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BARRY SMITH, CHIEF SCIENTIST, SABRE HOLDINGS

The Continuing Evolution of Revenue Management



Despite the latest advancements, the practice of revenue management is far from mature. Recent breakthroughs show that using customer choice models will further improve the field of revenue management.

During the past 30 years, we've seen revenue management evolve with changing airline business opportunities from overbooking to discount allocations to origin and destination control and beyond. I've heard from some airlines a belief that O&D is the ultimate approach to revenue management and that there are no significant benefits beyond current state-of-the-art systems. I believe we are about to enter a new era of revenue management that takes advantage of new customer data and modeling. While current revenue management systems provide significant benefits, future revenue management systems and the business processes they support can become significantly simpler and more productive by shifting our focus more toward the customer.

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A Customer Focus

The development of revenue management has provided incremental benefits to airlines by controlling seat inventory at finer levels of detail. Because revenue management systems are focused on inventory, the increase in control granularity has caused revenue management systems to become more complex and more challenging to monitor and control. Let me explain how a customer view can help.

Airline revenue management is based on the analysis and forecasts of reservations

and seats sold. This indicates what customers purchased, but not what they actually wanted. Estimating spilled demand, recapture and up-sell are examples of inferring what customers wanted. But these tend to be used to modify our booking-based view of the market and don't provide much insight into the underlying demand in a market. Ideally, we'd like to know customer preferences for price, product quality, screen placement and promotion. These preferences are the foundation for customer

choice models that tell us the relative demand for any product (itinerary/fare combination) in a market.

Customer choice models simplify the forecasting process by linking together

the demand for the products in a market. Today, we track bookings and forecast demand for individual itineraries and classes separately. Every forecast must be adjusted to reflect demand changes at the market level caused by schedule, price or availability. This is not only complex but can easily introduce inconsistencies in forecasts and controls. By forecasting at the market level and mapping to the individual product, we ensure consistency. These forecasts automatically incorporate the impacts of schedule, price and availability. So the effect of closing or opening a fare class on one flight can be reflected in the demand and inventory controls for other related flights. Forecasting accuracy also improves because

forecasts at the market level are more accurate than those made at the individual itinerary fare level and customer preferences are relatively stable.

Garrett van Ryzin, a professor of private enterprise at Columbia University in New York City, New York, and Kalyan Talluri, a professor of economics and business at the Universitat Pompeu Fabra in Barcelona, Spain, have developed an approach to incorporating customer preferences directly into revenue management forecasting and optimization models and have shown significant theoretical benefits. I believe that these models will be in production use in the next several years.

Why haven't we done this before? Collecting data to observe customer shopping behavior has been very difficult in the past. In particular, we need to know what people asked for, what options they saw and what they did. Access to this data has been difficult due to the volume of transactions and the impact of the required data collectors on the performance of reservations systems. This type of data is more accessible from online sources including online travel agencies, airline Web sites and next-generation shopping platforms such as Sabre Airline Solutions' *SabreSonic™* Shop. In addition to the detailed shopping data, we can also observe overall shopping performance. The labs group supporting Sabre Airline Solutions is developing reports to answer questions such as, "How often do I show up on low-fare search engines?" or "How often do I have the best service or lowest fare in the market?"



Simplifying Systems

Incorporating customer data can simplify systems as well as the models used to forecast. The overall design and flow of revenue management systems have not changed significantly in the past 20 years. We collect data from the reservations system in the off-peak times and then race to complete database updates, forecasting, optimization and reporting processes before the revenue management staff arrives the next morning. This tends to drive hardware requirements for this off-line processing and limits the collection and modeling to specified reading days.

Tracking customer shopping involves a lot of data. Fortunately, forecasting and optimization models don't need all the details, only the customer preferences. Customer preferences are relatively stable and don't need to be recalibrated every day. So, customer shopping calibration does not need to run the daily processing loop. This, combined with the elimination of the bottom-up detailed forecasting, allows us to consider several areas of simplification:

- We can reduce data storage. Revenue management systems store data associated with inventory controls and bookings. In an inventory-based view, we need to summarize booking activity by flight and reading date. As forecasts are made at finer levels of detail, booking and cancellation events become less frequent and the storage requirements increase. Storing the summarized data now requires significantly more space than storing the details (actual reservations). While we may need the summarized data for reporting and monitoring, it is not necessary for customer-based forecasting and optimization models.
- We can target revenue management processing to where it is most valuable. Since we only need booking information, we can reduce the cost and improve performance by feeding data to the revenue management system as events occur (booking, cancellation, price change, availability change) through a publish/subscribe framework. Forecasts and optimization models can be triggered by events or rules associated with

accumulated change in bookings or availability. In this way the processing and updates are directed to flights and situations that provide an opportunity for revenue improvement rather than an arbitrary calendar. We know that more frequent forecasting and re-optimization significantly improves revenue management performance. In this framework, real-time monitoring and optimization become practical.

Other Benefits

Having a customer view will not only improve revenue management performance, it has significant benefits in related marketing functions of pricing, scheduling and distribution.

Revenue management and inventory control were developed to micromanage a relatively static pricing structure to match demand to supply. Customer choice models can help markets that are inefficiently or inconsistently priced. Talluri has done some groundbreaking work to demonstrate how to use customer preferences to design the right mix of products in your markets. While Talluri's work helps capture the opportunities with a static pricing structure, unfortunately there is no single right answer to airline pricing. The best price for any request depends on who is asking, what they are asking for and what the other options available are. Airline pricing is riddled with inconsistencies such as non-stops priced lower than competitor connections and connecting service priced higher than your own non-stops. These inconsistencies cannot be avoided with a static fare structure. The solution is dynamic pricing. Given a shopping request, we estimate the likelihood of selling any product shown to an agent or customer and adjust dynamically priceable fares to increase expected profitability. If this approach is implemented in conjunction with the revenue management system to avoid displacement, then any adjustment can provide incremental profitability. Dynamic pricing does not yet exist, but we are working hard to make this a reality.

Customer choice information can also improve the performance of reservations

office and Web site sales by selling toward profit. For example, suppose we have a request that can be satisfied by one of two flights. While both flights are wide open and all fares are available, one has a higher likelihood of eventually selling out; it now has a higher bid price. The net profit associated with any sale is the fare minus the bid price. If an early-booking customer is indifferent, then we can increase profit by displaying the flights in a way that encourages booking the flight with the lower bid price.

The objective of revenue management is typically to adjust price to match demand to supply of seats. Revenue management forecasts can also be used to help match supply to demand in two ways. First, revenue management forecasts and optimization are integrated with the schedule planning process in the origin and destination version of the *Sabre® AirFlite™* Fleet Manager. This ensures that capacity is assigned where it is most profitable. Second, revenue management forecasts and optimization can help by making changes in aircraft assignments late in the booking process. Because demand forecasts get more accurate closer to departure, this approach, typically known as demand-driven dispatch, has been shown by Boeing at the Massachusetts Institute of Technology to increase airline profitability by up to 5 percent. There is academic research underway to build schedules that include many swap opportunities.

The Future of Revenue Management

Revenue management has provided increasing benefits through various stages of development during the past 30 years. Today's systems and business processes are the most effective ever. But, rather than thinking we are nearing the end of the revenue management evolution, I believe that we have reached the mid-point of its development. The next steps will take us in the direction of business and technical sophistication rather than complexity. With revenue management processes based on the customer preferences, future revenue management organizations and systems can be much simpler and more effective. **E**

+count it up

30,000+ Number of crewmembers who have their schedules generated through the *Sabre® AirCrews®* Schedule Optimizer.

45,000+ Number of crewmembers worldwide whose pairings are generated using the *Sabre® AirCrews®* Pairing Optimizer.