that charter passengers are protected by ATOL (Air Travel Organiser's Licence), which is a UK financial protection scheme that protects most air package holidays sold by travel businesses. The organization supports consumers currently abroad and provides financial reimbursement for the cost of replacing parts of an ATOL protected package. The bankruptcy of Monarch implied a significant loss in terms of passengers that was not recovered, even a year after (Eugenio-Martin and Perez Granja, 2021). Almost two years later, on 23rd September 2019, Thomas Cook airline also announced its bankruptcy. However, on this occasion Spanish policymakers decided to intervene. Thus, on 11th October, the Spanish government published *Real Decreto* 12/2019, which contained a set of urgent measures to contain the effects of the Thomas Cook bankruptcy. These incorporated the following measures that were applicable exclusively to the Canary and Balearic Islands, where Thomas Cook was significantly present:

1. 100% discount on the passenger tax for each extra seat programmed for the winter season.
2. 12% discount on the Enaire (Spanish air control) tariff.
3. Reinforce the promotion of tourism destinations.
4. A credit line of 200 million euros for the tourism business.
5. Extension of the social security bonus for discontinuous job contracts.
6. Opening a new information office at the social security office for procedures, such as deferment of payments.
7. Opening a new information office at the tax office for procedures, such as deferment of payments.
8. Coordination for support and information measures for businesses in the process of bankruptcy.
9. Analysis and restructuring of current employment policies.
10. Promotion programme for Spain as a tourism destination in alternative markets.
11. Development of measures to consolidate the tourism season 2019-2020 in the two Spanish archipelagos.
12. Reinforcement of the Smart Tourism Destination Network.
13. Design of a joint strategy to defend the general interest of Spanish stakeholders.

Measures 1, 2 and 11 focused on incentives to the airlines to enter or strengthen their current traffic; while measures 3, 10 and 12 focused on reinforcement of the destination. Measures 5 and 9 pursued employment recovery; whereas measures 6, 7, 8 and 13 sought steady recovery from the situation.

4. Results

The results of the paper are shown for the univariate and multivariate cases. Firstly, the univariate series works with total British tourists' arrivals to each island on a monthly basis between January 2012 and February 2020. The dataset is drawn from the Spanish Airport Operator (AENA), and provides an overall view of the impact of the bankruptcy, so that it shows the net impact on the number of passengers. Secondly, the multivariate case deal with the series of all airlines simultaneously. It allows any significant redistribution of passengers among the companies to be measured. In particular, the airlines considered are: British Airways, easyJet, Jet2, Monarch, Norwegian, Ryanair, Thomas Cook and TUI, which are those that operated up to 2019 (except Monarch).

Level interventions

The results are shown in chronological order, so that Monarch's bankruptcy is shown first, followed by Thomas Cook. Table 1 shows the univariate STSM estimates of the Monarch case. A level intervention is introduced in October 2017 to test whether the exit of Monarch made a difference in passenger traffic to the island. The first column shows the univariate STSM of Monarch series traveling from the UK to Tenerife. The level is significant and estimated at 206,454 passengers, which represents the average number of passengers that the island receives each month from the UK. The slope is estimated at 979.72, which is significant and suggests that, on average, each month the number of passengers from the UK is expected to grow by that amount. The seasonal component is also significant, which means that the arrivals are subjected to seasonality. For each month, the seasonal component represents a shift with respect to the level. For simplicity, these seasonal estimates are omitted in the table.

Table 1. Univariate Structural Time Series Model of UK arrivals to Canary Islands' airports following the Monarch bankruptcy (January 2012 – February 2018)

	Tenerife	Lanzarote	Gran Canaria	Fuerteventura
Level	206454.91	131284.76	76348.57	66442.75
	[0.000]	[0.000]	[0.000]	[0.000]
Slope	979.72	788.16	349.94	423.06
	[0.007]	[0.000]	[0.132]	[0.001]
Seasonal χ2	313.14	223.13	508.37	61.77
	[0.000]	[0.000]	[0.000]	[0.000]
Monarch	-24287.09	-10534.77	-6417.43	-4395.33
	[0.000]	[0.022]	[0.027]	[0.091]
Normality	4.479	1.042	1.001	2.672
	[0.107]	[0.594]	[0.107]	[0.263]
Heteroscedasticity	1.551	1.5731	1.684	0.532
	[0.167]	[0.173]	[0.167]	[0.917]
Durbin-Watson	2.027	2.112	2.082	1.876
Serial correlation	17.334	14.867	40.197	25.17
	[0.691]	[0.830]	[0.007]	[0.240]
R^2	0.961	0.979	0.983	0.934
R^2s	0.537	0.669	0.546	0.358
p.e.v.	2.93*10^7	1.10*10^7	5.34*10^6	9.70*10^6

p-values in squared brackets

More importantly, the level intervention is significant and shows that after Monarch's exit the number of passengers dropped permanently by 24,287. Such a drop is interpreted as permanent because the series comprises a sufficiently long series after the level intervention, so that the market has had sufficient time to settle after the exit. The same interpretation is applied to the other islands. However, the permanent declines are not as large as in Tenerife because the proportion of the British market was also lower. In relative terms, the market size fall in Tenerife reached 11.76%, compared to Lanzarote (8.02%), Gran Canaria (8.40%) and Fuerteventura (6.61%). This represents a net loss of passengers that could not be recovered by the incumbent airlines or new entrants. Hence, Hypothesis 1 does not hold for any of the islands. It suggests that free entry is not a sufficient condition for encouraging incumbent airlines or new entries to take over the traffic lost from Monarch's exit.

Table 2. Univariate Structural Time Series Model of UK arrivals to Canary Islands' airports following the Thomas Cook bankruptcy (January 2012 – February 2020)

	Tenerife	Lanzarote	Gran Canaria	Fuerteventura
Level	219338.23	129260.68	75256.4	64635.54
	[0.000]	[0.000]	[0.000]	[0.000]
Slope	874.69	566.98	270.62	295.33
	[0.004]	[0.040]	[0.226]	[0.027]
Seasonal χ2	456.94	332.04	638.71	73.74
	[0.000]	[0.000]	[0.000]	[0.000]
Monarch	-24721.91	-10219.33	-6190.26	-4235.00
	[0.000]	[0.022]	[0.031]	[0.000]
Thomas Cook	-9942.03	-7038.21	-598.19	-8820.36
	[0.062]	[0.114]	[0.830]	[0.062]
Normality	4.911	3.115	0.026	4.674
	[0.086]	[0.211]	[0.987]	[0.097]
Heteroscedasticity	0.485	1.153	1.815	1.028
	[0.965]	[0.360]	[0.068]	[0.472]
Durbin-Watson	2.042	2.059	2.048	1.879
Serial correlation	27.142	23.745	22.383	27.976
	[0.166]	[0.306]	[0.378]	[0.141]
R^2	0.962	0.958	0.986	0.925
R^2s	0.497	0.314	0.5107	0.345
p.e.v.	5.66*10^7	1.87*10^7	5.66*10^6	1.06*10^7

p-values in squared brackets

Table 2 shows the results of the Thomas Cook bankruptcy case. The series is now extended up to February 2020, just before the Covid-19 pandemic. The model estimates the fall after the Thomas Cook exit. It shows that in Tenerife the drop was about 9,942 passengers, which represents 4.53% of the current market. For the other islands, the impacts are: Lanzarote (5.44%), Gran Canaria (0.79%) and Fuerteventura (13.64%). If we add all the interventions, we find that the net loss of passengers in the Canary Islands after the Monarch exit was about 45,366; whereas after Thomas Cook it was about 26,399. Hence Hypothesis 1 does not hold for most of the islands, with Gran Canaria experiencing a minor impact. Nevertheless, the impact is much lower than in the Monarch case, which suggests that the incumbent airlines have managed to take over some of the traffic, as suggested by Hypothesis 3. It should be remembered that after Thomas Cook's exit, the

Spanish Government applied an incentives scheme. In order to test whether this made a difference for some incumbent airlines, the multivariate model is applied.

Table 3 shows the multivariate series analysis. It disentangles the series by airline, and therefore distinguishes whether a particular airline has grown in the number of passengers after Monarch's or Thomas Cook's exit. The first Monarch intervention shows that British Airways gained an advantage from Monarch's exit by increasing their number of passengers by about 2,561. Nevertheless, this figure is far from the Monarch fall of 50,726 passengers, since it only represents 5.04% of the drop. Hence, Hypothesis 2 cannot be held.

Moreover, Thomas Cook also shows a negative figure, which proves that it did not benefit from Monarch's exit, but that both airlines were suffering deterioration in passengers at the same time. More interestingly, the Thomas Cook level intervention shows a redistribution of passengers among the incumbent airlines. It shows that British Airways increased its traffic by about 1,587 passengers and more importantly, Jet2 (a holiday airline with scheduled operations) increased its traffic by about 25,951. The increase in traffic in Jet2, soon after Monarch's exit, contrasts with its response after Thomas Cook's. In the former, Jet2 did not respond, whereas in the latter case, the response was very marked. Hence, this evidence confirms that Hypothesis 3 holds. Moreover, the joint market increase supported by Jet2 and British Airways represents 38.82% of the Thomas Cook decline. The rest of the drop was not covered by the incumbent airlines.

Table 3. Multivariate Structural Time Series Model of all Canary Islands' incumbent airlines after the Monarch and Thomas Cook bankruptcies (January 2012-February 2020)

	Thomas Cook	Ryanair	Monarch	easyJet	TUI	Jet2	Brisith Airways	Norwegian
Level	85520.98	93892.89	51959.11	54627.14	81606.29	132906.08	8438.5	7906.39
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)
Slope	188.8	-356.11	262.44	304.73	-133.21	2019.27	66.25	-131.07
	(0.738)	(0.575)	(0.411)	(0.001)	(0.682)	(0.038)	(0.334)	(0.697)
Seasonal χ2	182.74	370.92	7.074	333.52	160.5	358.92	98.98	170.81
	(0.000)	(0.000)	(0.793)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Monarch	-12896.63	-3598.4	-50726.6	1881.84	2380.19	3039.31	**2561.65**	-2409.28
	(0.006)	(0.363)	(0.000)	(0.184)	(0.425)	(0.420)	(0.001)	(0.112)
Thomas Cook	-70921.28	-262.29	-	2394.5	-4045.32	**25951.41**	**1586.88**	2100.87
	(0.000)	(0.950)	-	(0.109)	(0.187)	(0.000)	(0.054)	(0.201)
Normality	3.101	13.393	16.212	0.002	20.99	19.083	14.926	16.447
	(0.212)	(0.001)	(0.000)	(0.999)	(0.000)	(0.000)	(0.001)	(0.000)
Heteroscedasticity	2.197	0.625	0.481	1.039	2.612	1.597	2.512	1.563
	(0.023)	(0.886)	(0.969)	(0.461)	(0.008)	(0.115)	(0.010)	(0.126)
Durbin-Watson	1.731	1.361	2.06	1.625	1.991	1.897	1.659	1.821
Serial correlation	33.418	37.003	24.521	22.5825	22.049	24.439	17.727	27.973
	(0.042)	(0.017)	(0.269)	(0.367)	(0.397)	(0.272)	(0.666)	(0.141)
R^2	0.942	0.952	0.979	0.974	0.918	0.991	0.959	0.93
R^2s	0.649	0.212	0.7496	0.486	0.338	0.577	0.456	0.277
p.e.v.	2.30*10^7	2.26*10^7	1.08*10^7	4.06*10^6	8.46*10^6	1.71*10^7	7.55*10^5	2.54*10^6

p-values in squared brackets

Tests

According to Commandeur and Koopman (2007), in order of importance, the model should be checked for independence (absence of serial correlation), homoscedasticity, and normality of the error terms. The absence of serial correlation can be tested by the Durbin-Watson statistic or the Box-Ljung Q-statistic. The latter is tested with a Chi-squared distribution with *q*-*p* degrees of freedom, where *q* denotes the number of autocorrelations to be tested and *p* denotes the number of hyperparameters estimated. The homoscedasticity is checked employing the H(*h*) statistic that tests if the variance of the residuals of the first third is equal to the last third of the time series. It is tested with an F distribution with *h*,*h* degrees of freedom, where *h* denotes the integer value resulting from dividing the length of the series by three. Finally, normality can be tested by employing the Bowman-Shenton test. This considers a Chi squared test, such that normality is accepted if the critical value is below 5.99, which represents 95% probability of being a normal distribution.

As can be seen in the Tables 1 and 2 for the univariate series, there are no problems of serial correlation, heteroscedasticity or normality. For some cases in the multivariate series (Table 3), there are more problems, especially with normality. This is expected to happen in series with some degree of volatility with marked changes in frequency, or in those series with marked entries and/or exits. Nevertheless, if we compare the results from both cases, they are pretty similar, which confirms that the multivariate estimates are consistent.

6. Conclusions and discussion

This paper has studied the impact of exits on passenger traffic, and represents a first in applying structural time series to quantifying net impact, as well as the distributional impact of exits among incumbent airlines. Specifically, the paper has shown that the impact of a bankruptcy on a key airline is negative for passenger traffic in the short run. However, policymaking can make a difference on this outcome if a set of effective incentives can be provided.

The Monarch bankruptcy shows that under a *laissez faire* policy, the incumbent airlines did not respond by taking over lost traffic from Monarch's exit. Capacity constraints (Strassmann, 1990) and network economies may have impeded incumbent airlines increasing their presence on the route. For Tenerife, the analysis of the univariate series showed a negative impact on the number of arrivals of about 93.04% of the Monarch series. Therefore, it reveals that the exit of Monarch was not covered by the incumbent airlines. Moreover, the multivariate estimates show that the net gain in traffic among the incumbent companies only covered about 5.04% of Monarch's level. Similar figures were shown for the other islands.

The case of Thomas Cook was different. Policymakers decided to intervene in the market and provided a set of incentives for the incumbent airlines to take over part of the traffic left by the charter airline. As a result of this, for Tenerife, 65.28% of Thomas Cook passengers were not lost, but redistributed among the incumbent airlines. In particular, Jet2 increased its traffic by about 25.76% of its size at that time, and British Airways increased it by about 49.24%. These kinds of results were also seen in the other islands.

Overall, this paper has revealed a number of interesting points that are worth discussing. First, the results of the paper show that under *laissez faire* conditions, airlines' decisions did not vary over time. This suggests that the number of airline operations is conditioned by their own multi-market strategy equilibrium and optimal size. After Monarch's exit, new market opportunities seemed to arise, but none of the incumbent airlines made a move to take over the lost passengers. Second, it shows that capacity constraints are restraining the short run expansion of airlines. This can particularly be seen in Monarch's bankruptcy, as it was a global phenomenon rather than specific to these routes. The incumbent airlines may also have interests in other markets, which they may prioritize to take over. Thus, a global reaction needs to be taken into account. Third, the incumbent reaction may be subject to the possibility of gaining bargaining power with respect to the airport and tourism destination managers. In the Canary Islands' case, the presence of six to eight airlines in the market seemed to be sufficient to prevent such predatory moves. Fourth, the incentive scheme did not impede a net loss of passengers after Thomas Cook's exit, but it avoided a larger loss. It may support, under certain circumstances, airport and tourism destination managers' claims for the presence of incentive schemes. Fifth, policymakers should assess the cost of the incentives scheme and compare them with the expected benefits, not only in terms of direct financial income at airports, but also in terms of direct, indirect and induced GDP generated by tourism.

This paper has shown the impact of Thomas Cook's bankruptcy five months after its exit. Unfortunately, the Covid-19 pandemic has altered the series and circumstances so much that it will inevitably condition future market entries and exits. Moreover, further research may be required in order to understand the trade-off between costly incentives and free exits. Applied general equilibrium models or cost benefit analysis may provide richer insights that can complement this study. Finally, future research may employ this kind of methodology to test the effects of Covid-19 on the whole market, as well on the redistribution of traffic among the remaining airlines.

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