The Effect of Airport Hub Dominance on Average Airfares: A Systematic Review

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Abstract:

The effect of airport hub dominance on the average airfares, a central topic in airline pricing analysis, has evoked much research on it. The effect is also called hub premiums. This paper examines this effect by conducting systematic review and analysis on the existing literature on hub premiums. The procedures of the systematic review include setting up the inclusion criteria, searching for relevant literature, and extracting information from literature. The results establish the presence of hub premiums in the US airline market. Even in other overseas airline markets, such as the Chinese and European airline markets, there is evidence for positive hub premiums. In addition, this paper finds that the presence of low-cost carriers has negative effect on airfares, thus lowering the existing hub premiums. This paper contributes to the limited number of systematic reviews regarding hub premiums in the existing literature. It provides important evidence in understanding the structure and competition of the US airline industry.

Keywords: Hub Premiums; Airport Dominance; Airline Pricing; Systematic Review.

1. Introduction

The airfare effect of airport hub dominance, also called hub premiums, is an important topic in the airline pricing field, which evokes much empirical research on it. The basic questions regarding airport hub premium include: 'What is a hub airport?' and 'What is an airport hub premium?'. Here the paper introduces some basic definitions related to airport hub premium. The concept of hub usually is closely related to airline deregulation events. Specifically in the US, the airline deregulation occurred at 1978 leads some airlines to build up hub-and-spoke networks, instead of just using point-to-point networks. A point-to-point network for an airline is a network where (1): there is no central airport (or hub airport) for that airline, and (2): The flights are all direct flights between non-hub (or non-central) airports. On the other hand, a hub-and-spoke network for an airline involves a hub airport that serves as a center for most of the airline's flights. In order to get to the destination airports, some flights need to first get to the hub airport and then take a transfer. The hub-and-spoke mode can reduce the costs of airline operations, providing economics of scale. However, it may also cause congestion in hub airports. The US airline deregulation mentioned above, which enables airlines to build up hub-and-spoke networks, thus evoke many studies and debates regarding the hub airports and airline competition. Among them, a phenomenon called 'hub premium' is of particular interest. Hub premium refers to the generally higher airfares charged by an airline for routes that arrive at or depart from the airline's hub airport, compared to the airfares for routes that have no touch on the hub airport. Investigating the factors of hub premium and the effect each factor has on hub premium constitutes great importance in understanding the structure and competition of airline industry.

This paper conducts a systematic review and analysis based on the existing literature to examine the existence of hub premiums. The methodology includes setting up the inclusion criteria for the literature, conducting literature search via Google Scholar and the studies already been selected, and extracting the information from the selected studies using an organized spreadsheet. The detailed information on methodology is described in the Methodology section below.

Based on the selected studies, it can be seen that the early literature on a carrier's hub premiums employed direct comparisons of airfare measures between the routes passing through the carrier's hub airport and the routes not passing through. One of those early studies is the study by

Huston and Butler [1]. Later literature on hub premiums, such as Borenstein's study in 1989 [2], usually adopted econometrics model to statistically control for other variables affecting airfares, such as the route distances. The data and results from all selected studies suggest a positive effect of airport hub dominance on airfares, establishing the presence of hub premiums. Furthermore, the low-cost carriers play an important role in affecting the hub dominance. The selected studies found that the presence of low-cost carriers has negative effects on average airfares, thus reducing the existing hub premiums.

The remaining part of the paper is structured as followed: (1): The section Methodology describes the methods this paper used to conduct systematic review and analysis. (2): The section 'The Airfare Effect of Airport Hub Dominance' describes the methods of analysis adopted by the existing literature and their results and outcomes regarding the hub premiums. (3): Finally, the 'Conclusion and Discussion' section summarizes the main conclusion of this paper, the paper's contribution to the existing literature, and its limitations.

2. Methodology

This paper employs the traditional method for conducting systematic reviews. The traditional method for systematic reviews generally involves the following process: (1): Setting up the inclusion criteria, the criteria used to determine whether to include a study or not; (2): Determining, specifically, how to search for the relevant literature, then conducting the literature search; (3): Specifying how to extract relevant information and data from the selected literature. The following subsections address each part of the above process.

2.1 Inclusion Criteria

This paper targets on studies that focus on the airline markets. When selecting them, there is no restriction on the time of the studies and the countries/regions/airports those airline markets locate at. But the focus is still the US airline market. In terms of topics, the target includes any papers studying the presence of and the causes for the airline price premium.

Despite the criteria on the subjects of studies and the topics, this paper does not have as much requirement on the studies' methodologies and whether they are theoretical or empirical. However, for studies that do have empirical portions, those utilizing proper econometrics, which give estimates of causal effects and inferences, is strongly preferred over those just having exploratory data analysis, which cannot identify causal effects.

2.2 Literature Search

Having built up the inclusion criteria, we then conduct the literature search using the following two methods: (1): Direct literature search on Google Scholar (2): For studies that have already been selected, a backward literature search based on their bibliographies and references.

2.3 Information/Data Extraction

Finally, given all selected studies, we extract relevant information and data from them in a systematic way. We build up a spreadsheet to store the important results of each selected study. The spreadsheet has six columns. The first three columns are 'Author', 'Date', and 'Source,' respectively. These three columns together refer to which specific selected study we're looking at. The last three columns are 'Methodology', 'Effects (Data)', and 'Conclusions.' The 'Methodology' column simply points to the method the selected studies employ. It could be the construction of a theoretical framework or empirical regression models such as mixed-effects regression and difference-in-difference estimation. The 'Effects (Data)' column just stores our causal effects of interest and their empirical estimates. Finally, the 'Conclusions' column specifies the results of analysis based on the information in the 'Effects(Data)' column. The detailed template of the spreadsheet and the information in it are provided later in the Results section.

3. The Airfare Effect of Airport Hub Dominance

3.1 Review of Methodologies

The early studies regarding the hub premium does not use econometrics model: they do not control for variables or factors that could possibly affect the airfares using regression models. Basically, what they use is the method of direct comparison, comparing airlines' airfares at hub airports to their airfares not at hub airports. The study by Huston and Butler is an example [1]. Huston and Butler focused on the Ozark-TWA merger, which generated a new single airline with St. Louis as the hub airport [1]. To investigate the effect of this 'newly-created' hub airport on average airfares, they conduct a direct comparison between the airfares charged before the merger (before the 'emergence' of the hub airport) and the airfares charged after the creation of the hub airport, for those routes having St. Louis as their destinations [1].

However, as mentioned before, those early studies do not include other possible variables affecting average airfares, such as the distance of the routes. As a result, more and

more authors employ econometrics methods that can statistically control for multiple price-affecting variables. In order to use econometrics models, researchers need to identify the independent variables used to measure the hub premium and the other possible price-affecting variables.

First, before reaching to those other variables that possibly affect the average airfares (the variables that need to be statistically controlled in the regression model), this paper needs to figure out how the existing literature generally measures the hub premium. Because hub premiums refer to the effects on airfares, the dependent variable is normally one of the prices, yield (average airfares per mile), or the ratio of the airfares charged at hub airports to the airfares charged at non-hub airports. The independent variables in the regression model should be measures that characterize whether an airport is hub or not. The normally-used independent variables include the airlines' airport dominance and the route dominance. This is easy to interpret because the more dominance an airline is at an airport, the more 'hub' or central the airport is for the airline. A classic paper by Borenstein uses the airport dominance and route dominance as independent variables, with dependent variables being the average airfares and the ratio of average airfares of the hub airline to the average airfares of the non-hub airline [2].

After the identification of the main variables, it is for researchers to include other variables in the regressions to control for them. In the study by Borenstein described above, the main control variables include the route distance, the average load factor, airport scarcity, carrier identity, etc. [2]. All of these are common variables to be included in the regressions for later studies. For example, the work by Abunassar and Koford includes factors such as the airport load factor [3]. What is more about the Abunassar and Koford study is that it further includes the dummy variable representing whether there are low-cost carriers (LCC) at the airport [3]. This is important because the participation of LCCs might have large influence on the carriers' airport dominance and route dominance, thus influencing the average airfares.

It should be noticed that here this paper does not present the exact definitions regarding the airport dominance and the hub dominance because there is no uniform agreement upon them. The definitions of them vary according to different papers.

3.2 Outcomes

Overall, this paper confirms the presence of hub premiums via the results from the studies reviewed. That is, given an airline, the airfares for routes that get in touch with the hub airport are higher than the airfares for routes not touching with the hub airport. Specifically, this paper concludes that higher airport dominance and route dominance generally lead to higher average airfares, given all other factors unchanged. In addition to the above, this paper also finds, from the existing literature, that the presence of low-cost carriers has negative effect or downward pressure on the average airfares, controlling on other factors. Thus, when investigating the hub premium effect, which is associated with the airport dominance and route dominance, one must consider the presence of LCCs in regression models and analysis, in order to really isolate the effect of dominance from other confounding effects. In summary, given the findings from the existing literature, the presence of airport hub premiums is found. But the negative price effect of the presence of LCCs suggests that the presence of LCCs can moderate the existing hub premiums. Below this paper presents the data and outcomes of those studies and the subsequent analysis on them.

One early study on hub premiums is the Huston and Butler's study [1]. They did a direct comparison of the average airfares before and after the Ozark-TWA merger for routes arriving at St. Louis, the hub position [1]. It turned out that, for the routes arriving at St. Louis, the average unrestricted airfares increased by 13.1% (significant at the 1% level) after the merger [1]. The average restricted airfares increased by 45.9% after the merger [1]. Both numbers imply the presence of hub premiums. Another early study by the GAO (The US Government Accountability Office) conducted direct comparison between the yields for routes starting at hub airports and the yields for routes that only have access to non-hub airports [4]. They defined hub airports by an airport dominance, measured by the percent of all enplanements that is conducted by the dominant airlines [4]. For hub airports dominated by a single airline, the definition is an airport dominance of more than 60% [4]. For hub airports dominated by two airlines, the definition is an airport dominance of more than 85% [4]. The GAO eventually found a 27.2% higher yield in 1988 for routes starting at the hub airports, compared to the yields for routes not accessing the hub airports [4]. After adjusting for distance, this number becomes 21.0%, both suggesting airport hub premiums associated with airport dominance [4].

After those early studies on hub premiums, researchers began to employ econometrics model to statistically control for other variables, such as route distance, that could possibly affect airfares. One classical study is by Borenstein [2]. The author analyzed the effects of airport dominance and route dominance on the average airfares,

after adjusting for the load factor, route distance, carrier identity, airport scarcity, and so on [2]. The author defines the airport dominance to be the weighted average of the observed airline's share of daily passengers at the two endpoints on the observed route, and the route dominance to be the observed airline's share of overall local passengers on the observed route [2]. The results revealed a one percent rise in the airline's route share had a positive airfare effect, between 0.03% increase and 0.22% increase, after adjusting for other variables [2]. Apart from the route dominance, increasing the airline's airport dominance by one standard deviation contributed a 1.6% increase in the airline's median price, after adjustments [2]. All of the above suggest a positive airfare effect led by the airport and route dominance, confirming the presence of hub premiums. Another study that adopted econometric models is the study by Dresner and Windle in 1992 [5]. The authors used the difference in yields produced by a carrier between ABA routes (origin – destination – origin routing) and BAB routes as the dependent variable [5]. To extract the hub premiums, the authors investigated the effect of the difference in airport market shares between ABA vs. BAB routes on the difference in yields, adjusting for other variables such as the dummies for airports [5]. They found that, compared to a carrier with 10 percent market share at both ends of the route, a carrier with 28 percent higher market share at the origin airport earned a 1.3% higher yield [5]. This higher yield implied the positive effect of airport market share, or airport dominance, on the airfares. Therefore, it could be seen from the moderately higher yield that a moderate hub premium exists.

Further studies on hub premiums noticed the importance of LCCs as they can affect the airport dominance of the existing hub airlines. For example, Abunassar and Koford included the domestic passenger enplanement share of low-cost carriers to control for the LCCs [3]. In their regression of the ratio of an airport's average fare to the national average on the airport concentration, they found that an increase in airport concentration from low concentration level to a monopoly produced 10.2% increase in fares, adjusting for other variables [3]. Importantly, they found a negative coefficient (-0.401) for the LCCs variable mentioned above, suggesting that the presence of LCCs may moderate the existing hub premiums [3]. In addition to the above case, Lee and Luengo-Prado also realized the negative significant effects brought by the presence of LCCs [6]. Specifically, the presence of LCCs lowered market prices by eight to twenty percent [6]. Therefore, evidence points to the fact that hub premiums do exist, but the hub premium effects can be lowered or moderated by

the entry or participation of LCCs. Later papers such as the study by Hofer, Windle, and Dresner, where the positive, statistically significant effects of airport and route dominance on airfares were reported to decrease after adding the competition from LCCs, further confirmed the conclusion above [7].

Though all the studies evaluated above focus on the US airline market, the existence of hub premiums might not be limited to the US airline market. Actually, there are studies focusing on the European airline market and the Chinese airline market. For example, Lijesen, Rietveld, and Nijkamp reported the positive significant hub dominance premiums for Air France, Swiss Air, and Lufthansa [8]. The empirical estimates of hub dominance premiums are 14%, 14%, and 15% for Air France, Swiss Air, and Lufthansa, respectively [8]. Chen and Lei, focusing on the Chinese airline market, found that in the premium travel market, one percent increase in the hub airline's market share led to 0.92 percent increase in airfares on the route [9]. Therefore, it is fair to say that hub premiums exist not only in the US but also in other overseas markets. Overall, based on all analysis above on the existing literature, this paper confirms the presence of hub premiums and further concludes that LCCs can reduce the existing hub premiums [10].

4. Conclusion

In conclusion, the airport hub dominance generally has positive effects on average airfares, showing the presence of hub premiums. However, when the hub carriers face the entry or presence of low-cost carriers, the amount of hub premiums decreases. Even in airline markets outside of the US market, there exists evidence for hub premiums. This paper contributes to the existing literature in the following two aspects. First, throughout the existing literature, there is a limited number of systematic reviews regarding hub premiums. This paper thus contributes to the limited number of systematic reviews in the airline pricing and hub premiums fields. Second, compared to the previous systematic review by Tretheway and Kincaid on hub premiums, which includes mainly the studies on the US market, this study focuses on not only the papers related to the US airline market, but also the papers related to other overseas markets such as the European market.

Admittedly, this paper also has certain limitations. This paper does not conduct further empirical analysis on hub premiums. In the future it is possible to expand on this paper by adding empirical analysis using the most up-to-date airline data. Through this, it is possible to test whether the conclusion mentioned above still hold in recent airline

data.

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