Characterisation of Dynamic Pricing Strategies of Airline Tickets -China Southern Airlines as an Example

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Abstract. This paper focuses on airlines' dynamic pricing strategy for air tickets, aiming to explore its diversified features in depth. Dynamic pricing strategy provides a strong impetus for airline operation and revenue optimisation, which is conducive to improving airline efficiency and promoting the development of the aviation industry. Taking China Southern Airlines as an example, the study finds that the airline's dynamic pricing strategy is flexible, market-differentiated and time-sensitive by collecting fare data of different routes from April 2023 to May 2023, and analysing the characteristics of the dynamic pricing strategy based on the characteristics of fare fluctuations. The study finds that the airline's dynamic pricing strategy has flexibility, market variability and time sensitivity. The results of the study have certain reference value for exploring the nature of the airline's dynamic pricing strategy, optimising the airline's operation and revenue management, and promoting the prosperous development of the whole aviation industry.

1 Introduction

In recent years, China's aviation industry has been developing vigorously, the demand of travellers has been diversified, the number of airlines has been increasing, and the market competition of airlines has intensified. In this severe background, airlines increasingly pay attention to and practice dynamic pricing strategy [1]. Dynamic pricing is one of the main elements of revenue management, and with the continuous deepening of the research on revenue management [2]. The research on dynamic pricing has been relatively abundant, and the related literature can be referred to Bitran and Caldentey, Shen and Su et al [3,4]. The dynamic pricing strategy for airline tickets refers to maximising profits by adjusting fares in response to expected changes in demand under the influence of changes in time, place, environment and supply and demand. According to IATA (2023), airlines that use dynamic pricing see an average revenue boost of 12-15%, while CAAC data shows that domestic airline fares fluctuated by 210% in 2023 (lowest discounted price to full price).Dynamic pricing enables airlines to make reasonable fare regulation based on market demand, thus effectively avoiding the occurrence of air ticket supply and demand imbalance due to pricing strategy errors, and gradually becoming the core means for airlines to improve their

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competitive advantage and cope with market changes, and therefore has received extensive attention and research [5]. An in-depth study of the characteristics of the dynamic pricing strategy of airline tickets can help to improve the level of airline revenue management and provide guidance for theoretical research and practical application. The characteristics of airlines' dynamic pricing strategy refer to a series of regular features in the process of airlines' dynamic adjustment of airfares according to various factors. As a leader in the domestic airline industry, China Southern Airlines, the characteristics of its dynamic pricing strategy are worth an in-depth study. By collecting data on the air ticket price changes of China Southern Airlines in different time and space from April 2023 to May 2023, and using descriptive statistical analysis method and comparative analysis method, the present study this paper analyse and conclude that the characteristics of the dynamic pricing strategy of air tickets have flexibility, market differentiation, and time sensitivity, which collectively reflect the essence of the airline's dynamic pricing strategy and its operation mechanism, and are the key elements in understanding and analysing how airlines achieve revenue optimisation and market competition through dynamic pricing. By analysing the characteristics of dynamic pricing strategy of China Southern Airlines, it can not only provide a reference for the further optimisation of pricing strategy of China Southern Airlines, but also help other airlines to learn from its experience, so that airlines can formulate a more scientific and reasonable pricing strategy in the complex and changeable market environment, and then promote the healthy and sustainable development of the air transport industry.

2 Methods

2.1 Data source

Sample selection: the data for this study comes from the civil aviation dataset platform and the official website of China Southern Airlines, covering the complete price series for a total of 61 days from 1 April to 31 May 2023 (including the May Day Golden Week).The data covers fare information for different days in advance of ticket purchase, and data on external variables of holiday arrangements for the same period are also collected.

Route coverage: 3 types of typical routes operated by China Southern Airlines (see Table 1) are selected to ensure spatial heterogeneity.

Table 1. Sample route classification

Route Type	Sample Route	Distance travelled (km)	Average fare in April-May (yuan)
Business MainlineS	Shanghai-Beijing	1078	1270.06
Tourist Hotline	Chongqing-Shenzhen	1150	739.40
High-speed rail competitive routes	Xiamen-Shanghai	850	1201.1

2.2 Analysis method

This study adopts descriptive statistical analysis to analyse the trends of fares over time on different routes, the differences in fares in different spatial markets, and the relationship between demand characteristics and fares; it also adopts comparative analysis to compare the similarities and differences between the three types of routes in their dynamic pricing

strategies, and analyses and derives the core characteristics of the South China Airlines in its dynamic pricing strategy.

3 Result

3.1 Analysis of time dimension

3.1.1 Ticking advance and fare relationship

On the Shanghai - Beijing route business trunk, non-peak hour advance booking can enjoy 6.1-6.7% discount, flight fares are lower and less fluctuating, and as the flight departure date approaches, some flights reduce prices. Business travellers travel with obvious purpose, strong timeliness and lower price sensitivity. China Southern Airlines analysed and concluded the travel characteristics of business travellers and obtained higher revenues by increasing flight fares close to the departure date.

On the Chongqing-Shenzhen travel hotline, during off-peak hours (13 April-25 April and 8 May-30 May): economy class prices were generally ￥600-￥970 (3.1-5.5% discount), with the lowest price occurring on 13 April (￥600, 3.1% discount).China Southern Airlines dynamically adjusts discounts according to the progress of booking, and flexibly adjusts prices near holidays or when flights take off, and purchases tickets 2-3 weeks in advance for the biggest discounts.

On the Xiamen-Shanghai high-speed railway competition route, the price is lowest on Tuesday and Wednesday, mostly 30%-40% off (￥660-￥950), and as low as ￥660 for many flights on 18-19 Apr. Fares are lowest in the 2-3 weeks before flight departure (e.g., flights on 18 Apr are priced at 30% off (￥660)), and the price rises gradually nearer to the time of take-off. In order to cope with the competition of high-speed rail, China Southern Airlines will formulate differentiated fare strategy in advance.

3.1.2 Analysis of fare differences between weekdays and weekends

Shanghai-Beijing business trunk line has higher fares for prime-time business travel flights from 8-10 a.m. and 2-4 p.m. Prices from Friday to Sunday (e.g., 21 April, 28 April) are generally higher than those on weekdays.

Chongqing-Shenzhen traveller hotlines show a cyclical upward trend in weekend fares. Prices from Friday to Sunday (e.g., 28 April, 5 May) are generally higher than those on weekdays, and prices for late flights (e.g., CZ8494) have risen significantly.

Xiamen-Shanghai high-speed rail competing routes do not have serious weekend premiums, and prices generally increase by 10-30% from Friday to Sunday. The difference in fares between weekdays and weekends is relatively small. In the face of the impact of convenient alternative choices on travellers' choices, price fluctuations on this route are relatively flat.

3.1.3 Impact of holidays on fares

Airline fares show significant seasonal fluctuations during Qingming Festival and May Day Labour Day.

For the Shanghai-Beijing business route, the price enters a fast rising channel one week before the holiday, with fares rising to ￥1,350-￥1,630 (economy class 7.6% off - full price),

and full price fares (￥1,630) appearing on 28 April and 3 May, forming an obvious price peak, with prices rising by more than 50% before and after the Labour Day holiday.

Chongqing-Shenzhen tourist routes, May Day holiday fares rose by 100%-200% (e.g., CZ3456 from ￥810 to ￥1,940), full-price tickets appeared centrally. After the holiday, prices fell quickly, but still at a high level (e.g., CZ3456 at ￥1,610 with a discount of 8.3% on 4 May).

On the Xiamen-Shanghai route, prices rose rapidly during the May Day holiday, reaching as high as ￥2,200 full price, and then quickly dropped by 30% after the holiday.

3.2 Spatial dimension analysis

3.2.1 Regional fare differences

The fare structure of Shanghai-Beijing, as a core business trunk route in China, shows the typical characteristics of business routes. Thanks to the business links between the Yangtze River Delta and Beijing-Tianjin-Hebei, the route maintains a high benchmark fare. China Southern Airlines has adopted a more refined class classification strategy with higher pricing on this route.

The price formation mechanism of the Chongqing-Shenzhen route is more influenced by the leisure travel market. As an important source of tourism in the Pearl River Delta region, Shenzhen has a rich source of tourists and strong spending power of travellers, and fares from Shenzhen are relatively higher than those from Changsha. This phenomenon is closely related to the level of regional economic development and passenger structure.

The Xiamen-Shanghai route, on the other hand, faces alternative competition from ground transport, with the efficient accessibility of the high-speed rail network posing a significant constraint on airline pricing. With lower average fares and a relatively small fare fluctuation range on this route, China Southern's pricing is more prudent in a mixed transport market.

3.2.2 Impact of external competition

On the Shanghai-Beijing route, the number of flights launched by each carrier was high, but China Southern Airlines, as a leader in China's aviation industry, had a strong influence and reputation that made more travellers preferred, and it was able to adjust its fares according to its own operating conditions and market demand. Competition on the Chongqing-Shenzhen route is relatively low, and China Southern adopts a flexible pricing strategy for this route, adjusting prices in accordance with real-time demand changes. The Xiamen-Shanghai route faces strong competition from high-speed rail, which puts greater pressure on China Southern Airlines, which needs to continuously adjust its pricing strategy and launch special fares to attract travellers when necessary.

3.3 Demand characterisation

3.3.1 Business passenger demand and pricing strategy

As a core domestic business route, the passenger composition and demand characteristics of the Shanghai-Beijing sector show distinctive business travel attributes. The travelling time is concentrated in the morning and evening peak hours on weekdays, and the elasticity coefficient for fares is lower, but the requirements for flight punctuality and cabin service

quality are significantly higher than those for leisure passengers. In response to the travel characteristics and needs of business travellers, China Southern Airlines has implemented premium pricing during prime business hours and also formulated differentiated ticketing rules.

3.3.2 Tourist travellers' demand and pricing strategy

Travellers on the Chongqing-Shenzhen tourism hotline are more price-sensitive, have a significant tendency to purchase tickets in advance and respond positively to fare promotions, and their choice of travel time shows obvious seasonal fluctuations. Therefore, China Southern Airlines maintains higher fares in the peak season and offers special discounts in the off-season.

3.3.3 Passenger demand and pricing strategies under high-speed rail competition

Air transport on the Xiamen-Shanghai route faces fierce competition from high-speed rail, and travellers usually weigh key factors such as fares, journey time and convenience when choosing. In order to enhance competitiveness, China Southern Airlines dynamically adjusts fares on one hand, and on the other hand, launches air-rail combined transport products by upgrading the quality of cabin services to meet the differentiated travel needs of different passengers.

4 Basic characteristics of China southern airlines' dynamic pricing strategy

4.1 Flexibility

The fare system of China Southern Airlines presents significant market adaptability and demand response characteristics, with high flexibility, and can use low-priced flights to guide passenger flow to low-demand periods. In terms of the temporal adjustment mechanism, the company has established a multi-level price adjustment system based on the window period for purchasing tickets (7 days/14 days/21 days), the distribution of time slots within the week (weekdays/weekends), and the seasonal cycle (holidays/off-peak seasons).In terms of spatial layout, the fare setting takes into account spatial factors such as the geographical characteristics of the routes, the regional economic level, and the competitive intensity of alternative modes of transport, and its differentiated pricing mechanism fully takes into account the characteristics of the segmentation of the passenger groups: for the business travellers, who are less price-sensitive, it mainly adopts value-added services, while for the leisure travellers, it focuses on price-incentive programmes. This three-dimensional dynamic adjustment framework of time, space and segments demonstrates the high flexibility of pricing strategy.

4.2 Market differentiation

China Southern Airlines has implemented a precise market segmentation pricing mechanism for different route types. Business routes mainly adopt a value-oriented pricing model to meet the special needs of business passengers for convenience and comfort by optimising flight scheduling and improving service quality, thus supporting higher fares. For leisure and tourism routes, the demand elasticity pricing method is adopted, whereby a floating fare system is implemented based on seasonal fluctuations in passenger flow and the degree of

price sensitivity of travellers, with the benchmark price maintained in peak seasons and gradient discounts introduced in low seasons. In the route market facing competition from high-speed rail, China Southern Airlines adopts a competitive pricing strategy by comparing and analysing the relative advantages of air transport and high-speed rail in terms of time cost, service experience, etc., and sets a competitive pricing system in the market. This classification pricing method based on airline characteristics not only effectively meets the differentiated demand characteristics of various market segments, but also significantly improves the airline's market penetration rate [6].

4.3 Time sensitivity

China Southern Airlines' fare system shows significant time sensitivity. Its price fluctuations and time elements have multi-dimensional correlation characteristics, mainly reflected in three dimensions: based on the difference in the length of the ticket window period, the early bird discounts and the proximity of the ticket to form an obvious price difference; the difference between weekday and weekend fares; and before and after the holidays show typical seasonal price fluctuations. This refined time-dimension price regulation mechanism enables airlines to implement precise revenue optimisation strategies based on the time-distribution characteristics of market demand, improving airline revenue and verifying the key regulating role of the time element in dynamic pricing theory.

5 Research meaning

5.1 The multiple contributions of China southern airlines' dynamic pricing strategy characteristics to its development

By analysing the differences in passenger demand on different route types (e.g., business routes, tourism routes and high-speed rail competitive routes), a more refined price elasticity prediction model is constructed, which improves the precision of the pricing strategy and optimises China Southern Airlines' revenue management.

On high-speed rail competitive routes, differentiated products (e.g., air-rail intermodal services) are designed in conjunction with passenger price sensitivity; on business routes, customer loyalty can be enhanced through a combination of high-value-added services to strengthen the competitive advantage and increase the competitiveness of China Southern Airlines in the market [7].

By dynamically adjusting capacity allocation based on historical fare fluctuation trends, China Southern Airlines can increase passenger seating capacity during peak seasons, and reduce idle capacity during off-season through demand stimulation strategies to reduce unit operating costs and improve resource utilisation.

The in-depth study of pricing strategies provides theoretical support for the algorithmic optimisation of the revenue management system, and helps to build an intelligent dynamic pricing system based on big data, improve the scientific nature of decision-making, promote the digital transformation of China Southern Airlines, and push forward pricing reform [8].

By accurately identifying the price sensitivity of different customer segments, implementing customised marketing strategies to increase the conversion rate of ticket purchases, deepening customer relationship management at China Southern Airlines, and differentiated service solutions can significantly increase the retention rate of high-end customers (expected to increase by more than 15%).

5.2 The value of China Southern's dynamic pricing strategy characteristics for the industry and its impact on the aviation market

China Southern Airlines reveals the pricing laws under different transport scenarios, promotes the improvement of the industry's revenue management level, and provides the industry with empirical research samples of market segments. Accordingly, airlines can establish a more accurate fare formation mechanism, develop complex transport products and improve their revenue management system.

China Southern Airlines' dynamic pricing mechanism can effectively adjust the degree of matching between capacity and demand, optimising the allocation of transport resources. By establishing a demand forecasting model, each airline company can achieve efficient use of transport resources and improve operational efficiency while ensuring service quality.

The dynamic pricing strategy of China Southern Airlines has become a practical sample of digital transformation, verifying the importance of data-driven decision-making in air transport management, providing a replicable technical path for the industry to promote the construction of intelligence, promoting the combination of big data and artificial intelligence, and facilitating the modernisation of air transport management systems [9].

SAC promotes the deepening of customer demand research, inspires industry operators to change their competitive thinking, promotes collaborative innovation and resource integration within the industry, and promotes airline companies to shift from competition to co-operation [10], and promotes the high-quality development of the aviation industry.

6 Conclusion

Based on the empirical analyses of three types of typical routes of China Southern Airlines, this study finds that the dynamic pricing mechanism of its air tickets presents significant characteristics: flexibility, market differentiation and time sensitivity. The results of the study not only reveal the intrinsic law of airline ticket price fluctuation, but also systematically explain the multidimensional characteristics of dynamic pricing. Although some of the micro-level analyses are not in-depth due to data accuracy, the research results still provide a valuable theoretical framework and operational guidelines for the optimisation of China Southern Airlines' revenue management system. China Southern Airlines' innovative practice in the field of dynamic pricing has a significant demonstration effect. Its successful experience shows that a scientific and reasonable price adjustment mechanism can not only enhance the enterprise's own market competitiveness, but also provide an important reference for the management innovation of the whole civil aviation industry. In the future development of air transport enterprises, they should combine the full market characteristics and continue to improve the synergistic mechanism of dynamic pricing and resource allocation, so as to achieve the sustainable improvement of the overall efficiency of the industry.

This study proposes the following development directions for the dynamic pricing strategy of the aviation industry: First, establish a regular market research mechanism to more accurately grasp the changes in supply and demand, so that the pricing strategy can better reflect the actual market demand, and gain a deeper understanding of the demand characteristics of different groups of travellers, so as to provide a more accurate basis for dynamic pricing. Secondly, continuing to promote pricing reform in various aspects in response to the existing pricing problems in China's aviation industry. People will make use of technologies such as big data and artificial intelligence to improve dynamic pricing strategies, make up for deficiencies, and increase the accuracy and efficiency of pricing. Third, in the optimisation of operation strategies for high-speed rail competitive routes, airlines should break through the single price competition model and build multi-dimensional competitive advantages through product differentiation and service upgrading. Fourthly,

strengthening cooperation and alliance with other airlines, through resource sharing and collaborative pricing, airlines should avoid disorderly price competition, and improve the overall level of industry revenue through cooperation to jointly meet market challenges. The competition of domestic airlines is mainly based on price for a long time, and bottomless price competition will not bring profit for airlines, and co-operation and win-win situation is the plan for long-term development.

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