PRICING THE FLEXIBILITY OF AIR TICKETS: GENERATION OF ALTERNATE MODELS AND COMPARISON OF REVENUE AND RISK

A THESIS

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Abstract

Air-ticket demand for a flight is uncertain whereas air ticket prices are fluctuating. Due to uncertain travel plans, passengers either have to cancel their confirmed bookings or have to postpone their ticket bookings. Passengers' travel uncertainty costs them cancellation penalty when bookings are cancelled or higher fare if bookings are postponed. The travel uncertainty from passengers' side causes revenue uncertainty to airlines. Financial options can work as a price discrimination tool when airlines cannot discriminate between passengers based on their travel uncertainty (Fang & Whinston, 2007). Since options' holders have right but no obligation to exercise, passengers can use this mechanism to hedge against uncertainty in future travel plans. Thus airlines have incentive to offer options-like instruments to passengers with travel uncertainty and can implement it easily via internet (Walker et Al., 1998).

Flexible air tickets are introduced by airlines across the globe. These tickets are comparable to call options as they enable the owner to have a right without obligation to book a seat in future at a fare mentioned while purchasing it. India's private airline company Jet Airways is offering "FareLock" which is a flexible air ticket at a price INR 350 for a domestic flight and INR 700 for an international flight operated by Jet Airways. By treating flexible air tickets as financial options, the first research question provides an approach to check the prices of flexible air tickets. Jet Airways' FareLock is considered for the price checking. The price data for two domestic routes and two international routes of Jet Airways is collected for a period of two months and air ticket price volatility is calculated like stock price volatility as explained by Jain & Cox (2011). One of the standard option pricing method, the Black-Scholes (BS) model for call options is applied to check the pricing of FareLock (for both domestic and international). The actual volatility obtained from two-months price data is compared with the implied volatility obtained from the BS model and appropriateness of pricing is decided. The

results indicate that for passengers, FareLock is in-the-money for international routes and also when purchased within three weeks of date of departure for domestic routes as well. The BS model provides one approach to price the flexible air tickets and airlines can use this approach to implement flexible air tickets policy. The BS pricing approach is also provides insights regarding validity of flexible air tickets.

Financial options can not only be used to book air tickets for a future travel date like in flexible air tickets but can also be used to cancel an air ticket. A financial options-like method is proposed to book as well as cancel an air ticket. Call option-like products can be used to book the air ticket so as to mitigate risk associated with price fluctuations and put option-like products can be used to cancel the air ticket and also reduce the cost of cancelation from passengers' point of view. In the second part of the study the two systems are compared viz Fixed Cancellation Penalty System (FCPS) (similar to practice adapted by various Indian civil aviation companies) and proposed Options-Like Instrument System (OLIS) for their expected revenues. Mathematical models for both the systems are proposed and in contrast to Akgunduz et al., (2007) model, OLIS proposes passengers are options holders and airlines are options issuers. The two systems FCPS and OLIS are compared for various demand scenarios in a simulation based study. The results suggest that the proposed OLIS is yielding 2%-10% more revenue than existing FCPS. The new demand effects like *buy-up, stimulation* and *dilution* are studied and it is found that *buy-up* and *stimulation* can slightly increase the expected revenues but *dilution* can cause more dent to expected revenues than the collective incremental effects of *buy-up* and *stimulation*.

The third research question compares revenue risks associated with the proposed OLIS and existing FCPS by using various risk measures such as Value-at-Risk (VaR), Conditional Value-at-Risk (CVaR) and Unit Normal Linear Loss. Inventory theory and revenue management are closely related and both the theories have to deal with the risk related to

perishable inventory (Zhuang & Li, 2011). Hence inventory theory risk measure of Unit Normal Linear Loss is also considered along with VaR and CVaR. The result of risk measurement comparison of OLIS and FCPS suggests that airlines not only gain revenue by implementing OLIS as compared to FCPS but can also reduce their revenue risk. A target revenue is attained with more probability with OLIS as compared to FCPS.

OLIS is an extension to flexible air tickets from the point of view of both bookings and cancellations and this research suggests methods to model, price and measure risks regarding with options-like air tickets. The OLIS provides a comprehensive solution to airlines as it increases revenue, manages revenue risk and improves airlines' seat allocation efficiency. The premium obtained by issuing options can act as a source of riskless revenue for the airlines and option mechanism is appealing to both airlines and passengers as it is voluntary for both of them (Gallego et al., 2008). The passengers can mitigate the uncertainty associated with their travel; and reduce the cost of cancellation and late booking by choosing right type of options. With the type of option chosen by the passenger, airlines can get important information about the travel possibility of the passenger and by offering options, airlines can segment passengers based on their willingness-to-pay for mitigating travel uncertainty. Thus options-like air tickets provide mechanism that allows win-win situation for both passengers and airlines.

Keywords: *Airline Revenue Management, Risk Management, Call Option, Put Option, Flexible Air-tickets, Price Volatility, Risk-Measure, Value-at-Risk, Conditional Value-at-Risk, Unit Normal Linear Loss.*

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