

Managing revenue in a hypercompetitive air passenger service market

Background

Airlines compete for passengers along several dimensions including fare, schedule, network coverage, service quality, and loyalty benefits – among others. However, over the past few decades we have seen a convergence in offerings that make alternative carriers less and less distinguishable from a consumer perspective. To compete in markets with otherwise undifferentiated products, airlines have developed revenue management (RM) capabilities intended to get the right passenger, in the right seat, at the right time.

Problem Statement

For this project, you will create a simple model of two rival carriers, each managing revenue for a single flight departure in a non-stop market. The goal of this exercise is to understand how RM affects competitive dynamics in a market where total demand exceeds capacity and passengers with the greatest willingness to pay are the last ones to book.

For simplicity, assume the carriers offer identical products and passengers select the cheapest available option (not exceeding their willingness to pay) at the time of booking. Each carrier's goal is to maximize revenue by adjusting fares in response to bookings on-hand versus expected bookings on-hand and their estimate of demand remaining. The carriers form their forecasts independently and can only observe their own bookings. Estimates of remaining demand are dynamic and represent a combination of initial expectations with a correction for cumulative bookings and an adjustment for recent trends.

Analysts continuously update their estimate of remaining demand throughout the booking window. The process begins with an initial forecast based on historical patterns for similar flights in the past. This forecast establishes a baseline expectation for how many bookings should accumulate at various points in time before departure. As the booking period progresses, analysts regularly compare actual bookings against these expectations to evaluate whether the flight is performing according to plan.

When an analyst observes a deviation between actual and expected bookings, this triggers a forecast reassessment. If bookings are lagging expectations, the carrier typically reduces its forecast of remaining demand, assuming that fewer passengers will book than originally anticipated. Conversely, if bookings are running ahead of forecast, the carrier raises its expectation of remaining demand.

The updated forecast drives pricing decisions. A reduced demand forecast generally leads to price reductions to stimulate additional bookings, while an increased forecast often prompts price increases to maximize revenue from apparently stronger demand.

When one carrier lowers prices, it may capture bookings that would otherwise have gone to its rival. The competitor then observes fewer bookings, potentially misinterpreting this as weaker market demand rather than a competitive effect. This misinterpretation can trigger unwarranted forecast reductions and price decreases.

Since each carrier can only see its own bookings and not the competitor's, they face an inherent challenge in distinguishing between genuine demand shifts and competitive effects when interpreting booking signals. Initial differences in forecast demand or adjustment sensitivities can cascade into dramatically different market outcomes, even when the underlying demand conditions are identical.

What competitive dynamics should we expect to unfold in such an environment? How will fares evolve over time if one carrier is booking ahead of expectation and the other behind? What if both are below expectation? Both above? Additionally, how does performance vary with different initial expectations? How does this compare with the effect of different sensitivities to recent bookings in adjusting expectations of remaining demand?

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