Journal of Air Transport Management 14 (2008) 113–122

Contents lists available at ScienceDirect

Journal of Air Transport Management

journal homepage: www.elsevier.com/locate/jairtraman

The Southwest effect: A time-series analysis on passengers carried by selected routes and a market share comparison

D.E. Pitfield

Transport Studies Group, Department of Civil and Building Engineering, Loughborough University, Loughborough, Leicestershire LE11 3TU, UK

ARTICLE INFO

Keywords:
Low-cost carriers
ARIMA models
Intervention analysis
Market share

ABSTRACT

The Southwest effect has been known for some time in terms of the US airline's impact on pricing, competition and traffic volumes. But recent estimates of the impact on traffic and market shares do not exist. This desideratum can be addressed by applying autoregressive integrated moving average (ARIMA) models with intervention analysis to key domestic air routes in the USA, where Southwest has started service. The paper first deals with the choice of routes to be examined and, after a preliminary statistical description of these, applies ARIMA models. These results are examined for both their statistical qualities and their reasonableness and the impacts are compared to those previously determined in the same way for Ryanair's routes from London.

1. Introduction

This paper is concerned with identifying the impact of Southwest's start up on traffic volumes and airline market share on a variety of US domestic city pairs. Autoregressive integrated moving average (ARIMA) modelling with intervention analysis is used to estimate the impact of Southwest's start of service on route traffic. A comparison of this with actual market shares enables inferences to be made on the impact on competitors.

Previous published work (Pitfield, 2007a) has been able to demonstrate, using the same modelling approach, what the impact of Ryanair's start up of service from London Stansted (STN) has been on competing airlines flying from other airports in the London system to either the same airport as Ryanair but more usually to an airport that is not thought of as a secondary airport. The impact is considerable. Passenger numbers grow on the route as a result of the start up and Ryanair at least captures that growth and normally has an impact on existing carriers by taking some of their share of the market as well. Southwest's impacts and shares can be compared to Ryanair.

The impact of Southwest on prices (Morrison, 2001) and its competitors is so well known it has long been referred to as 'the Southwest Effect' (US Department of Transportation, 1993; Richards, 1996) with evidence being seen at Baltimore–Washington International (BWI) Airport (Phillips, 1996) and again at Denver (DEN) Airport Business (2006). Although estimates exist of the impact on traffic in the past papers of Windle and Dresner (1995), Dresner et al. (1996) and Vowles (2001), there are no recent estimates[1] and a current estimate of the intervention effect on passenger numbers of Southwest, and its market share on the routes will enable comparisons with these past estimates and with the Ryanair impact previously determined. In addition, it will allow impacts to be determined for a much more mature market situation when the most recent start-ups are examined.

US Bureau of Transportation Statistics Form 100 data are available online on a monthly basis from 1990 (Bureau of Transportation Statistics, 2006). These details origin–destination passengers carried between airports by airline and ARIMA models can be applied to these data before the start up of Southwest on routes when its impact can be estimated.

2. Data

The difficulty with this proposed approach, given the longevity of Southwest and its presence on many routes before 1990, is that the routes that can be examined are limited. Clearly, the start of Southwest service has to be after 1990 so that a time series model can be built before it intervenes. In addition, there is some credibility in the notion that 'important' routes should be looked at. In terms of passenger volume this can be based on the size of airports and Table 1 lists the 10 busiest US airports. But this does not help much in terms of determining which city pair flows are 'important' or which could demonstrate the size of impact of

[1] Other issues are addressed by Boguslaski et al. (2004), where the entry patterns of Southwest are investigated and airlines identified that might be vulnerable to such competition. McMullen and Du (2007) investigate the impact of the ATA–Southwest code share.

E-mail address: D.E.Pitfield@lboro.ac.uk

0969-6997/$ - see front matter © 2008 Elsevier Ltd. All rights reserved.
doi:10.1016/j.jairtraman.2008.02.006

Table 1
Top ten US airports by total passengers, 2005

Airport	Total passengers
Atlanta, Hartsfield (ATL)	85,907,423
Chicago, O'Hare (ORD)	75,510,003
Los Angeles (LAX)	61,485,269
Dallas/Ft.Worth (DFW)	59,064,360
Las Vegas (LAS)	44,280,190
Denver (DEN)	43,307,335
Phoenix, Sky Harbor (PHX)	41,204,071
New York (JFK)	40,584,001
Houston (IAH)	39,713,920
Minneapolis/St. Paul (MSP)	37,563,664

Source: Derived from 〈http:/infoplease.com/ipa/A0004547.html〉.

Southwest on principal domestic traffic flows. An approach is taken here which first examines Federal Aviation Administration data to identify city pairs in the 48 contiguous states that have a large number of flights between them as a guide to which city pairs should be examined in the US Bureau of Transportation Statistics data to determine total passenger flows on corridors (see Table 2). This analysis is undertaken for 2005 and then candidate routes are examined. Some of these candidates represent flows between hub airports, for example Atlanta, Hartsfield (ATL)–Dallas/Fort Worth (DFW) and Chicago O'Hare (ORD)–Minneapolis St. Paul (MSP) and some represent flows between hubs and non-hubs, for example, ORD–Washington Reagan (DCA).[2]

A further aspect that should be covered is airport usage. Southwest often uses secondary airports, for example Chicago Midway (MDW) instead of ORD and BWI instead, at the time of the commencement of service, of the other Washington Airports, Reagan (DCA) and Dulles (IAD).[3] There is an opportunity here to investigate its impact on major carriers flying the same corridor, but not using the secondary airports. Traffic on this Washington–Chicago corridor provides an opportunity to study this impact as Southwest started at BWI in September 1993 and was in competition with United and American as well as at various times American Eagle, US Airways and Northwest.[4]

Another route that can be examined is Philadelphia (PHL) to ORD as Southwest commenced service here in May 2004 and uses only one secondary airport (MDW not ORD) compared to the main competition from United, American and US Airways. Traffic from PHL to both ORD and MDW can be examined.[5]

Further, the route between MDW and Providence, Rhode Island (PVD) has been operated by Southwest since October 1996. In addition, service has been offered from Manchester–Boston Regional Airport, New Hampshire (MHT) from June 1998. Both of these New England cities are promoted as Boston airports with one being recently renamed and both being about 50 miles from Boston. Of course Boston, Logan (BOS) is served by the major carriers who for much of the period were United and American. Although Chicago–Boston does not feature as a major city pairing from Table 2, it is clear that the inclusion of Providence and Manchester traffic brings it up to nearly 3 million in 2005 with some 170 flights scheduled in the summer period and so it is very worthy of study on any grounds of importance. Southwest is again using secondary airports at both ends of the route and there is the issue of their code share with ATA Airlines to explore.

Another route from Chicago Midway (MDW), where Southwest operates a number of services, is to Oakland, California (OAK). This is a secondary airport for San Francisco as the two cities are 13 miles apart on opposite sides of San Francisco Bay. This service officially started in April 2002. However, the US Bureau of Transportation Statistics data records Southwest flights to OAK in most months and in most years since 1990 when the earliest available data are available online. Not only that, but there are also regular flights to San Francisco (SFO) recorded in the US Bureau of Transportation Statistics data. Nevertheless, the volume of Southwest traffic shows a sharp increase on the official commencement of service so the impact of this official start up on the Chicago (ORD and MDW)-Bay area (SFO and OAK) can be examined. The main competitors are American on SFO–ORD, United on OAK–ORD and SFO–ORD along with ATA on SFO–MDW.[6] The overall route in 2005 carried just over 2.5 million passengers.

Finally, although the start up is very recent (January 2006), Denver (DEN) to Las Vegas (LAS) represents an opportunity to examine the impact when Southwest uses the same airports as its competitors. Competition here is with United, American West and Frontier Airlines, another low-cost airline.[7] The previous work by Pitfield (2007a) would suggest that this impact would be greater than the case of one airport being shared with the competition and that this would be greater again than the case where Southwest uses two secondary airports. However, competition from another low-cost carrier, Frontier, may dilute this impact.

The other candidate routes in Table 2 either show that Southwest commenced service before 1990[8] or that it does not serve these airports as of mid-2006.

3. ARIMA modelling

The formal method of ARIMA modelling and intervention analysis can be found in a variety of textbooks including Wei (1994) and McDowall et al. (1980) and the published appendix to Pitfield (2007a) contains both an outline of this and of the assessment of goodness-of-fit.

The purpose of ARIMA models is to duplicate as closely as possible the typical variations in a time series. Their adequacy is checked by examining both goodness-of-fit statistics and whether the residuals are white noise. If they are adequate, then the model will have captured all the indigenous factors that underlie the variation in the series being modelled. If such a model is calibrated on the traffic data before the commencement of Southwest service, then the same model form, plus an intervention variable, can be applied to the whole data series to establish the impact on the total series of the start up. This can then be compared to the size of actual market shares and inferences drawn on the impact of competition.

As the data series are monthly observations from 1990, it is clear that there will be both seasonal and non-seasonal components in the model. In essence, the series is forced to have

[2] Airline Hubs are listed by Oster Jr. and Strong (2006) but these are not in accordance with the FAA's definition of hubs and non-hubs which is based on the number of enplanements.

[3] By late 2006 Southwest was flying to MDW from IAD and ATA was code sharing with Southwest from DCA to MDW. Airline Weekly (2006) refers to 'Battling for the Capital'. DCA is capacity constrained and only handles domestic and Canadian trans-border flights of less than 1250 miles.

[4] It might be hard to think of MDW as secondary as it is 10 miles from downtown Chicago whilst ORD is some 17 miles distant. Similarly, although BWI is 11 miles from downtown Baltimore it is only 33 miles from Washington DC whereas IAD is 25 miles distant with DCA closer at 5 miles. It was the start of service at BWI that is the focus of Dresner et al. (1996).

[5] For this and the remaining routes the estimates can be described as recent with Southwest start ups being mid to late 1990s or after 2000.

[6] The impact of the ATA Southwest code share can again be investigated.

[7] ATA has a presence on all these routes prior to the code share.

[8] Otherwise it would be especially interesting to examine the impact on the traffic between the Bay area (San Francisco, SFO and Oakland, OAK) to LAX first noted by United States Department of Transportation (1993).