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The effect of de-hubbing on airfares

Kerry M. Tan*, Andrew Samuel

Department of Economics, Loyola University Maryland, 4501 N Charles St., Baltimore, MD, 21210, USA

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ABSTRACT

This paper studies the price effect of de-hubbing, which occurs when an airline ceases hub operations at an airport. We develop a simple theoretical model to study the impact of de-hubbing on prices and quantities of direct flights at the hub airport. Using an event study of seven cases of de-hubbing between 1993 and 2009, we analyze how average airfares change following de-hubbing. Consistent with the theoretical implications, the empirical results suggest that airfares decrease when there is a low-cost carrier presence at the de-hubbed airport, whereas airfares increase when the de-hubbed airport is not serviced by a low-cost carrier.

1. Introduction

Hub-and-spoke networks have become the predominant route network structure for legacy carriers since the U.S. airline industry deregulated in 1978. Under this system, a legacy carrier moves passenger traffic between spoke airports through one of its hub airports in order to exploit economies of scope and economies of traffic density. Each of these airlines has several hub airports strategically located in different regions of the United States.[1] However, some of the legacy carriers have recently de-hubbed an airport by ceasing hub operations at that airport, which significantly reduces capacity and the number of spoke airports serviced by the de-hubbed airline. For example, American Airlines de-hubbed both Nashville International Airport (BNA) and Raleigh-Durham International Airport (RDU) in 1995, as well as Lambert-St. Louis International Airport (STL) in 2004. Delta Air Lines de-hubbed Cincinnati/Northern Kentucky International Airport (CVG) in 2006 and Dallas/Fort Worth International Airport (DFW) in 2005. Finally, US Airways de-hubbed Newark Liberty International Airport (EWR) in 1995, whereas Continental Airlines de-hubbed Denver International Airport (DEN) in 1995. This paper analyzes the impact of de-hubbing on airfares at these seven de-hubbed airports.

There is a small, yet growing literature on the economic impact of de-hubbing in the airline industry. Redondi et al. (2012) formally define the criteria for identifying cases of de-hubbing and identify 37 airports that have been de-hubbed between 1997 and 2009 worldwide. They find that de-hubbing, which can occur due to weak demand or a strategic decision to focus on other nearby hub airports, results in a significant and permanent decrease in the number of scheduled flights and seats offered. However, they do not take into consideration the ramifications of de-hubbing on airfares, which is one of the major contributions of our paper. Bilotkach et al. (2014) estimate the consumer welfare effects of de-hubbing using the Budapest Liszt Ferenc International Airport as a case study. They find that there was a net decrease in overall capacity following the de-hubbing of that airport by Malev Hungarian Airlines despite low-cost carriers increasing their service to the airport and weigh the reduction in flight service with potential lower airfares charged by low-cost carriers. To the best of our knowledge, our paper is the first to study the effect of de-hubbing on airfares in the U.S. airline industry.

In contrast to the lack of attention spent on de-hubbing, the existing literature has been focused on the hub premium, in which prices are higher, on average, when at least one of the route's endpoints is a hub airport for the servicing airline. Legacy carriers experience more market power at their hub airports because

* Corresponding author.
E-mail addresses: kmtan@loyola.edu (K.M. Tan), asamuel@loyola.edu (A. Samuel).

[1] For example, American Airlines currently utilizes Dallas/Fort Worth International Airport, John F. Kennedy International Airport, Los Angeles International Airport, Miami International Airport, and O'Hare International Airport as hub airports within the United States.

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passengers are attracted to the higher frequency of flights and the increased variety of destinations that they offer from the hub airport. Moreover, Lederman (2008) finds that certain passengers are willing to pay higher prices in order to receive future awards from the airline's frequent-flyer program. Early works empirically estimated the value of the hub premium by regressing logged airfares on airport market shares, while controlling for other factors. Borenstein (1989) and Evans and Kessides (1993) both find that airport market shares has a positive and statistically significant effect on airfares. More recently, Lee and Luengo-Prado (2005) use hub dummy variables as a more explicit proxy for the hub premium and find that prices are between 12.2% and 13.0% higher, on average, when the flight travels to or from an airline's hub airport. Finally, Bilotkach and Pai (2014) use a clever difference-in-differences estimation strategy to distinguish a hub premium from a dominance premium at major U.S. airports that serve as a hub for two airlines. To be sure, this paper does not attempt to identify the existence of a hub premium; rather, we focus on price changes on routes where an airline has de-hubbed at least one of the endpoint airports. Indeed, in contrast to the prior literature on hub-premiums which focuses on studying the difference between hub and non-hub routes at a given point in time, we are interested in the impact of prices before and after de-hubbing. Thus, we are specifically interested in studying how de-hubbing changes the market structure because of changes in the de-hubbed airline as well as due to the strategic responses (to de-hubbing) of other airlines in that same market.

To study this issue, we develop a simple theoretical model that explains how the presence of low-cost carriers influences the price response to de-hubbing. The key results of the model are driven by the differences in the cost structure for legacy carriers and low-cost carriers. Although economies of density are possessed by both the de-hubbing airline and its rivals, the economies of density are assumed to be stronger for low-cost carrier rivals than legacy carrier rivals. Under this assumption, our model predicts that average airfares should decrease after de-hubbing when the de-hubbed airport is serviced by a low-cost carrier, whereas prices should increase where no low-cost carrier exists. The model's predictions regarding changes in airline capacity are also consistent with the data. Although we present only the duopoly case, our results hold for the general oligopoly case.

In order to analyze these theoretical predictions, we study seven instances of de-hubbing at domestic airports between 1993 and 2009. Using a difference-in-differences estimation approach, we find a positive and statistically significant price increase after de-hubbing at some airports, whereas airfares significantly decreased to and from other de-hubbed airports. The distinction between the contrasting results depends on whether low-cost carriers service the de-hubbed airport. Low-cost carriers respond to de-hubbing by increasing their capacity on routes to and from the de-hubbed airport, which puts more competitive pressure on airfares. On the other hand, airfares for routes to or from de-hubbed airports without any low-cost carrier presence increase due to the reduction in the availability of substitutes because of the net reduction in capacity. Thus, the empirical results are consistent with the testable hypotheses of our theoretical model.

2. A model with de-hubbing

In this section we present a simple stylized model of competition between two airlines: a hub airline that de-hubs at an airport and a rival airline, which may be either a legacy carrier or a low-cost carrier. The model is similar in spirit to Brueckner and Spiller (1991) with some key simplifications in order to focus on the empirical analysis of the price effects of de-hubbing. We use the model to derive comparative static results of the impact of de-hubbing on average prices and quantities of direct flights to and from the de-hubbed airport (and do not focus on connecting flights). It should be noted that these comparative statics are independent of the impact of de-hubbing on connecting traffic markets.

Consider an airline with a hub and spoke network at some hub city. There are n exogenously determined spokes, therefore, there are n hub-inclusive markets.[2] We assume that the hub airline competes with a separate competitor within each of the n hub-inclusive markets. Thus, there are n identical, segmented, duopoly markets in which the hub airline competes with a rival airline. Although in reality airline markets are not duopolies, the key comparative static results we derive extend to the case with more than two firms. Additionally, there are $n(n-1)$ non-hub markets that use the hub to travel between non-hub cities in the hub and spoke network (i.e. connecting flight travel). The hub traffic market of the hub airline is identified with the letter H and the rival airline with the letter L (to denote legacy or low-cost carrier), and the non-hub traffic (of the hub airline) is identified by NH.

Within each of the n markets, the hub and rival airline's products are assumed to be perfect substitutes.[3] Thus, the inverse demand curve for the hub and rival airline is given by,

$$p = a - b(q_H + q_L),$$

where q_H is the hub traffic quantity of the hub airline and q_L the hub traffic of the rival airline. Inverse demand (price) for the hub airline (in the non-hub market) is given by,[4]

$$p = a - \beta(q_{NH}).$$

With regard to costs we follow Brueckner and Spiller (1991) and assume that both airlines possess economies of density,[5] but that the hub airline's economies of density are increasing in the number of spokes n. To reflect this, the hub airline's total cost in each of the n markets is,

$$c_H(q_H + (n-1)q_{NH}) - \gamma\frac{(q_H + (n-1)q_{NH})^2}{2},$$

and the rival airline total cost is given by,

$$c_L q_L - \delta\frac{q_L^2}{2},$$

where c_H, c_L, δ, γ are all positive constants, and δ and γ capture the intensity of the economies of density.[6]

Given the above demand and costs, the profit of the hub airline is,

[2] Hub-inclusive markets refers to travel to and from the hub as opposed to *through* it. This follows the terminology used in Brueckner and Spiller (1991) and Brueckner et al. (1992).

[3] We follow the standard Cournot framework as presented in Martin (2002). Although we assume that the airlines' products are perfect substitutes, none of our results depend on this assumption.

[4] Although we assume identical intercepts for the hub and non-hub demand, the results of our model are not sensitive to this assumption.

[5] Most economists believe the airline industry has economies of density, but there is no agreement that the industry has economies of scale (holding density constant). As such, we focus on economies of density instead of economies of scale. See Caves et al. (1984) for a detailed discussion on this issue.

[6] Note that our model is analytically almost equivalent to a model where de-hubbing affects the intercept of the demand (instead of through the cost function).