ISSN: 2688-9323

Research on the Impact of the New Crown Epidemic on the Business Strategy of Civil Aviation Enterprises

Qianyu Liu, Huiling Wu, Xinrui Zhang and Keren He

School of Anhui University of Finance and Economics, Bengbu 233000, China

Abstract

As an important part of China's transportation industry, aviation has always had an interactive relationship with China's national economy. As the head market of the transportation industry, the development of civil aviation enterprises can affect the development of regional economy on the one hand, and can also drive the economic development of tourism and other industries from the perspective of industrial economy. Due to the blow of the epidemic, international aviation has fallen into a cold winter, and low-cost civil and domestic aviation has ushered in a buffer period of development, this article will discuss the development status and development strategy adjustment of China's civil aviation enterprises under the new crown epidemic based on civil aviation passenger traffic.

Keywords

Civil Aviation; Transportation; National Economy; Passenger Traffic.

1. Introduction

The air transport industry can be said to be one of the most important industries in the world, and it is also a reflection of a country's technical level and service level. The development of China's civil aviation market relies on the promotion of China's urbanization construction since the reform and opening up, and the overall improvement of residents' consumption and transportation level. After China's civil aviation market has reached a certain level of development, it has in turn promoted China's economic growth. The contribution of the air transport industry to economic growth is unquestionable, since the first airliner was put into operation in the 50s, the global commercial air traffic has increased 70 times, which is an unmatched growth multiple of other modes of transportation, which can show that aviation demand can be said to be a global rigid demand, representing a vast commercial market. According to the statistics of China's Civil Aviation Administration in 2015~2019, in these five years, the total turnover of China's civil aviation has increased every year, and by 2019 has exceeded 120 billion ton-kilometers. By March 2021, China's domestic civil aviation market has recovered strongly, of which China Southern Airlines has achieved a growth rate of more than 8% compared with 19 years, which is very gratifying under the shadow of the epidemic. As an industry that pays more attention to technology and service levels, the aviation industry is very sensitive to changes in national economic development policies and strategies. Generally speaking, the development of China's aviation industry and the fluctuations and changes of China's economic development are basically consistent on the whole. Since China has changed from focusing on growth rate to focusing on development quality in recent years, China's civil aviation market on the whole has similar characteristics to China's economic development process.

China's civil aviation market started at a relatively low level, but the development speed is particularly fast, as of this year has become the world's second largest air transport system. In 2019, China's civil aviation industry carried out a wide range of route adjustments with great impact, with a new route mileage of more than 9,000 kilometers, an industry-wide operating

ISSN: 2688-9323

income of more than 1,000 billion yuan, a passenger traffic volume of more than 600 million person-times, and the turnover of civil aviation passengers accounting for more than 30% of the entire transportation industry. In 2020, China issued a notice on civil aviation price supervision, which improved the level of air transport services, created a fair competition air transport market order, protected the legitimate rights and interests of consumers, and further improved the development level of China's air transport industry by increasing civil aviation supervision. At the same time, China also pays more attention to introducing high and new technology into the aviation industry and promoting the high-quality development of the aviation industry.

Therefore, many experts predict that in the long term in the future, China's civil aviation enterprises will continue to develop rapidly, and may usher in the peak of further development.

2. Literature Review

As the saying goes, if you want to be rich, you must build roads first, and this saying also reflects the importance of transportation to regional economic development. The transportation industry is a bridge connecting various industries, regions and national departments and organizations, and is a necessary basis for information transmission in a modern society; In particular, the current development of e-commerce and Internet economy has spawned the rise of the logistics industry, so that the transportation industry has its own extended industry with high dependence, on the other hand, the emergence of emerging industries and the development of the national economy have expanded the market scale of the civil aviation market, which has promoted the rapid development of the civil aviation market. During the epidemic, production and work were suspended everywhere, and transportation was basically paralyzed, among which the suspension of international aviation has had a huge impact on the entire international trade, and it can be said that the cold winter period of international trade for nearly a year has been affected by the ban on international aviation.

Aviation also performs certain urban functions, such as creating jobs, creating economic value, and attracting foreign investment. On the other hand, aviation also reflects the level of economic development of a region. When the per capita income and consumption level of residents in a region reach a certain level, the construction of aviation hubs is of commercial value. Therefore, China's major aviation airports are located in China's 1st and 2nd tier cities, and the main proportion of China's aviation industry also comes from passenger aviation in first- and second-tier cities.

From the above perspective, it can be shown that the development of aviation enterprises affects the regional economy. The regional economy also affects the coverage of the aviation industry, the size of the masses, the revenue effect, etc.

3. Empirical Analysis

3.1. Model Construction

3.1.1. Variable Selection

(1) The variable being explained

Since this paper mainly studies the impact of economic development on the civil aviation market, civil aviation passenger traffic can describe the development of civil aviation market from the perspective of market size, so civil aviation passenger traffic is selected as the explanatory variable.

(2) Explanatory variables

According to the above theoretical analysis of the previous literature and relevant data, it can be obtained that civil aviation reflects the development level of the regional economy on the

ISSN: 2688-9323

one hand, and on the other hand, regional economic development also has a certain role in promoting civil aviation passenger traffic. And the higher the economic development level of a region, the more people flow, the larger the scale of civil aviation hubs built in the region, the higher the revenue, and the economic development level of a region can be expressed by per capita GDP and household consumption level. Therefore, GDP per capita and household consumption level were selected as explanatory variables. It is predicted to be positively correlated with civil aviation passenger traffic.

3.2. Model Settings

In this paper, a binary one-time regression model is selected to construct the model, and the model settings are as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_1 X_2 + \varepsilon_i$$

where Y represents civil aviation passenger traffic (10,000 people), X1 represents per capita GDP, and X2 represents residents' consumption level (yuan).

3.3. Data Acquisition

The data in this article is mainly collected through the webpage of the National Bureau of Statistics, mainly collecting the number of civil aviation passengers in China and China's economic development related data from 1978 to 2020, and the data are as follows:

Table 1. Sample situation

time	Civil aviation passenger traffic (10,000 people)	GDP per capita (yuan)	Household consumption level (yuan)
1978	231.00	385	184
1979	298.00	423	208
1980	343.00	468	238
1981	401.29	497	264
1982	445.23	533	284
1983	391.45	588	315
1984	554.17	702	356
1985	747.00	866	440
1986	996.00	973	496
1987	1310.00	1123	558
1988	1442.00	1378	684
1989	1283.00	1536	785
1990	1660.00	1663	831
1991	2178.00	1912	916
1992	2886.00	2334	1057
1993	3383.00	3027	1332
1994	4039.00	4081	1799
1995	5117.00	5091	2329
1996	5555.00	5898	2763
1997	5630.00	6481	2974

ISSN: 2688-9323

time	Civil aviation passenger traffic (10,000 people)	GDP per capita (yuan)	Household consumption level (yuan)
1998	5755.00	6860	3122
1999	6094.00	7229	3340
2000	6721.66	7942	3712
2001	7524.00	8717	3968
2002	8594.00	9506	4270
2003	8759.00	10666	4555
2004	12123.00	12487	5071
2005	13827.00	14368	5688
2006	15967.84	16738	6319
2007	18576.21	20494	7454
2008	19251.12	24100	8505
2009	23051.64	26180	9249
2010	26769.14	30808	10575
2011	29316.66	36277	12668
2012	31936.05	39771	14074
2013	35396.63	43497	15586
2014	39194.88	46912	17220
2015	43618.00	49922	18857
2016	48796.05	53783	20801
2017	55156.11	59592	22969
2018	61173.77	65534	25245
2019	65993.42	70078	27504
2020	41777.82	72000	27438

3.3.1. Model Inspection and Correction

(1)Preliminary estimates

The least squares method is used to estimate the regression of the explanatory and explanatory variables, and the parameter estimation results are as follows:

Table 2. OLS estimation results

Dependent Variable: Y
Method: Least Squares
Date: 12/19/21 Time: 01:10
Sample: 1978 2020
Included observations: 43

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	215.9085	711.5218	0.303446	0.7631
X1	0.320619	0.418996	0.765207	0.4486
X2	1.370378	1.116836	1.227018	0.2270

R-squared	0.967152	Mean dependent var	15447.98
Adjusted R-squared	0.965509	S.D. dependent var	18641.57
S.E. of regression	3462.044	Akaike info criterion	19.20432
Sum squared resid	4.79E+08	Schwarz criterion	19.32719
Log likelihood	-409.8929	Hannan-Quinn criter.	19.24963
F-statistic	588.8619	Durbin-Watson stat	1.330644
Prob(F-statistic)	0.000000		

First, the model is tested for significance. The t-test of the two explanatory variables has a school-running probability greater than 0.05, and the t-test fails, indicating that the explanatory variable is not significant. The F-statistic of the model is 588.8619, its adjoint probability is 0.0000, and the F-test passes. Overall, the significance test of the model fails. Then, the economic significance test of the model shows that the coefficient values of the two explanatory variables are positive, indicating that the per capita GDP and household consumption level are positively correlated with the passenger traffic of civil aviation, which is in line with the previous forecast. Since the t-test of the model does not pass, the prediction model may have certain multicollinearity problems, and the model will be further modified in the future.

3.3.2. Multicollinearity Testing and Correction

(1) Correlation coefficient test

Table 3. Correlation coefficient matrix

	X1	X2
X1	1	0.998314911...
X2	0.998314911...	1

This can be observed by testing the correlation coefficient on the explanatory variables. The correlation coefficient of the two explanatory variables in the table reached 0.9983, and the correlation coefficient value was high, indicating that there was a multicollinearity problem between the two explanatory variables.

(2) VIF test

Table 4. VIF value

Variance Inflation Factors
Date: 12/19/21 Time: 18:08
Sample: 1978 2020
Included observations: 43

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	506263.2	1.816266	NA
X1	0.175558	500.7296	296.9705
X2	1.247323	510.4553	296.9705

The VIF expansion factor test is the most commonly used method for testing multicollinearity problems. According to the test of the variance inflation factor values of the two explanatory variables in the figure above, they are much greater than 10, indicating that the model does have a serious problem of multiple collinearity.

(3) Stepwise regression modifies collinearity

As shown in the figure, after using the stepwise regression method to modify the model, only one explanatory variable X2 remains, which represents the consumption level of residents. Firstly, the significance test of the model is carried out on the probability of running a school for the end variable X2 of the T test is 0.0000, indicating that the T test has a high scientific coefficient value of 0.96667 and a scientific coefficient value, indicating that the model fits well, the accompanying probability of the F statistic is 0.0000, the F test passes, and the model is significant overall. The DW value is 1.241573. The economic significance test of the model is then carried out, and the coefficient of the explanatory variable X2 is positive, which represents a positive relationship between the consumption level of residents and the number of civil aviation passengers, which is in line with the previous forecast. However, the observation model test values are all high, and it is suspected that the model may have heteroscedasticity. Next, the model is tested for heteroscedasticity.

Table 5. Stepwise regression results

Dependent Variable: Y
Method: Least Squares
Date: 12/19/21 Time: 01:05
Sample: 1978 2020
Included observations: 43

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	89.83116	688.6750	0.130441	0.8969
X2	2.223548	0.064480	34.48419	0.0000

R-squared	0.966671	Mean dependent var	15447.98
Adjusted R-squared	0.965858	S.D. dependent var	18641.57
S.E. of regression	3444.502	Akaike info criterion	19.17234
Sum squared resid	4.86E+08	Schwarz criterion	19.25426
Log likelihood	-410.2053	Hannan-Quinn criter.	19.20255
F-statistic	1189.159	Durbin-Watson stat	1.241573
Prob(F-statistic)	0.000000		

3.3.3. Heteroscedasticity Test

(1)WHITE test

Table 6. White test

Heteroskedasticity Test: White

F-statistic	9.662200	Prob. F(5,37)	0.0000
Obs*R-squared	24.35059	Prob. Chi-Square(5)	0.0002
Scaled explained SS	257.5833	Prob. Chi-Square(5)	0.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/19/21 Time: 18:13
Sample: 1978 2020
Included observations: 43

Variable	Coefficient	Std. Error	t-Statistic	Prob.

According to the results of the White test in the table above, the nR^2 of the model is 24.35059, and its adjoint probability is 0.0002, which is much less than the set significance level of 0.05. Indicates that the model rejects the null hypothesis that there is heteroscedasticity in the model.

(2)Logarithmic transformation corrects heteroscedasticity

The economic significance expressed by the logarithmic transformation method represents elasticity, and the logarithmic transformation of the model can alleviate the heteroscedasticity problem on the one hand, and more effectively analyze the economic problem on the other hand. Therefore, after performing a logarithmic transformation of the model, the output result is as follows:

ISSN: 2688-9323

Table 7. Logarithmic model estimates results

Dependent Variable: LOG(Y)
Method: Least Squares
Date: 12/19/21 Time: 01:06
Sample: 1978 2020
Included observations: 43

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.050371	0.127975	0.393603	0.6959
LOG(X2)	1.082815	0.015878	68.19599	0.0000

R-squared	0.991261	Mean dependent var	8.615035
Adjusted R-squared	0.991048	S.D. dependent var	1.704704
S.E. of regression	0.161291	Akaike info criterion	-0.765823
Sum squared resid	1.066601	Schwarz criterion	-0.683907
Log likelihood	18.46520	Hannan-Quinn criter.	-0.735615
F-statistic	4650.693	Durbin-Watson stat	0.638381
Prob(F-statistic)	0.000000		

The heteroscedasticity test is performed on the model, and the output structure is as follows:

Table 8. Logarithmic model white test results

Heteroskedasticity Test: White

F-statistic	0.668773	Prob. F(2,40)	0.5180
Obs*R-squared	1.391337	Prob. Chi-Square(2)	0.4987
Scaled explained SS	1.915668	Prob. Chi-Square(2)	0.3837

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/19/21 Time: 01:22
Sample: 1978 2020
Included observations: 43

According to the White test results of the model in Table 8, the adjoint probability of nR^2 of the model is 0.4987, which is much greater than the set significance level of 0.05. Indicates that the model accepts the null hypothesis and that there is no heteroscedasticity in the model. Therefore, the logarithmic model is successfully constructed, and its canonical form is as follows

$$LN\widehat{Y} = 0.050371 + 1.082815\,LNX_2$$

$$(0.393603) \quad (68.19599)$$

$$R^2 = 0.991261 \quad F = 4650.693 \quad DW = 0.638381$$

Firstly, the significance test of the model is performed on the t-test with a probability of 0.0000, which is significantly lower than the above model, and the t-test passes. The R-Q value of the model is 0.991261, which is a high R-Q value, indicating that the overall fit of the model is good. The adjoint probability of the F test is 0.0000, and the F test passes, indicating that the model is significant overall. The significance test of the model indicates that for every 1% change in the consumption level of residents, the civil aviation passenger traffic fluctuates upward by about 1.08%, indicating that the consumption level of residents has a positive impact on the civil aviation passenger volume, which is in line with the previous forecast and passed the economic significance test. However, observing the DW value of the model, it is found to be 0.638381, indicating that the model has at least first-order autocorrelation problems, so a higher-order autocorrelation test will be performed on the model.

3.3.4. Self-correlation Testing

DW test can easily test the autocorrelation problem of the model, but DW test has its limitations, that is, it can only test the low-order autocorrelation of the model, while the high-order autocorrelation of the model can be tested by the partial correlation coefficient. It has been determined above that the model has at least a first-order autocorrelation problem, so the higher-order autocorrelation problem of the model will be tested by the partial correlation coefficient test.

(1)Higher order autocorrelation tests

Table 9. Partial correlation coefficient test results

Date: 12/19/21 Time: 01:17
Sample: 1978 2020
Included observations: 43

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.544	0.544	13.636	0.000
		2	0.298	0.003	17.833	0.000
		3	0.138	-0.03...	18.752	0.000
		4	0.070	0.012	18.995	0.001
		5	0.095	0.086	19.458	0.002
		6	-0.03...	-0.16...	19.509	0.003
		7	-0.21...	-0.23...	22.042	0.002
		8	-0.33...	-0.15...	28.177	0.000
		9	-0.38...	-0.13...	36.407	0.000
		1...	-0.34...	-0.10...	43.466	0.000
		1...	-0.22...	0.054	46.440	0.000
		1...	-0.15...	0.010	48.024	0.000
		1...	-0.14...	-0.05...	49.414	0.000
		1...	-0.07...	0.032	49.821	0.000
		1...	-0.02...	-0.01...	49.852	0.000
		1...	0.047	-0.05...	50.010	0.000
		1...	0.207	0.129	53.193	0.000
		1...	0.222	-0.00...	57.022	0.000
		1...	0.227	0.019	61.173	0.000
		2...	0.179	-0.01...	63.862	0.000

As shown in the white noise plot of the partial correlation coefficient test results, it can be seen that the length of the first bar chart in column 2 exceeds the dotted line on the right, indicating that the model only has a first-order autocorrelation problem, and the model will be corrected by the generalized difference method.

(2) Autocorrelation correction - generalized difference method

Table 10. Autocorrelation correction model

Dependent Variable: LOG(Y)
Method: ARMA Generalized Least Squares (BFGS)
Date: 12/19/21 Time: 01:07
Sample: 1978 2020
Included observations: 43
Convergence achieved after 7 iterations
Coefficient covariance computed using outer product of gradients
d.f. adjustment for standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.107253	0.355513	0.301686	0.7645
LOG(X2)	1.069646	0.045318	23.60306	0.0000
AR(1)	0.760138	0.141465	5.373321	0.0000

R-squared	0.994885	Mean dependent var	8.615035
Adjusted R-squared	0.994629	S.D. dependent var	1.704704
S.E. of regression	0.124935	Akaike info criterion	-1.234774
Sum squared resid	0.624353	Schwarz criterion	-1.111899
Log likelihood	29.54763	Hannan-Quinn criter.	-1.189461
F-statistic	3889.733	Durbin-Watson stat	1.525383
Prob(F-statistic)	0.000000		

$$Y = 0.107253 + 1.069646 LNX_2 + 0.760138 AR(1)$$
$$(0.301686) \quad (12.60306) \quad (5.373321)$$
$$R^2 = 0.994885 \quad F = 3889.733 \quad DW = 1.525383$$

According to Table 10, the t-test adjoint probability of the explanatory variables and AR terms in the model is 0.0000, indicating that both explanatory variables are significant and the t-test is passed. The adjusted R-LCD value of the model is 0.994629 The R-Q value of the model is high, indicating that the overall fit of the model is good. The adjoint probability of the t statistic value is 0.0000, indicating that the model is significant overall, and the F test is passed. The economic significance of this model indicates that for every 1% change in residents' consumption level, civil aviation passenger traffic fluctuates upward by about 1.07%, which further shows that there is a significant positive correlation between residents' consumption level and civil aviation passenger traffic.

4. Conclusion

According to the above theoretical analysis and final model construction results, the consumption level of residents has a significant impact on the passenger traffic of civil aviation enterprises in China. This mainly reflects the interdependent relationship between the development of China's civil aviation enterprises and China's economic development. Compared with rail and road transportation, civil aviation has the advantage of shorter and faster time, but it also has the characteristics of higher price. Therefore, its market is mainly aimed at some high-consumption users and just-in-demand users, and low- and middle-income groups mainly travel by railway tools. Therefore, civil aviation is very sensitive to price changes, and when it encounters peak traffic periods such as holidays and other peak traffic and becomes a rigid demand, aviation prices will rise. When the demand for travel weakens, the price will be reduced, and even during the epidemic, China's aviation once fell into a downturn in the short term. Therefore, in view of the above analysis conclusions, the following strategic suggestions are put forward for the development of civil aviation enterprises.

4.1. Keep Prices Competitive

As the impact of the epidemic has affected China's national consumption level and future consumption expectations, many consumers prefer to choose more cost-effective and lower price airlines when choosing civil aviation travel. Therefore, the development of civil aviation enterprises should find the right development strategy, choose a low-cost market development strategy based on the competitiveness of air ticket prices in a timely manner, increase discourse power and revenue capacity by occupying market share, carry out long-term market expansion, and maintain the competitiveness of air ticket price power; Based on the control of price competitiveness, civil aviation should increase the scientific and systematic cost management of enterprises in the process of development, and should not blindly reduce the service level due to price competitiveness, but should reduce aviation costs within a controllable range.

4.2. Deeply Cultivate the Base of First-tier Cities

The level of household consumption depends on the income of residents, and the above conclusion is explained from another perspective, that is, the income of local residents affects the passenger traffic of local air hubs. Therefore, the market of the base where air transport companies are located plays a pivotal role in air passenger traffic. Civil aviation companies should pay attention to the operation, maintenance and shaping of corporate image of the base market. As mentioned above, the main proportion of private aviation's revenue comes mainly from first-tier cities, so in these cities, the competition between airlines is also the fiercest. By building their own hubs in these cities, airlines need to improve service levels and capture the market share of their bases.

References

[1] Qiu Xiaohua,Zheng Jingping,Wan Donghua,et al. Analysis of China's Economic Growth Dynamics and Prospects[J]Economic Research Journal,2006(5) : 4 - 12.

[2] Qingbao Liu, Liangli Wei, The Source Driving Force of China's Economic Growth: An Empirical Study of the "Troika" on the Pull of China's Economic Growth[J], Special Economic Zone, 2007(12): 257 - 258.

ISSN: 2688-9323

[3] Zhu Yuxia, Niu Guofen, Chen Ailian, Sun Wei, Zhang Qiao, Zhao Sijian. Research on the Application of Potato Income Insurance Based on Multi-Source Remote Sensing Data [J]. Agricultural Resources and regionalization in China, 2021,42 (10): 223-232.
[4] Feng Wenli, Zheng Haoyu. Analysis of remote sensing technology in agricultural insurance field [J]. Rural Finance Research, 2021, (07): 3-8.
[5] Kim laughs at the day. Application of High fen Remote Sensing in Agricultural Insurance [J]. China High-tech, 2021, (12): 72-74.