Customer Satisfaction and the Financial Performance of Chinese Airlines

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ABSTRACT

This paper focuses on studying the relationship between customer satisfaction measured by customer complaints and the financial performance of Chinese carriers. The financial performance is measured by using the revenue to operating cost ratio, operating profit and net profit to cost ratios of the carriers. The empirical results show that delayed baggage has a negative and significant effect on customer complaints. Rainfall and temperature have positive and negative effects on complaints respectively. Customer complaints have a negative and statistically significant effect on all the three measures of financial performance of carriers. These results are in fact consistent with our expectation that customer satisfaction is indeed relevant for the financial performance of carriers. They also provide support for the carriers to put in their resources to improve their service quality in order to yield a higher customer satisfaction as it can actually raise their profitability in the end.

Keywords: customer satisfaction, complaints, on-time performance of scheduled flights, baggage mishandling and profitability of carriers

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INTRODUCTION

The competitive environment of the Chinese civil aviation market has been altered significantly starting in the middle of 2000s and the airline industry has also become more competitive. Besides competing on ticket prices, carriers also compete on the service quality in order to win their customers. Indeed, customer satisfaction is one of the major measures of performance of business corporations such as airlines. Airline companies devote considerable amount of resources in delivering high quality services for raising customer satisfaction and ultimately hoping to improve their revenue and profit.

In the literature, there has been considerable research studying the relationship between the firm performance and customer satisfaction and focusing on how the customer satisfaction affects the profitability of carriers. However, the relationship among customer services, customer satisfaction and firm performance is not really straightforward. Researchers such as Banker, et al. (2000), Behn and Riley (1999), Anderson et al. (1994), Dresner and Xu (1995) and Steven et al. (2012) have found a positive linkage between customer services, customer satisfaction and profitability. However, Anderson and Mittal (2000), Johnston et al. (1990), Johnston (1995), Ittner and Larcker (1998) have not found such a relationship. Indeed, Merkert and Pearson (2015) argue that there is no simple relationship between customer satisfaction and profitability of airlines as customer satisfaction does not necessarily lead to customer loyalty and repeat business. In addition, most of these studies focus on the US airline industry. However, there is little research on the relationship between financial performance and customer satisfaction of service quality of the airline industry in China despite the growing importance of the service quality in the area of non-price competition. In order to increase customer satisfaction, Chinese carriers have been devoting their valuable resources to reduce flight delays, baggage handling errors and to improve in-flight services, etc. However, it is not yet clear how the improvement in the service quality and customer satisfaction is related to the financial performance of Chinese carriers.

This paper targets to study the link between customer satisfaction and the financial performance of Chinese carriers. Among the indicators of customer satisfaction, customer complaints are a measure of dissatisfactions with the service quality and they have been used extensively in the literature as a negative feedback (Behn and Riley (1999), Dresner and Xu (1995), and Nagar and Rajan (2005), Sim et al. (2010), Riley, et al. (2003), Steven et al. (2012), and Yee et al. (2008)). Our empirical results show that customer complaints have a negative and statistically significant effect on financial performance variables such as revenue to cost ratio, operating profit to cost ratio and net profit to cost ratio. This empirical result confirms the relevance and importance of the relationship between customer satisfaction and financial performance of Chinese carriers.

This paper makes contribution to the literature in at least two areas. First, this is the first study that can provide a more comprehensive analysis on the relationship between customer satisfaction and the financial performance of carriers in the Chinese airline industry. The empirical results of this study confirm the relevance of customer satisfaction to the financial performance of the carriers. As a result, carriers are interested in putting in their resources to improve their service quality and customer satisfaction. Second, the Civil Aviation Authority of China (CAAC) has been placing more emphasis on the bill of rights of passengers and putting in more resources in investigating passenger complaints and pushing the improvement of the service quality of Chinese airline industry since 2006.

Consequently, starting in 2009, it designated March 15 as the "passengers' rights day" in order to encourage the carriers to provide better service quality to their customers. In addition, our study is a timely one for businesspeople as they can use customer satisfaction information to help predict the financial performance of the carriers given the negative relationship between the profitability and customer complaints. Moreover, as the financial information of listed carriers are reported quarterly and customer complaint information is available monthly, one can use monthly customer complaint information to help predict the financial performance of the carriers before their financial results are announced in the next quarter as suggested by Behn and Riley (1999). Similarly, the management of carriers may also use the trend of customer satisfaction data to predict their financial performance and to plan for their appropriate policy measures or actions for improving the service quality of their carriers.

This paper is composed of four parts. In the next section, the data and methodology adopted in this paper are discussed. In section 3, the empirical results are reported and discussed. The last section concludes our discussion.

DATA AND METHODOLOGY

In this paper, an unbalanced panel data set of 6 listed Chinese carriers including Air China, China Eastern Airlines, China Southern Airlines, Hainan Airlines, Shanghai Airlines, and Shandong Airlines is used. All six of them are listed on Shanghai or Shenzhen Stock Exchanges and they are also the largest airlines in China. This data set is from the third quarter of 2004 to the first quarter of 2009 and the customer complaint and baggage mishandling information of the fourth quarter of 2005 and the second quarter of 2006 are not available as the CAAC did not publish the customer complaints and baggage mishandling information for these two quarters. In addition, the CAAC stopped publishing the information of baggage mishandling after the first quarter of 2009. Therefore, our data set also stopped at this quarter. Altogether there are 92 observations in the data set.

The data set is derived from four sources. The quarterly data of customer complaints, baggage mishandling information, the information of on-time performance of scheduled flights are obtained from the July 2004 to May 2009 issues of China Civil Aviation (Zhongguo Minyong Hangkong), which directly published the announcements or press releases of the CAAC, and the website of the CAAC. These complaints are received by the CAAC and they have been checked to be valid. The quarterly data of weather information of humidity, rainfall and temperature are calculated from the monthly provincial data published in the China Meteorological Yearbook 2005-2010. The information of available seat kilometer, flight number and revenue-ton-kilometer of carriers are obtained from the Statistical Data on Civil Aviation of China 2005-2010 published by the CAAC. The quarterly weather information of humidity, rainfall and temperature are calculated from the monthly provincial data published in the China Meteorological Yearbook 2005-2010. All the financial data such as revenue, operating profit, net profit, operating cost and selling cost of carriers are obtained from CSMAR databank of GTA Finance and Education Group which records all the quarterly financial reports of listed enterprises of Shanghai and Shenzhen Stock Exchanges. In addition, given that China Southern Airlines is holding 60% ownership of Xiamen Airlines during the sample period, Xiamen Airlines are the subsidiary of China Southern Airlines and the revenue, cost and profits of Xiamen Airlines are consolidated into those of China Southern Airlines. Consequently, the customer complaints, baggage mishandling errors and on-time performance of Xiamen Airlines are

added to the counterparts of China Southern Airlines in order to reflect the parent-subsidiary relationship between them.

Following Behn and Riley (1999), Dresner and Xu (1995), Sim et al. (2010) and Steven et al. (2012), the two stage least square estimation method is adopted in conducting the analysis: the first stage is the analysis of customer complaints, a proxy of customer satisfaction, and the second stage is the analysis of the revenue and profitability of carriers given the fitted or predicted values of customer complaints in the first stage. First, regarding the first stage analysis of customer satisfaction, as some carriers did not receive any complaint for some periods of time, the variable of customer complaints is actually censored. In our case, about 7.6% of the full sample has zero complaints. Given this censoring nature of the data set, the fixed effect Tobit model which controls the fixed effect of each carrier is adopted as follows:

$$\begin{aligned} COMPL^{*}_{it} &= \alpha_i + \beta' x_{it} + \varepsilon_{it}, \qquad \varepsilon_i \sim N(0, \sigma^2_{\varepsilon}), \\ COMPL_{it} &= COMPL^{*}_{it} \text{ if } \mathrm{COMPL}^{*}_{it} > 0, \\ &= 0 \qquad \text{if } \mathrm{COMPL}^{*}_{it} \le 0 \end{aligned} \tag{1}$$

where αi is the fixed effect of carrier i, COMPLit*, is the unobserved counterpart of observed customer complaints variable, COMPLit, measured as the number of customer complaints per 100,000 passengers received by the CAAC against carrier i in quarter t. $\mathbf{X_{it}}$ is a vector of independent variables which include variables of baggage mishandling problems, percentage of overall on-time performance scheduled flights of carriers, weather conditions and seasonal dummies for quarterly data. Let us briefly discuss the independent variables in this Tobit model.

On-time Performance of Scheduled Flights

According to the CAAC published information of the passenger complaints against carriers, delays or cancellation of scheduled flights are one of the two major areas of complaints (the other major area is baggage mishandling problems) as reported in Table 1.

In fact, according to Table 1, these two factors are much more important than the third factor, ticketing, booking and check-in. According to Table 1, on-time performance and baggage problem account for more than 60% of all customer complaints received. In addition, Behn and Riley (1999) and Steven, et al. (2012) included this variable in their customer satisfaction analysis. As a result, the variable of the overall on-time performance of scheduled flights, ONTIMEit, of carrier i in quarter t is included in our analysis. It is measured in terms of percentage of on-time arrivals and departures of scheduled flights. Flights are considered as on-time when they land or depart within 15 minutes of the scheduled time shown in the carriers' computerized reservation system. According to Table 2, the overall on-time performance of all carriers is steadily improving from 79.9% in 2004 to 83.12% in 2007.

However, starting in 2008, it has been decreasing. Starting in 2009, the CAAC separated carriers into large and small carriers in reporting their on-time performance. Large carriers are usually state-owned carriers such as the big three state-owned carriers while small carriers also include all non-state-controlled or private carriers which are usually small. In fact, there are big differences between large and small carriers that large

carriers have higher on-time performance than small carriers. Holding others constant, it is expected that on-time performance has a negative impact on the customer complaints. Therefore, hypothesis H1 is stated as follows:

H1: Holding other factors constant, on-time performance has a negative effect on customer complaints.

Table 1: Customer Complaints Received by the CAAC from 2004 to 2012

Complaint types	2004 (%)	2005 (%)	2006 (%)	2007 (%)	2008 (%)	2009 (%)	2010 (%)	2011 (%)	2012 (%)
flight delays	51.50	58	50.94	39.22	32.42	33.51	31.9	28.18	50.22
baggage problems	13.23	16.5	19.69	27.45	35.66	33.47	31.9	30.91	15.94
ticketing problems	8.82	8	10.69	11.37	5.24				
in-flight services	2.40	2.8	5	8.63	2.74			0.45	0
flight information	3.21			4.31	8.23				
check-in services	4.41	6.6	3.13	2.35	4.24				
cargo problems	1.60	1.1	3.13	1.96	1.75				
other	7.62	7.1	7.81	4.71	9.73				
passenger services						9.8	7.36	8.64	6.00
ticketing, booking & check-in						15.1	12.88	11.27	13.64
over-sold tickets						1.63	6.13	2.29	1.94
re-funding						0.82	2.45	6.36	8.27
animal death						0.41			
services for disabled							1.23	0.45	0.07
ticket price						0.41	0.61		0.14
flight connection								0.45	0
chartered flights									0.07
miscellaneous						2.86	5.52	5	3.57
Total cases	499	364	320	255	401	245	163	220	1342

Note: 1. The information reported is obtained from Statistical Data on Civil Aviation of China 2005-2013.
2.There is a change of classification of complaints by the CAAC starting in 2009. Therefore, the types of complaints are different from the previous years.

Table 2: On-time Performance of All Carriers from 2004 to 2012

	2004	2005	2006	2007	2008	2009		2010		2011		2012	
						large	small	large	small	large	small	large	small
On-time flights (%)	79.9	82.1	81.59	83.12	82.14	81.9	73.43	75.77	68.9	77.9	72.67	76.0	70.5

Note: 1. The information reported is obtained from Statistical Data on Civil Aviation of China 2005-2013.
2. There is a change of classification of complaints by the CAAC starting in 2009. Large refers to large carriers and small refers to small carriers.

Baggage Mishandling Problems

Besides the on-time performance of scheduled flights, the quality of baggage handling service is another important service quality variable included as well. According to Table

1, the baggage mishandling problem has actually overtaken on-time performance of scheduled flights to be the largest reason for customer complaints starting from 2008 to 2011. However, there is more room for improvement in the area of baggage handling. Following the literature all three types of baggage mishandling, delayed baggage, BAGDLYit, broken baggage, BAGBKit, and missing baggage, BAGMSit, are included into our model as well. Holding other things constant, baggage errors have a positive impact on customer complaints. Consequently, hypothesis H2 is stated as follows:

H2: Holding other factors constant, baggage mishandling variables have a positive effect on customer complaints.

Unfortunately, the CAAC does not disclose any information of ticketing (ticket over-sold), booking and check-in problems of each carrier and other factors listed in Table 1 during our sample period. As a result, these variables cannot be included in this study. After-all, the problems of ticketing, booking and check-in, the third largest factor, only account for 11.27% and 13.64% of the total complaints in 2011 and 2012 respectively and it is smaller than the factors of baggage mishandling and on-time performance according to Table 1.

Weather Conditions

Weather conditions are in general not considered by the existing literature as a factor for explaining customer complaints as they are not the service quality variables of our interest. However, we believe that they are relevant for this study. First, this data set does not have any information for scheduled flight cancellation. In the literature, bad weather is often an important reason for severe scheduled flight delays or cancellation. As a result, we may proxy the variable of flight cancellation by using the weather variables. Second, bad weather, such as, heavy snow from snow-storm, does not only cause delays or cancellations of aircraft landing and take-off in an airport, but it also leads to severe traffic problems such as long traffic jams or even closing down of highways going to and from the airport. All of these cause tremendous stress on the passengers who have to rush to the airport to catch their flights. In addition, under bad weather, service failure of carriers is also more likely to appear and passengers may have to be confined in an airport for many hours. If the management and their subordinated staff of carriers are not well trained in managing these crises, customers could be very frustrated by all these problems which all appear together under bad weather and are more prone to filing customer complaints against their carriers or request compensation from their carriers in the end (Chen, et al. 2012).

Mazzeo (2003) measures the impact of weather by using the number of foggy days, days of thunder storm and days of snow storm. However, this weather information is available only in some particular Chinese cities or provinces and is not available nationwide. As a result, similar weather information cannot be used in this study. Instead, these three particular pieces of weather information which is available in all provinces: relative humidity, HUMit (%), rainfall, RAINit (measured in mm), and temperature, TEMPit (measured in Celsius) are used. Increases in humidity raise the possibility of foggy weather and these two are actually closely correlated. Similarly, increases in rainfall also reflect the higher possibility of thunder storms or even flood. Finally, decreases in

temperature reflect the higher possibility of more snow storms or blizzards. High humidity, high rainfall and low temperature will also negatively affect the service quality of carriers in the end. The China Meteorological Yearbook reports the monthly data of each province. In order to convert this monthly data into quarterly data, the following aggregation is conducted: First the national average of monthly temperature across all provinces is calculated. Second, within a particular quarter, the average quarterly temperature across the three national average monthly temperatures in a particular quarter is calculated. The same average quarterly humidity and rainfall are obtained in the same manner. Holding other things constant, customer complaints are increasing in HUMit and RAINit and decreasing in TEMPit. As a result, H3 is stated as follows:

H3: Holding other factors constant, customer complaints are increasing in humidity and rainfall and decreasing in temperature.

Other Control Variables

In addition, two control variables are also included into the model: annual flight number and annual revenue-ton-kilometer of passengers and cargoes (both are logarithmically transformed). As the Chinese carriers have been growing rapidly during our sample period, the flight number of each sampled carrier is introduced in order to capture the rapid increases in the routes or passengers. To control the effect of carrier size, an output variable such as revenue-ton-kilometer of passengers and cargoes of each sampled carrier is introduced as a measure of carrier size. Finally, in order to control the seasonal effects that may be present in the quarterly data, the seasonal dummy variables are also included to capture the presence of any seasonal effect in the model.

In the second stage, the fixed effect regression analysis of the total revenue to operating cost ratio, REVRit, and operating profit to operating cost ratio, OPRFRit and net profits to operating cost ratio, NPRFRit of carriers is conducted as follows:

$$\begin{aligned} Y_{it} = {} & \delta_i + \gamma_1 COMPFIT_{it} + \gamma_2 MKTS_{it} + \gamma_3 ATK_{it} + \gamma_4 OCOSATK_{it} + \\ & \gamma_5 SELLCOS_{it} + \gamma_6 COMFMK_{it} + \gamma_7 Q_{2it} + \gamma_8 Q_{3it} + \gamma_9 Q_{4it} + \varepsilon_{it}, \end{aligned} \tag{2}$$

where the dependent variable, Yit, is REVRit, OPRFRit or NPRFRit. δi is the fixed effect of carrier i. COMPFITit is the fitted or predicted COMPLit generated from the first stage of analysis of the estimation of equation (1) and it is the major variable of interest in this study. This variable is the negative feedback from customers which reflects the overall customer dissatisfaction toward the overall service quality of the carriers. Marketing research has shown that customer satisfaction is closely related to the customer retention and the revenue of the corporations. Consequently, customer complaints are expected to have a negative effect on the dependent variable. As a result, Hypothesis H_4 which is also the most important hypothesis of this study is stated as follows:

H_4: $\gamma 1 < 0$ as customer complaint has a negative effect on the financial performance variables holding other factors constant.

MKTSit is the market share of carrier i in period t calculated based on the sales revenue of carriers. Given the fact that carriers are in fact competing on route level, it is

ideal to calculate the market share or capacity based on route level information. However, route level information is not available and only firm level information is used to calculate market share or capacity. The literature in general supports that an increase in the market share raises the revenue of the carriers. As a result, it is expected that market share has a positive effect on the revenue of carriers.

ATKit is the logarithm of available ton kilometer and it is the output capacity of carriers. ATKit is only available as annual observations which are calculated from dividing the revenue-ton-kilometer of passengers and freight by overall load factor of carrier i in year t. The capacity of carriers in servicing their passengers is measured by the variable of ATKit. In general, if a carrier expects increases in new route or passengers, they may lease a new aircraft to service them. Therefore, an increase in ATKit raises the revenue.

OCOSATKit is the operating cost to available ton kilometer ratio and it measures the operating cost per unit of carrier output capacity. An increase in operating cost to available ton kilometer ratio implies a deterioration of the operating cost control of carriers and it is expected to have a negative effect on the dependent variables.

The ratio of selling expenses to operating cost, SELLCOSit, is used so as to capture any possible impact of selling effort on the financial performance variables. An increase in the selling expenses (e.g., advertising expenses) to operating cost is expected to have a positive effect on the dependent variables, especially revenue to cost ratio, as these selling expenses help capture more demands of the services of carriers. As a result, it is expected to have a positive effect on the dependent variables.

COMPMKit is the cross product of COMPLit and MKTSit. This variable is added to the model in order to study whether the effect of customer satisfaction on the financial performance varies with the market dominance. Steven, et al. (2012) argues that a dominant carrier is easier in gaining higher profitability than a less dominant carrier even the dominant carrier provides a lower level of customer satisfaction. As a result, this variable helps measure whether this interaction effect exists or not. Finally, Q_{2it}, Q_{3it}, and Q_{4it} are the dummy variables for the second, the third and the fourth quarter respectively. The econometric estimation of equation (1) and (2) is conducted by using the econometric package of LIMDEP 8.0. The estimation results will be reported in the next section.

EMPIRICAL RESULTS

Before discussing the empirical results of our study, let us first consider the means and standard deviations of relevant variables. The average number of customer complaints is 0.1913 per 100,000 passengers received by the CAAC. Regarding the service quality, the average on-time performance of scheduled flights is 82.92%. The average delayed baggage, broken baggage and missing baggage are 9.6813, 6.6404 and 0.5236 per 100,000 pieces of baggage respectively. Delayed baggage is the largest problem reported compared with the other two baggage mishandling problems. Regarding the weather variables, the average humidity, rainfall and temperature are 64.91%, 68.86 mm and 13.93 ^{o}C. The average annual flight number, FLINUMit, is 183,124 and the average revenue-ton-kilometer, RTKit, is 3579.5 million ton-km. The average revenue to operating cost ratio, REVRit, and the average operating profit to operating cost ratio, OPRFRit, are 0.9705 and -0.0204 respectively. The average net profit to operating cost ratio, NPRFRit, is -0.0148. As the carriers are in general making losses, this indicates that the listed carriers are in general not performing well. The average market share, MKTSit, is 0.1856. The average logarithm of available ton kilometer, ATKit, is 24.08. Finally, the average

operation cost to ATK ratio, OCOSATKit, is 0.1912 and the average selling expense to operating cost ratio, SELLCOSit, is 0.0634.

Table 3: Means and Standard Deviations of Relevant Variables

Variable	Definition	Mean	SD
COMPL	The number of customer complaints per 100,000 passengers received by the CAAC in a quarter	0.1858	0.1267
ONTIME	Percentage of on-time scheduled flights within a quarter	82.8736	2.6516
BAGDLY	The number of reported delayed baggage per 100,000 baggage received by the CAAC in a quarter	9.3717	13.2730
BAGBK	The number of reported broken baggage per 100,000 baggage received by the CAAC in a quarter	6.3618	10.5426
BAGMS	The number of reported missing baggage per 100,000 baggage received by the CAAC in a quarter	0.4744	1.6333
HUM	Humidity (%) calculated by averaging over the three monthly reported average humidity measures for all provinces in a quarter.	64.9039	4. 0951
RAIN	Rainfall (mm) calculated by averaging over the three monthly reported average rainfall measures for all provinces in a quarter.	68.8563	41.9606
TEMP	Temperature (°C) calculated by averaging over the three monthly reported average temperature measures for all provinces in a quarter.	13. 9341	8. 2739
FLINUM	Annual flight number	183124	127178
RTK	Annual revenue-ton-kilometer of carrier (million ton-km)	3570.5	2795.57
REVR	Total revenue divided by the operating cost	0.9705	0.1292
OPRFR	Operating profit divided by operating cost	-0.0204	0.1396
NPRFR	Net profit divided by operating cost	-0.0148	0.1298
MKTS	Market share calculated based on their sales revenue	0.1856	0.1281
ATK	Logarithm of available ton kilometer of carriers	24.0806	0.9523
OCOSATK	Operating costs divided by available ton kilometer	0.1912	0.1421
SELLCOS	Total selling expenses divided by operating cost	0.0634	0.0164

Note: 1. The information of passenger complaints, delayed baggage, broken baggage and missing baggage and on-time scheduled flights is collected from the China Civil Aviation.
2. The information of humidity, rainfall and temperature is collected various issues of China Meteorological Yearbook.
3. All financial data of sampled series are obtained from CSMAR databank of GTA Finance & Education Group.

The empirical results of the two stage analysis are reported in Table 4 and 5a and 5b. Let us consider the first stage fixed effect Tobit analysis reported in Table 4.
In measuring the goodness of fit, the ANOVA fit, which is computed based on the ratio of Var(predicted dependent variable) to Var(dependent variable) is used in this model. The ANOVA fit of the fixed effect Tobit analysis is 0.5921 indicating a relatively high goodness of fit. In addition, the signs of most of estimates of independent variables are consistent with our expectation. Among the estimates of baggage errors, only BAGDLYit, is positive and statistically significant at a five percent level and hypothesis H_2 is partially accepted. This indicates that an increase in delayed baggage undoubtedly raises the customer complaints. However, the estimate of on-time performance, ONTIMEit, has no significant effect on customer complaints and hypothesis H_1 is rejected. Regarding weather variables,

the estimate of RAINit is positive in value and the estimate of TEMPit is negative in value. Both of them are statistically significant at one percent level and hypothesis H_3 is partially accepted as well. These results imply that increases in rainfall or decreases in temperature raise the customer complaints. They are in fact consistent with what was discussed in the earlier section. Finally, our seasonal dummies are all statistically significant at one percent level. Given that the first quarter is the benchmark, the seasonal effect is the largest in the third quarter i.e. the summer holiday quarter compared with the first quarter. It is expected as there are much more demands for air travel during the high season of the summer holiday period of July and August. The problems of baggage mishandling or ticket oversold are also more severe as well during this period and may lead to more customer complaints in the end. The second quarter is the second highest following the third quarter.

Table 4: Two Stage Analysis of Carrier Revenue: First stage – Fixed Effect Tobit Analysis of Customer Complaints

	fixed effect Tobit analysis	
	estimates	t-ratio
BAGDLY	0.0030**	2.1393
BAGBK	0.0006	0.4123
BAGMS	-0.0094	-1.4760
ONTIME	-0.4798	-0.9493
HUM	0.0067	0.8611
RAIN	0.0035***	2.9272
TEMP	-0.0494***	-3.0739
FLINUM	0.0152	0.1178
RTK	-0.1573	-1.3818
Q2	0.5642**	2.0178
Q3	0.6262*	1.8913
Q4	0.2305***	2.7638
σ	0.0863***	12.8792
ANOVA fit	0.5505	
Obs.	92	

Note: 1. '*', '**' and '***' indicate that the corresponding estimates are statistically significant at ten, five and one percent level of significance respectively.
2. ANOVA fit is computed based on the ratio: Var(predicted dependent variable) / Var (dependent variable).

Regarding the second stage fixed effect regression, let us consider the results reported in Table 5a and 5b. Model 2, 4 and 6 include the variable of selling expenses to operating cost ratio, SELLCOSit, but Model 1, 3 and 5 do not. First, in terms of goodness of fit, the adjusted R^2 of Model 1 and 2 are 0.5283 and 0.5401 respectively indicating the relatively high goodness of fit of both models in explaining the variable of REVRit while the adjusted R^2 of Model 3 and 4 are only 0.1781 and 0.2320 respectively indicating that the goodness of fit is rather low in explaining the variable of OPRFRit. Finally, the adjusted R^2 of Model 5 and 6 are 0.1901 and 0.2504 respectively. The F statistics of all models are statistically significant at one percent level. This result shows that the independent variables are still meaningful and relevant in accounting for the dependent variables of all

models despite the fact that the adjusted R^2's of Model 3 to 6 are relatively low. Market share, MKTSit, and capacity, ATKit, are in general not significant in explaining all three dependent variables.

Table 5a: Two Stage Analysis of Carrier Revenue: Second Stage - Fixed Effect Regression Analysis of Carrier Revenue

	Revenue to cost ratio			
	Model 1		Model 2	
	estimates	t-ratio	estimates	t-ratio
COMPFIT	-0.4631*	-1.7629	-0.4990*	-1.9181
MKTS	0.8569*	1.8235	0.6091	1.2547
OCOSATK	-0.6830***	-7.8300	-0.6437***	-7.2268
ATK	-0.0702	-1.0724	-0.0233	-0.3324
COMFMK	0.2938	0.3307	0.5403	0.6080
SELLCOS			1.7642*	1.7346
Q2	0.0587**	2.0885	0.0598**	2.1547
Q3	0.0921***	3.5555	0.0988***	3.8217
Q4	-0.0365	-1.3268	-0.0384	-1.4132
Adj. R^2	0.5283		0.5401	
F	8.84***		8.63***	
Obs.	92		92	

Note: 1. '*', '**' and '***' indicate that the corresponding estimates are statistically significant at ten, five and one percent level of significance respectively.
2. F test is testing the zero restrictions of all estimates (including fixed effect estimates).
3. COMPFIT is the fitted COMPL variable generated from the 1st stage Tobit estimation.

Table 5b: Two Stage Analysis of Carrier Revenue: Second Stage - Fixed Effect Regression Analysis of Carriers' Operating Profit & Net Profit Ratios

	Operating profit to cost ratio				Net profit to cost ratio			
	Model 3		Model 4		Model 5		Model 6	
	estimates	t-ratio	estimates	t-ratio	estimates	t-ratio	estimates	t-ratio
COMPFIT	-0.6152	-1.6429	-0.6888*	-1.8968	-0.6465*	-1.8701	-0.7182**	-2.1527
MKTS	0.6172	0.9212	0.1101	0.1624	0.4899	0.7920	-0.0043	-0.0069
OCOSATK	-0.1759	-1.4146	-0.0954	-0.7672	-0.1682	-1.4652	-0.0897	-0.7856
ATK	-0.1335	-1.4299	-0.0375	-0.3828	-0.1239	-1.4373	-0.0303	-0.3370
COMFMK	0.8232	0.6499	1.3277	1.0705	0.8522	0.7289	1.3438	1.1793
SELLCOS			3.6105**	2.5433			3.5180***	2.6974
Q2	0.0179	0.4477	0.0202	0.5217	0.0152	0.4120	0.0175	0.4904
Q3	0.0624*	1.6909	0.0763**	2.1132	0.0514	1.5073	0.0649*	1.9561
Q4	-0.1220***	-3.1133	-0.1259***	-3.3213	-0.1261***	-3.4852	-0.1299***	-3.7294
Adj. R^2	0.1781		0.2320		0.1901		0.2504	
F	2.53***		2.96***		2.64***		3.17***	
Obs.	92		92		92		92	

Note: 1. '*', '**' and '***' indicate that the corresponding estimates are statistically significant at ten, five and one percent level of significance respectively.

2. F test is testing the zero restrictions of all estimates (including fixed effect estimates).
3. COMPFIT is the fitted COMPL variable generated from the 1st stage Tobit estimation.

In addition, the cross product of COMPFITit and MKTSit, COMFMKit, also has no significant effect on all the dependent variables in all six models. Although sampled carriers receive significantly higher revenue to cost ratio in the third and fourth quarter in Model 1 and 2, they also have significantly lower profit to cost ratios in the fourth quarter in Model 3 to 6.

Regarding the estimation of REVRit in Model 1 and 2, fitted customer complaints, COMPFITit, which is the focused variable of this study, have a negative effect on the revenue to operating cost ratio, REVRit, in both models and it is statistically significant at a ten percent level in Model 1 and 2. Operating cost to ATK ratio, OCOSATKit, has a negative effect on the dependent variable and it is significant at a one percent level in both Model 1 and 2. In addition, market share, MKTSit, has a positive effect on the dependent variable in Model 1 and it is significant at a ten percent level. The selling expense to operating cost ratio, SELLCOSit, has a positive effect on the dependent variable and it is also significant at a ten percent level in Model 2. These results are all consistent with our expectation discussed in the previous section. Finally, regarding seasonal effects, the third quarter generates the highest revenue to operating cost ratio and it is followed by the second quarter.

Regarding the estimation of OPRFRit in Model 3 and 4 in Table 5b, first, fitted customer complaints, COMPFITit, have a negative effect on the dependent variable and it is statistically significant at a ten percent level in Model 4. Most of the independent variables have no significant effect on the operating profit to cost ratio. Only the selling expenses to operating cost ratio, SELLCOSit, has a positive effect on the dependent variable and it is significant at a five percent level.

Finally, in Model 5 and 6, the overall pattern of results is in fact similar to those reported in Model 3 and 4. The fitted customer complaints, COMPFITit, have a negative effect on the net profit to cost ratio, NPRFRit, and their effects are statistically significant at ten and five percent level in Model 5 and 6 respectively. The selling expense to operating cost ratio, SELLCOSit, has a positive effect on the dependent variable and it is significant at a one percent level. As a whole, we obtain a consistent result that there is a negative and statistically significant relationship between customer complaints and the profitability of carriers across all models except Model 3. Therefore, hypothesis H4 is partially accepted as only the estimate of COMPFITit in model 6 is negative and significant at a five percent level.

The result that MKTSit, ATKit and COMFMKit are mostly statistically insignificant could be due to the fact that we are actually measuring the market share or capacity based on firm level data instead of route level data. As carriers are indeed competing on route level, they should be calculated from the route level information rather than the firm level information. However, most variables in this study are only available at firm level only. Given the present level of aggregation, we are unable to find any significant relationship existing between this group of independent variables and the dependent variables.

CONCLUSION

Customer satisfaction and improving service quality have become an increasingly important objective of the airlines and their regulators. In fact, the CAAC has been putting

in resources in achieving these objectives for the past several years. However, there is no research investigating how the service quality or customer satisfaction influences the financial performance of Chinese carriers. In this study, we bridge the knowledge gap by conducting an empirical study to investigate the effects of customer satisfaction on the financial performance of six listed Chinese carriers: Air China, China Eastern Airlines, China Southern Airlines, Hainan Airlines, Shanghai Airlines, and Shandong Airlines. The financial performance of carriers is measured by using the revenue to operating cost ratio, operating profit to operating cost ratio and net profit to operating cost ratio of the carriers. The empirical results show that customer complaints have a negative and statistically significant effect on all the three measures of financial performance of carriers. The effect of customer complaints on the net profit to operating cost ratio is significant at a five percent level. This result pattern is in general consistent among all three dependent variables. As a consequence, these results are in fact consistent with our expectation that customer satisfaction is indeed relevant for the financial performance of carriers.

The empirical results also provide support for the carriers to put in their resources to improve their service quality in order to yield a higher customer satisfaction as it can actually raise their profitability in the end. The management of carriers should monitor the customer feedback or complaints closely and devote sufficient resources to improve their service quality accordingly in order to achieve a relatively high customer satisfaction. In addition, businesspeople may also use the customer satisfaction information which is available monthly to help predict the financial performance of carriers before their quarterly financial results are announced.

A limitation of this paper is that only firm-level data on the service attributes and financial indicators are used. As airlines compete on route level, it would be better to estimate the empirical model based on route-level data. However, the service quality variables such as on-time performance, financial variables such as revenue, operating and net profit variables are only available at firm level. As a result, no significant relationship between financial variables and independent variables such as market share and ATK is found. If route-level data were available, different results might be obtained. Further research should be conducted in the area of including customer expectation of service quality. In reality, the management of airlines has to correctly perceive what their customers want and expect and to manage their own resources in meeting their customer expectations appropriately. Consequently, expected service quality may be included in evaluating customer satisfaction and its impact on the financial performance of carriers.

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