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Optimization of Revenue Management Strategies for Cathay Pacific Based on Dynamic Pricing Theory

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Abstract. This study optimizes revenue management strategies for Cathay Pacific Airways amid post pandemic market volatility and intensified Asia-Pacific competition. Addressing critical issues including demand forecast lag, imprecise price elasticity measurement, channel pricing inconsistencies, and insufficient transit passenger segmentation, this research proposes quantitative finance-driven solutions. Key strategies include rebuilding dynamic demand price elasticity models, implementing real-time cost fluctuation pricing mechanisms, and adopting differentiated unbundled pricing for premium cabins. Implementation safeguards encompass digital system upgrades, organizational restructuring, and compliance framework to enhance Revenue per Available Seat Kilometer (RASK). By integrating financial engineering with airline revenue management, this paper provides a replicable optimization framework that helps airlines maximize revenue, respond rapidly to cost changes, and innovate dynamic pricing during structural market shifts. Ultimately, these recommendations offer a forward-looking blueprint for sustaining profitability and long-term resilience in an increasingly global aviation landscape. Meanwhile, help airlines to chase profit maximization and decrease the pressure form fuel price or other cost fluctuation

Keywords: Cathay Pacific Airways, Revenue management, Dynamic pricing, Price elasticity, RASK

1. Introduction

In the post-pandemic era, the global aviation industry is experiencing a rapid recovery [1]. However, numerous full-service carriers are currently grappling with rising fuel costs and fierce competition from low-cost airlines (LCCs). As a flagship carrier in Hong Kong, Cathay Pacific faces significant challenges in its revenue management systems. Specifically, the airline's traditional static pricing strategies fail to respond quickly to real-time demand fluctuations, resulting in potential revenue leakage.

The core issue lies in the latency of current pricing models when facing dynamic market conditions. Therefore, the primary objective of this study is to investigate how to construct a dynamic pricing model combined with real-time demand forecasting. By doing so, this research aims to enhance Cathay Pacific's Revenue per Available Seat Kilometer (RASK) and optimize its strategic response to future cost changes and network adjustments.

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2. Literature review

2.1. Fundamentals of revenue management

Revenue management originated from the American airline industry deregulation of 1978, with the fundamental objective of selling the right product to the right customers at the right time. Foundational theories, such as EMSR models and Littlewood's rule, have established the mathematical framework for modern seat inventory control [2, 3]. Fundamentally, revenue management rests on three pillars: price discrimination, seat inventory control, and demand forecasting. Price discrimination enables carriers to segment heterogeneous customers based on willingness to pay, thereby capturing consumer surplus [4]. Seat inventory control optimizes seat allocation across fare classes to maximize revenue, while demand forecasting provides the data foundation for pricing decisions.

2.2. Strategic pricing: game theory & consumer behavior

Effective airline pricing hinges on accurate measurement of Price Elasticity of Demand (Ed) to enable third-degree price discrimination. Business travelers typically exhibit inelastic demand, permitting premium pricing, while leisure travelers are highly elastic and require discounted [3]. Static elasticity coefficients fail to capture real-time segment variations, leading to revenue leakage.

Furthermore, the Asia-Pacific aviation market is oligopolistic, where carriers' pricing decisions are interdependent. According to the Bertrand competition model [5], unilateral price cuts trigger retaliatory responses, converging toward a Nash Equilibrium that erodes industry profits, which is a classic prisoner's dilemma. Consequently, dynamic pricing models must embed competitive reaction functions rather than relying solely on internal cost or historical demand data, ensuring strategic responsiveness in hub-dominated markets like Hong Kong.

3. Current situation of revenue management and dynamic pricing at Cathay Pacific Airways

3.1. Current pricing mechanisms and procedures

Cathay Pacific's pricing mechanism is primarily driven by historical data analysis and inventory control logic. The decision-making workflow is highly automated yet supervised by revenue analysts, utilizing booking data and seasonal trends to forecast demand and allocate seats across booking classes [5]. Pricing relies heavily on rule-based triggers; for instance, the system dynamically adjusts fare class availability based on reservation velocity relative to preset thresholds. Furthermore, pricing authority is centralized at the Hong Kong headquarters to maintain strategic consistency.

3.2. The specific implementation and current status of the differentiation strategy

The Cathay Pacific primarily uses product unbundling to distinguish different groups of customers and achieve price differentiation.

Cabin Class Segmentation: The airlines in different cabins have different price-setting strategies.

Economic class: This cabin is highly competitive, and passengers are highly price-sensitive. This cabin class usually has restrictions to create price differentiation [6]. For example, the refundable flight tickets and nonrefundable flight tickets.

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Business class and other premium classes: For the first class and business class, the setting price strategy is usually value-based. Because, most business travelers usually have low-price elastic, this feature can help airlines maximize revenue [7].

Customer segmentation: The airlines use the Marco Polo Club Frequent Flyer Program to distinguish the high-value customers. However, compared with other strategies, the Marco Polo Club has limitations because the airlines require extensive data to distinguish different groups of people.

Differentiation of ancillary services: Nowadays, most airlines are trying hard to unbundle lots of services, for example, choosing the seats or extra luggage charged separately.

3.3. Application effects of the current dynamic pricing mode

Although the current model for Cathay Pacific can ensure the optimization of benchmark revenue, it does not have high efficiency operation in the complex or unexpected events in the market.

Revenue Stable: In the normal operation period, the current model can efficiently balance the load factor and control average ticket price, leading to maintaining and achieving the proceeds stably.

The limitation when facing market fluctuates: However, when the current model encounters the external shocks, for example, the oil price increase or geopolitical events, this model will have lag and inefficiency. Because the model relies on the historical data, it cannot react quickly and respond to market share, therefor when the model settings for pricing are difficult to realize, the demand changes and decreases the revenue.

Competitive responsiveness: Nowadays, the Hong Kong international airport is the oligopoly market, because the slot capacity at Hong Kong Airport has become saturated [8] and Cathay Pacific has a high market share at Hong Kong airport [1], making it difficult for the model to calculate the balance between the price and time, so the Cathay Pacific market share may be lost when competing with the low-cost airlines or full-service airlines.

4. Problems with the dynamic pricing strategy of Cathay Pacific Airways

Although Cathay Pacific has built revenue management, its dynamic pricing strategy still lacks refinement and real-time responsiveness, making it difficult to achieve revenue maximization.

4.1. The lag and deviation in demand forecasting

Nowadays, the current model relies on the historical time-series data, and the response mechanism is inflexible and slow. For example, when the current model encounters oil price increases or public health events, these external shocks, the model cannot react quickly to this variable data, leading to significant deviation between the actual market and the predicted value [8]. This lag leads to airlines not being able to increase the flight price when demand recovers, or not being able to efficiently sell the flight ticket when demand decreases, therefore resulting in significant opportunity cost and seats going unused.

4.2. The measurement of price elasticity is not precise enough.

The current strategy cannot precisely differentiate the variations in price elasticity across different market segments. For business travelers who are not price-sensitive and leisure travelers who are highly sensitive to the flight price, the pricing logic lacks sufficient differentiation [9]. It usually

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uses the same static elastic coefficient for different clients. Furthermore, the model lacks a real-time price game-theoretic mechanism with competitors, therefore, it cannot use competitors' real-time price adjustments in the oligopoly market to quickly react and rapidly optimize its reaction function, leading to being in a passive position in price competition. If Cathay Pacific continues to use the same static elastic coefficient in different cabins, it will not only fail to gain excess return for business travelers, but also lead to miscalculation for leisure travelers' price elasticity; therefore, it will decrease the revenue and profit.

4.3. Poor price coordination across multiple channels

Cathay Pacific faces barriers to price synergy between direct sales channels and distribution channels. According to IATA Airline Distribution strategies and e-commerce, the traditional distribution channels usually have high reservation costs that erode airline revenue [10]. To reduce the high-cost reliance, airlines are trying to guide sales through differentiated pricing, which leads to price asymmetry between direct sales and distribution sales. This channel conflict not only disrupts the overall pricing system and damages the brand's premium image, but also results in high distribution costs for ticket agencies, eroding final profits.

4.4. Insufficient segmentation of pricing for transit and non-transit passengers

Cathay Pacific, which is headquartered in Hong Kong, has failed to fully leverage its network advantages to create differentiated pricing for transfer travelers. Nowadays, Cathay's system has limited ability to distinguish between passengers whose final destination is Hong Kong and transfer travelers and lacks an attractive interline product portfolio pricing. Compared with other major transfer airports, the long-haul flights transfer products lack price competitiveness, leading to numerous potential transfer travelers losing, and the airport's hub value cannot be fully converted into a revenue advantage.

5. Problem in Cathay Pacific's current dynamic pricing system

5.1. Demand forecast lag and imprecise elasticity measurement

Cathay Pacific's weekly-aggregated forecasting creates a 72-hour update lag, causing fare adjustments to trail real-time shift [11]. This is compounded by blended price elasticity coefficients that average divergent segment sensitivities, generating 4-6% annual revenue leakage through systematic mispricing [11].

5.2. Premium cabin rigidity and transit segmentation gaps

Premium fares remain anchored to fixed booking-lead-time buckets rather than marginal willingness-to-pay, leaving load factors below 60% during soft demand periods [12]. Concurrently, transit passengers are treated as a homogeneous cohort despite distinct sub-segment behaviors, resulting in uniform surcharges that suppress task optimization [12].

6. Cathay Pacific's dynamic pricing optimization strategy based on quantitative finance

To address the lack of quantitative data support in Cathay Pacific's existing pricing strategy, this chapter will use financial mathematics and statistical methods to reconstruct the dynamic pricing

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models. Rather than relying solely on experience-based judgment, the approach analyses the time series to forecast the elasticity of demand, then uses mathematical modeling to ensure the functional relationship between cost and ticket price, and integrates the retail pricing logic to optimize the high-end product mix, thereby developing a data-driven dynamic pricing optimization plan.

6.1. Construct the price elasticity coefficient of demand

To address Cathay Pacific's current lag in elasticity calculation, it is recommended to introduce a dynamic demand pricing elasticity coefficient (E_d). Firstly, a functional relationship is established: between ticket price "p" and demand "Q", where b represents the elasticity coefficient. Unlike traditional fixed values, this strategy employs time-series analysis combining the historical reservation data and seasonal factor to produce rolling forecasts of demand for future periods. By real-time calculation of marginal revenue for different cabin classes [13], dynamically adjusting the value, prices can be raised appropriately during peak demand to maximize consumer surplus, and lowered during off-peak periods to fill occupancy rates.

6.2. Real-time price adjustment strategies based on cost fluctuations

Secondly, to address the rigidity of cost transmission, a cost-fare linkage pricing models is established. Fuel prices (C_{oil})and exchange rate fluctuations are included as variables in the price formula. Setting a cost fluctuation threshold " δ ", when the change in unit operating cost exceeds " δ " the automatic price adjustment mechanism is triggered.

The new formula is: $P_{new}=(C_{fixed}+C_{oil\_adjusted})\times(1+r)$, where r is the target yield. This strategy can ensure that during volatile fuel price fluctuations, ticket prices respond quickly and transmit the cost pressure to the market, avoiding profit erosion caused by rising costs, while using algorithms to lock in the minimum profit margins.

6.3. Exclusive pricing for high-end cabin classes

Drawing on quantitative models from retail, high-end cabins implement a benefit breakdown and an independent pricing strategy. Rather than relying solely on a fixed price for business class, the price of lounge access, flexible refunds and extra baggage are estimated and priced separately. By using a willingness-to-pay model, the high sensitivity of high-net-worth business travelers to flexibility is identified. For example, for business travelers who are not price-sensitive but time-sensitive, high-priced packages, including "free ticket changes + fast track" offered; for price-sensitive leisure travelers, base fares are offered, but value-added services require separate payment. Through this refined segmentation, maximize the consumer surplus of high-end class consumers and increase the proportion of non-ticket revenue. To operationalize these strategies, Cathay Pacific needs to provide guarantees in three areas. Firstly, improve the digital system, introduce an advanced revenue management and cost control platform, and ensure real-time data interaction and automated model computation. Secondly, optimize the organizational structure, build across-department collaboration teams, break down the data barriers and introduce quantitative analysis. Finally, build a mechanism by compliance and risk control to ensure the pricing strategy with local regulatory requirements. It also establishes contingency plans to address unexpected market fluctuations, thereby ensuring stable returns.

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7. Conclusion

This paper has systematically investigated the revenue management challenges facing Cathay Pacific Airways within the volatile post-pandemic aviation landscape. Through in-depth analysis of the current setting pricing model from airlines, using research to find out some serious problems: rigid cost transmission mechanisms, data silos and imprecise demand forecasting have significantly hindered the maximization of revenue per available seat kilometer (RASK). To address this systemic inefficiency less problem, this paper provides a robust optimization framework integrating quantitative finance methodologies. Specifically, based on the real-time elastic pricing model and strategic division of high-end cabin services, the purpose is to increase the level of revenue management and quick response when the market fluctuates.

From a managerial perspective, the research results show that converting from traditional static systems to nimble and data-centre decision-making process is not merely a normal operation upgrade but a strategic necessity. The proposed strategies provide the blueprints for Cathay Pacific to better navigate the complex competitive environment of the Hong Kong hub, ensuring that pricing decisions are both scientifically grounded and commercially aggressive. Furthermore, this research uses the principles of finance engineering to demonstrate effectiveness in aviation service management; also enrich the wide discussion on academics and increase the purpose of Cathay Pacific's profit increase and more effectively in airlines' dynamic pricing.

Looking forward, while this research focuses on the immediate post-recovery phase, the future exploration needs to combine predictive artificial intelligence with further refined demand sensing. Ultimately, the successful adoption of these new revenue management strategies will be a deciding factor in securing Cathay Pacific's long-term profitability and resilience against future global disruptions.

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