

Research on the Impact of Airline Fuel Price Fluctuations on China's Aviation Industry in the Post-epidemic Era

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Abstract. The first half of 2022 saw a significant increase in global crude oil prices, which led to a significant increase in China's jet fuel charges, with some airline tickets charging passengers more than the face value of the ticket. This paper explores consumers' responses to the increase in jet fuel charges. The study shows that consumers are less satisfied with the increase in fuel costs, that some consumers are choosing alternative travel options, and that airline ticket sales for business travel in summer 2022 are lower than in the same period last year. The article explores some preferential fare policies that airlines can use to improve the situation. This article has contributed to the subsequent policies offered by airlines. In the overall environment of rising crude oil charges, the future price trend of jet fuel charges will not return to the low prices before the epidemic, and its impact on consumers will become apparent over time. People's consumption levels and willingness to spend are gradually decreasing due to the work stoppage and economic slowdown caused by the quarantine policy under the epidemic in China. The trend of increased consumer appetite in the tourism sector, now brought about by the relaxation of the quarantine policy, will also level off.

Keywords: Airline Fuel Price Fluctuations; China's Aviation Industry; Post-epidemic Era.

1. Introduction

Airfares in China are generally composed of the face value of the ticket plus airline fuel cost, and some airlines also include airline accident insurance. Among these, airline fuel cost, which was first proposed in March 1992, has two charges: airport construction charges and fuel surcharges. Starting from November 2018, the maximum rate of in-flight fuel charges for domestic routes in China is RMB20 per person for routes up to and including 800 km, and for routes above 800 km, it is adjusted from RMB30 per person to RMB50 per person. Since the international crude oil price continued to increase during the first half of 2022 and peaked at 119.650USD/Bbl on May 8, new changes have been made to China's airline fuel charge rates [1]. In accordance with the new regulations issued in 2022, the charging policy for adult tickets will be a starting airline fuel charge of RMB100 per passenger for domestic routes up to and including 800km and a starting airline fuel charge of RMB150 per person for adult tickets for domestic routes over 800km. The airline fuel charge peaked on July 5. When it started charging an RMB200 fuel charge plus an RMB50 airport construction fee for routes over 800km, making the total airline fuel charge even higher than the face value of some tickets, this volatility sparked controversy.

2. Literature review

2.1 Airline market development under the COVID-19

COVID-19 pandemic is a disease breakout that spread throughout the world and has dealt a substantial blow to all sectors, especially the aviation industry. According to Doaa and his team members' research, the impact of the pandemic on the aviation industry includes a drop in international air passenger traffic and a potential loss of two-fifths of passengers at airports [2]. J Transp Geogr believes that in the face of a post-epidemic recovery in the business travel market, some medium-sized airports with a leisure focus will face competition from other leisure markets with competitive pricing and potentially fewer travel restrictions [3]. In short, airline incentives are key to restoring passenger traffic. In Rabia SAHIN's research, the impact of the epidemic will see some

carriers shift to low-cost operations, meaning that carriers will slightly increase airfares while reducing the quality of service such as offering limited meals [4]. The consequence of this is that the airlines may lose loyal customers and instead passengers will become more price-driven when purchasing tickets. The recovery of the aviation industry after the epidemic will also need to rely on government support. However, Megersa's study proved that although government support is significant, the imbalance may distort the competitive environment in the future [5]. The post-epidemic business travel market presents both opportunities and challenges. On the one hand, the quarantine and embargo imposed by the epidemic in China have hit the business travel industry hard, causing many airlines to go into the red. On the other hand, as time progresses. China's anti-epidemic policies are not as strict as they once were, demand for business and travel by air has revived, and even retaliatory spending has occurred. In counterpoint, the sharp increase in international fuel costs due to the impact of the epidemic has led to a rise in the cost of jet fuel, while consumers are spending less and the sharp increase in jet fuel costs is a blow to the sector.

2.2 Airline fuel cost

According to Bo Zou's research, airline fuel consumption is highly correlated with, and largely generated by, the revenue passenger miles and flight departures it generates. Regional airlines have opposite effects on mainline airline fuel efficiency: higher fuel per revenue passenger mile but improved accessibility [6]. For different airline route patterns, airlines will adopt different policies for charging for jet fuel, and the efficiency gains of mainline airlines can lead to significant cost savings. In addition to fuel prices, other evidence of cost shifting by airlines through cost changes that affect air fares.

3. Methods

3.1 Questionnaire

A questionnaire named "The impact of fluctuations in air-fuel charges on travel intentions and choices" on the airline ticket market was designed and constructed. It aims to collect and analyze the consumption behaviors of different groups of consumers, including travel intentions, satisfaction, and choices, in response to the increase in aviation fuel charges. It targets consumers in the business travel industry, who are differentiated by gender, age, income, spending power on airline ticket purchases, and the purpose of their travel, whether traveling for business or fun. The survey's main objective was to collect information on the behavior of different consumers in purchasing airline tickets in response to fluctuations in airline fuel charges to provide recommendations to airlines on their charging strategies. The survey was posted at Wenjuanxing, a professional online questionnaire, assessment, and voting platform in China. It was open from August 17 until August 25, and 82 questionnaires were collected from the target group.

3.2 Secondary data

Information on airline revenue data and civil aviation passenger traffic is gathered and analyzed from the National Statistics Office and stock development websites. The airlines include China Southern Airlines, Air China, and Spring Airlines, all of which are among the more recognizable brands in China. The figures serve as a relatively broad representation and provide a better summary of revenue information for the business travel market over the two years, which helps to understand the trends and movements in the market.

3.3 Data description of Company A

The article examines a selection of orders from a local Chinese business travel company A, from July to August last year and this year. The orders were mainly from air travelers on business, and the selected route was Nanjing-Qingdao, a route (i.e., the straight line distance from Nanjing to Qingdao)

of 569.3km. The data were collected to examine whether ticket sales on these selected routes were affected by fluctuations in the cost of aviation fuel for air travelers and thus to characterize further the impact it brought to the business travel market. For the summer of 2021, July to August, the airline fuel charge included in the order is ¥50, which is ¥0 for the fuel surcharge plus ¥50 for the airport construction tax. During summer 2022, orders will show a maximum fuel charge of ¥150, with the airport construction tax remaining the same at ¥ 50 and a much higher fuel charge. This paper will compare airline ticket sales and passenger satisfaction before and after the increase in air-fuel charges over the same period to determine the impact on the market and make recommendations to business travel companies.

The bill generation dates selected for the study data were 21 days between July 1 and August 27, 2021 (during which the flight was ordered) and 14 days between July 3 and August 16, 2022. A total of 207 orders were counted for the above periods. For this study, all orders selected were normal ticketing orders, and change and refund orders were excluded. The majority of the orders selected were from passengers traveling for business, which may be considered relatively inelastic in terms of price demand.

4. Results

4.1 Questionnaire results

Among those who participated in the survey on the impact of fluctuations in fuel costs on travel intentions and choices, 42.68% were male, and 57.32% were female. The proportion of people aged 18 to 25 was 65.85%, 26 to 30 was 21.95%, 31 to 40 was 4.88%, 41 to 50 was 6.1%, and over 50 was 1.22%. The survey was conducted among a younger age group. The salary distribution of the survey population is shown below in Figure 1, and the frequency distribution of air travel by survey population is shown below in Figure 2.

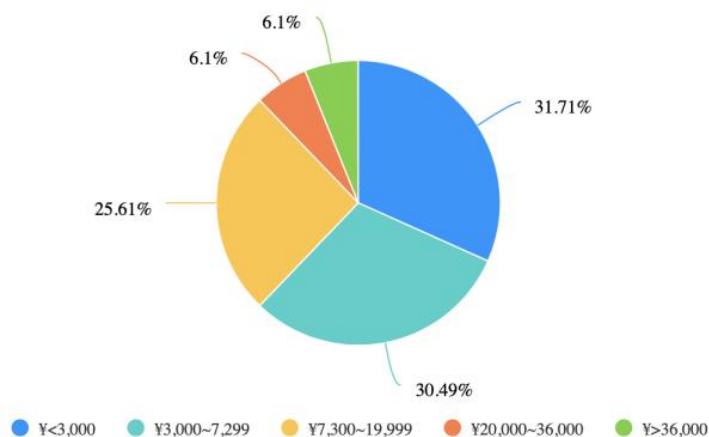


Fig. 1 Salary Distribution of the Survey Population (Photo credit: Original)

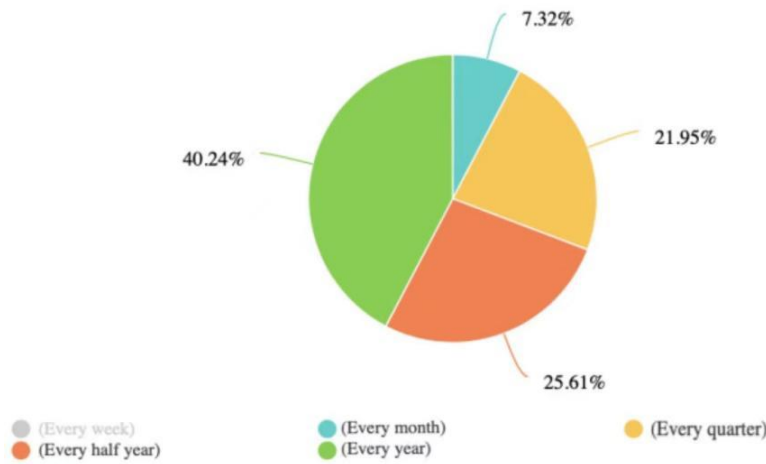


Fig. 2 Frequency Distribution of Travel by Survey Population (Photo credit: Original)

Figure 3 shows the distribution of single trips taken by the survey population and the amount spent on airline tickets in Figure 4, which shows that 39.02% of the survey population spent between 600 and 1,499 RMB on airline tickets, 24.39% spent between 1,500 and 3,499 RMB.

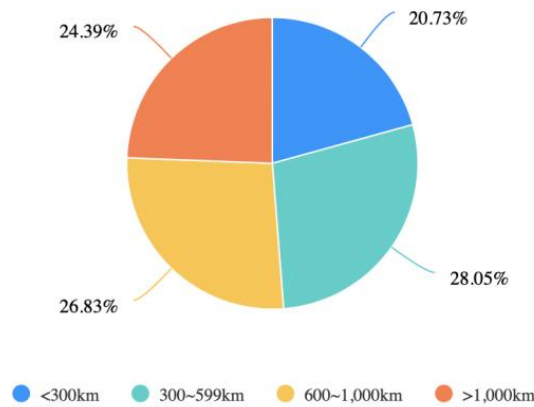


Fig. 3 Distribution of single trips by survey population (Photo credit: Original)

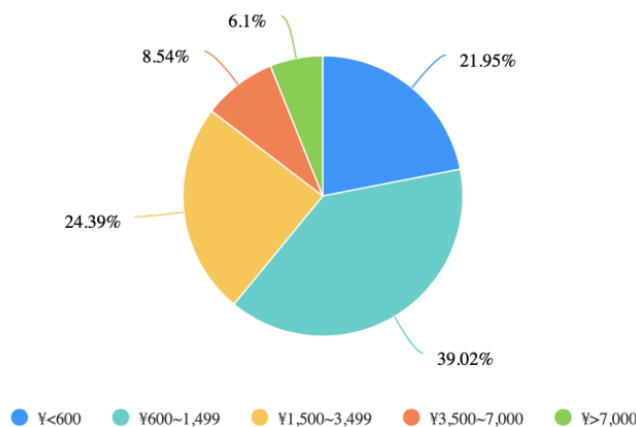


Fig. 4 Distribution of spending on airline tickets by survey population (Photo credit: Original)

The following questions in the questionnaire are on the Likert Scale, which is divided into 7 levels of agreement. The level of agreement increases from 1 to 7 (i.e., 1 Strongly disagree, 2 is Disagree, 3 Somewhat disagree, 4 is Neither agree nor disagree, 5 is Somewhat agreed, 6 is Agree, 7 Strongly agree) [7]. For those who travel by air for business, they agree that “the increase in jet fuel charges will affect their willingness to travel” at 3.15, “the increase in jet fuel charges will affect travel

satisfaction” at 3.52, and “the increase in jet fuel charges will affect travel satisfaction” at 3.52. “This suggests that this group has a relatively low price elasticity of demand and that the increase in fuel prices will have a low impact on their travel demand in the short term. For travelers traveling by air, their agreement with “the increase in jet fuel charges will affect their willingness to travel” is 4.34, and their agreement with “the increase in jet fuel charges will affect their satisfaction with traveling” is 4.26. Moreover, their agreement with “the increase in jet fuel charges will make me choose other modes of transport” is 3.1. This group is more sensitive to fluctuations in fuel prices. In the multiple-choice survey, 17.07% of the surveyed population chose ordinary trains, 92.68% chose high-speed trains, 47.56% chose self-drive, and 4.88% chose ferries due to higher fuel costs. If they still travel by air, the highest acceptable in-flight fuel cost for them is 59.76% for 250 RMB, 19.51% for 300 RMB, 9.76% for 350 RMB, and 7.32% for greater than 350 RMB.

The questionnaire shows that those aged between 18 and 25 with a budget of less than RMB 1,500 for airline tickets are the most sensitive to fuel cost increases. In the last open-ended question in the questionnaire, it was suggested that airlines or business travel companies should increase student discounts and family discount packages. In addition, introduce various pricing policies to mitigate the impact of sky-high fuel prices on the business travel market.

4.2 Multiple linear regression

Linear regression is used to examine the quantitative relationship between the dependent variable and independent variables. Without loss of generality, this paper gives the formula of multiple linear regression as follows:

$$y = \beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_3x_3 + \varepsilon \quad (1)$$

Where y is the dependent variable of daily sales of air tickets; β_0 is the intercept; β_i ($i = 1,2,3$) is the regression coefficients estimated by the ordinary least square’s method; x_i ($i = 1,2,3$) is the independent variable average prices, airline fuel cost, and average discount; and ε represents the residual, which is assumed to have an average of 0.

Table 1. Summary of the multiple regression model (Photo credit: Original)

	Coefficients	Standard error	t Stat
Intercept	6.686	2.267	3.030
Average prices	0.001	0.004	0.262
Airline fuel cost	-0.336	0.009	-3.809
Average discount	0.095	3.559	0.027
R square	0.228		
F Stat	5.020		
Significance F	0.004		

For the different influencing factors, the ANOVA analysis of sales volume volatility yields an F-statistic of 5.020, corresponding to a p-value of $0.004 < 0.05$, indicating that there are factors such as average fares, fuel costs, and average discounts that have an impact on sales volume movements. The p-value of 0.0003 is less than 0.05 for the effect of airline fuel costs on sales volume, which is statistically significant and allows for evidence that an increase in airline fuel costs reduces airline ticket sales volume. In contrast, both factors, average airfare, and average discount, have p-values greater than 0.05 and are not statistically significant and cannot, therefore, be judged to affect airline ticket sales volume.

5. Discussion

According to the Likert Scale of the questionnaire, consumers who travel by air for business and those who travel by air have an agreement level of 3.14 and 4.34, respectively, representing somewhat disagree and neither disagree nor agree. This means that the increase in fuel costs will not affect passengers' willingness to travel. Since the outbreak of New Crown Pneumonia in 2019, there has been a significant reduction in the desire of local residents to travel due to restrictions on local isolation policies in China regarding the risk of contracting the virus. The results of the Yu Hao 2021 study suggest that the negative impact of outbreak travel on Chinese residents has increased, and the positive impact has decreased, thus affecting people's willingness to travel [8]. As the epidemic is gradually brought under better control in China in 2022, people's long-pending travel plans are back on the agenda. Cheremnykh A.A argues that the average income of the population has a negative impact on the prices of economic and budget categories on airline ticket sales [9]. And their demand and willingness to travel (both for pleasure and business) increase, cushioning the negative impact of jet fuel costs on travel intentions. As a result, the increased cost of jet fuel will not significantly impact people's willingness to travel, at least in the short term.

The survey on the impact of fuel cost fluctuations on consumer satisfaction shows that travelers who travel by air for business are unlikely to experience a reduction in consumer satisfaction due to fuel cost increases. While travelers who travel by air experience a reduction in satisfaction as a result of fuel cost increases. This is reflected in the somewhat disagree and somewhat agree on levels of agreement between the two groups of respondents on the issue of higher fuel costs reducing passenger satisfaction. In the open-ended question at the end of the questionnaire on passengers' suggestions to airlines, some passengers suggested some fare incentives that they would like to see from airlines in response to the current spike in total airfares due to the increase in fuel costs. Such as offering more student discounts and baggage allowances, standardizing and stabilizing overall fares, increasing bonus points, and offering more multi-passenger fares for groups and families. One of the key points is the stabilization of fares. The current price trend of jet fuel charges is rising from RMB50 to RMB250 in two months, and its instability has greatly reduced consumer confidence.

As airfares rise, sales of HSR tickets are expected to increase as an alternative, and Xiaowen Fu's research shows that HSR services are competitive in terms of network connectivity, total journey time and cost efficiency [10]. Airlines must develop an effective hub-and-spoke network to become more competitive in international markets. The results of the questionnaire above suggest that if people were to give up travelling by air due to high fuel costs, travelling by high-speed rail would be the first choice for most people.

6. Conclusion

In summary, the increase in air-fuel charges has reduced passenger travel satisfaction, causing some passengers to prefer other travel options such as high-speed rail and self-drive. Data from the business travel company also shows that the increase in fuel costs in the summer of 2022 has resulted in fewer orders on the route from Nanjing to Qingdao in China than in the same period last year. The dramatic increase in airline fuel charges has been a controversial topic this summer, with much negative commentary on social media about the increase, causing some distress to many travelers. This article has contributed to the subsequent policies offered by airlines. In the overall environment of rising crude oil charges, the future price trend of jet fuel charges will not return to the low prices before the epidemic, and its impact on consumers will become apparent over time. People's consumption levels and willingness to spend are gradually decreasing due to the work stoppage and economic slowdown caused by the quarantine policy under the epidemic in China. The trend of increased consumer appetite in the tourism sector, now brought about by the relaxation of the quarantine policy, will also level off.

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