New book: Pricing Segmentation and Analytics
### by Tudor Bodea and Mark Ferguson, Business Expert Press

Pricing analytics uses historical sales data with mathematical optimization to set and update prices offered through various channels in order to maximize profit. A familiar example is the passenger airline industry, where a carrier may sell seats on the same flight at many different prices. Pricing analytics practices have transformed the transportation and hospitality industries, and are increasingly important in industries as diverse as retail, telecommunications, banking, health care and manufacturing. The aim of this book is to guide students and professionals on how to identify and exploit pricing opportunities in different business contexts. The first chapter looks at pricing from an economist's viewpoint, beginning with the basic concept of price elasticity and how it differs at the product, firm, and industry levels as well as the short term versus long term. Next, the common assumptions regarding the customer population's willingness-to-pay is discussed along with the price response curves that result from this assumption. Basic price optimization techniques are then explored with extensions provided for alternative objective functions and constrained supply. The second chapter looks at these same topics, but from a more practical standpoint, with examples provided from several consulting projects. The third chapter is on dynamic pricing, with a special emphasis on the most common application: markdown pricing. Similar to the first two chapters, both the theory and the application aspects will be covered. The fourth chapter covers the new field of customized pricing analytics, where a firm responds to a request-for-bids or request-for-proposals with a customized price response. In this situation, the firm will only have historical win/loss data and traditional methods involving price elasticity do not apply. The pricing analytics methodology along with several case studies are provided. The final chapter covers the relevant aspects of behavioral science to pricing. Examples include the asymmetry of joy/pain that customers feel in response to price decreases/increases. A set of best pricing practices are presented that are based on these behavioral responses. Finally, the appendix contains the details needed to build and implement a pricing analytics system in practice.

Evaluation copies are available from this address:
http://www.businessexpertpress.com/books/pricing-segmentation-and-analytics

Upcoming Workshop

The University Transportation Center (UTC) at the Georgia Institute of Technology will be sponsoring a workshop focused on integrating discrete choice and other models ground in behavioral theory with revenue management. The goal of the workshop, to be held in May in Atlanta, Georgia, is to bring together experts from discrete choice modeling and revenue management, present current research efforts in this area, and determine future research opportunities. The workshop will review current research, identify future research opportunities, explore collaborations with industry experts and software vendors to obtain data needed to successfully implement choice-based revenue management models, and gain perspectives from Associate Editors of top discrete choice modeling and operations research journals on ways to best position papers for journals from this inter-disciplinary topic.
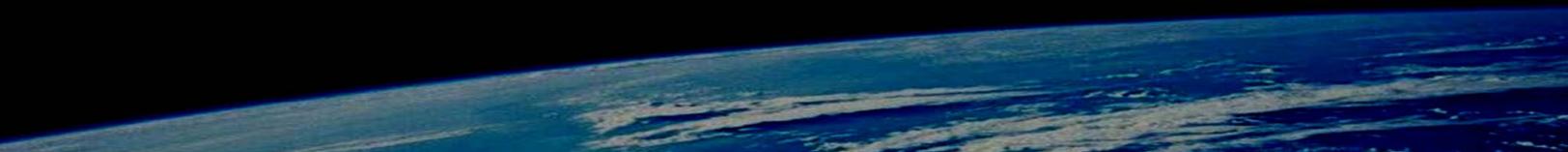
To encourage research in the choice-based revenue management area, UTC will be providing up to five full scholarships to doctoral students interested in attending the workshop. To apply for a scholarship, students should provide the following information:

1. A CV (no more than two pages). The CV should clearly indicate your program of study, prior educational background, and expected graduation date.
2. A short personal essay (no more than one page). The essay should address your interest in choice-based revenue management, prior research experiences relevant to revenue management and/or discrete choice modeling, and your proposed dissertation topic.
3. Nomination letter from your dissertation advisor (this should be submitted electronically directly by the dissertation advisor to maintain confidentiality of the nomination letters).

Nomination packages should be emailed to Laurie Garrow at Laurie.Garrow@ce.gatech.edu by 5 PM eastern time on Friday, March 2, 2012. Preference will be given to those doctoral students who have completed the first two years of their coursework and are in the process of starting their doctoral research.

Please stay tuned for the exact dates of the conference which will be finalized soon.

News from the *Journal of Revenue and Pricing Management*

Special Issue on Strategic B2B Pricing

Don't miss the latest issue of the *Journal of Revenue and Pricing Management (RPM),* which features research summarizing how firms treat the pricing function in industrial companies as a strategic activity – both as an integral part of firm strategy, and as a valuable, difficult to imitate way to build competitive advantage and to achieve superior profitability as a result of pricing activities.

These featured articles from the issue are now available free-to-view for a limited time:

The conceptualization of value-based pricing in industrial firms
By Stephan M Liozu, Andreas Hinterhuber, Richard Boland and Sheri Perelli

*Optimal pricing models in B2B organizations*
By Rafael Farres

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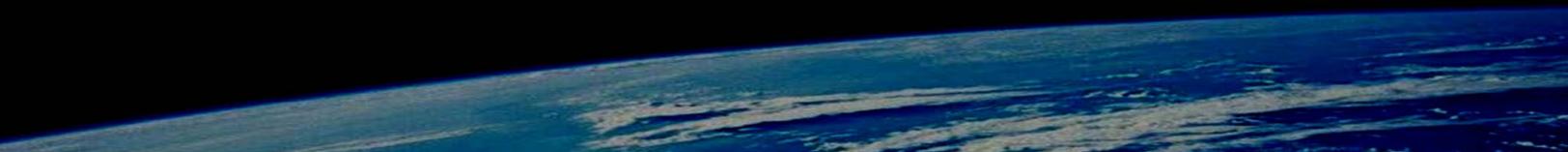
Keynote at the 2011 INFORMS annual meeting by Scott Nason

Jointly sponsored by the Aviation Applications Section and the Revenue Management and Pricing Section

The Airlines' Evolving Revenue Models

The airline industry has seen many changes during the past year. The merger of United and Continental Airlines, forming the world's largest airline, followed by the acquisition of AirTran Airways by Southwest Airlines, are major developments that will have significant impacts on airline business models. On another front, airlines and global distribution systems (GDSs) are suing each other and the Department of Justice is investigating the air travel distribution business. These may affect the structure of the GDS model that has long been in use. This dynamic business environment may require changes in the revenue models employed by the airlines. Scott Nason, former vice-president of revenue management at American Airlines, discussed these and other topics as part of his keynote presentation at the 2011 INFORMS meeting in Charlotte. In particular, Scott offered his perspectives on airline consolidation trends, distribution wars, and how revenue management models will need to evolve.

Why Airlines Merge – Or Why Not

I can recall being at a conference more than 20 years ago at the FAA with a group of industry experts. The consensus of that group was that within a few years, the airline industry would consolidate down to three big airlines. I wasn't part of that consensus, as I didn't see consolidation happening that extremely or that quickly. That's not to say there haven't been a lot of mergers: there have been, particularly lately with United and Continental; Delta and Northwest; US Airways and America West; American and TWA. These mergers have helped create the very large airlines we have today.

We have also seen a lot of airlines come and go. Some of the largest legacy airlines to disappear are now a few decades old and include Eastern and Pan Am. There have also been multiple airlines that have tried to provide a much better product at a competitive price. This includes "F or J" airlines that offer flights will all business class service to Europe. There have been three incarnations of this idea, the largest being EOS. All three of these airlines have disappeared and have followed the tradition of other airlines such as Air One, MGM Grand Air, and First Air that decided to provide a business class product at a competitive price. Maybe one day the idea will succeed, but not now.

On the other end, several low cost airlines including Virgin America and JetBlue have emerged and have succeeded by providing a higher-quality coach product. Spirit and Allegiant Airlines are examples of airlines that have provided low fares to consumers by introducing a very low cost / bare bones product.
So why do airlines merge, and why haven't we seen more mergers? There are three reasons why airlines merge: network benefits, cost synergies, and to gain competitive power. In some cases, mergers have been able to achieve one or more of these benefits, although the jury is still out on whether recent mergers are successful. Successful mergers include America West and US Airways, Delta and Northwest, and United and Continental. All of these mergers resulted in larger networks (which created competitive power) and cost reductions. There are lots of examples of failures though, including American Airlines and TWA. American closed the deal with TWA in spring of 2001, just a few months prior to 9/11. American immediately wished they hadn't purchased TWA, and quickly eliminated remnants of the old airline. Earlier on, US Airways purchased several smaller airlines including Piedmont Airlines and Pacific Southwest Airlines, but never achieved network benefits from these acquisitions. Delta purchased Western Airlines, a smaller west coast airline. From an
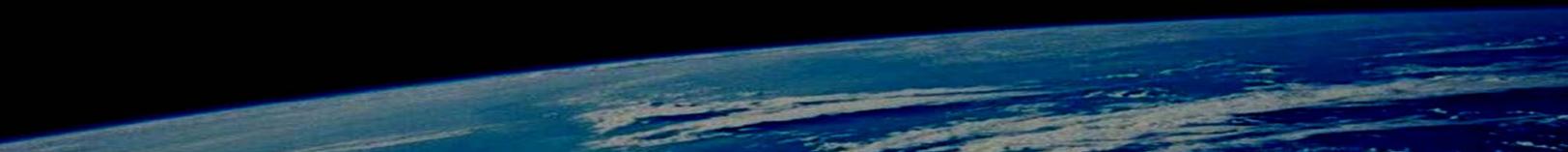
operational perspective, this merger was a success, but they were unable to achieve cost synergies due to the amount of money they had to spend to keep their pilots happy.

There are several reasons why airlines don't merge. One of the most difficult aspects involves labor. Seniority is very important to airline employees and determines not only their pay but the shifts they work. Pilots in particular get very adamant about seniority rights. There aren't enough good captain jobs to go around and some employees feel very disadvantaged by the merger. Pilots have a view of what their job trajectories are going to be through internal growth, and mergers upset that trajectory. Often airlines need to give pilots a lot of money in mergers to keep them happy.

Another reason why airlines don't merge is due to difficulties associated with systems and process integration. Most major airlines have a rather unique set of systems, and need to spend hundreds of millions of dollars trying to make these systems talk to each-other, or replacing one system with another. Process integration is also difficult. Each airline has a lot of unique rules and procedures regarding how to handle passenger disruptions, process refunds, etc.

The economies of scale are also not huge in mergers, and some aspects actually get more complex as airlines grow. Pilot training is one example. For an airline that owns a single aircraft type, pilots go to training once in their career (to move from co-captain to captain position). For an airline that owns two aircraft types, pilots now go to training four times over their career as they switch positions and aircraft types. These diseconomies of scale tend to occur with any employees who have equipment-specific qualifications.

Despite the disadvantages, there are benefits of merging, particularly as they related to corporate travel. Consider two airlines: one that covers 80% of the travel needs of a corporation and another than handles 50% of the travel needs of the corporation. This 50% includes the 20% that the first airline does not serve in addition to 30% overlap. The first airline that can serve 80% of the corporation's travel needs offers a 20% discount in exchange for receiving 80% of the travel. The second airline offers 30% discount in exchange for receiving 50% of the travel. The airline that meets the greatest needs of the corporation tends to win the contract negotiation. Through building larger networks, airlines are able to get corporate deals that they wouldn't get otherwise.

Similar advantages are also present when airlines are negotiating fees with GDSs and travel agencies. Being big is important in these negotiations. Another benefit of merging is that there are some economies of scale – merged airlines don't need two CIOs or presidents, and are able to achieve some cost savings by eliminating headquarter staff.

So where are we now? Well, we haven't gotten down to three airlines. We've seen a lot of mergers lately, but I don't think we're done yet and that airlines will find opportunities to merge for one or more of the reasons I stated earlier.

Distribution Wars

Customers can purchase airline tickets through a variety of distribution channels. They can buy direct by going to the airline website or, for a fee, by calling the airline's call center. Customers can still use traditional travel agents to book travel, although now they charge you for their service. Travel can also be booked via online travel agencies. Up until a few years ago, online travel agencies used to charge a small booking fee, but these fees have been eliminated and customers can book through sites such as Travelocity now without a fee. There are also still lots and lots of corporate deals. Most medium-sized companies have corporate deals with one or more airlines in which the corporation commits to providing a certain market share to the airline in exchange for discounts, VIP memberships, and other benefits. These bookings are made through corporate travel systems. Off-tariff distributions also exist, often in ethnic and overseas markets. There is some channel-differentiated
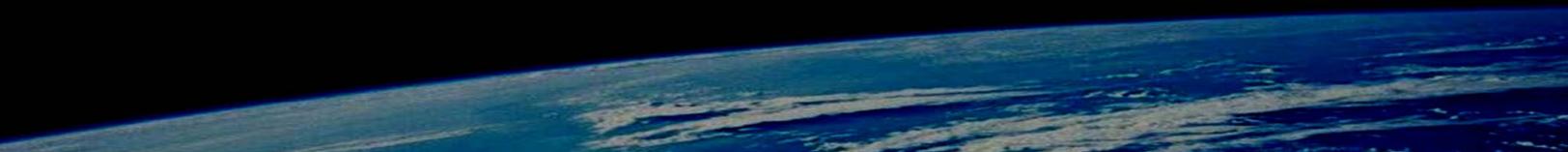
pricing, particularly for opaque products in which a customer commits to buying a fare without knowing detailed airline brand and itinerary characteristics.

In order for a channel to be priced competitively, it is critical for the channel to have every airline's schedule and fare data (including the lowest fares the airline offers). This ensures that travel agents have all of the information they need when making bookings. The way this has played out is that the major GDSs such as Sabre, Worldspan, and Amadeus have signed full content deals with airlines. If airlines commit to providing all of their schedule and fares (including lowest fares) for their entire network, the GDSs lower the booking fees they charge travel agents for making bookings through their systems. If the GDSs can get all airlines to sign full content agreements, they can then approach travel agencies and argue that they should use their system since they will be able to provide all of the information they need to serve their customers.

But what happens if an airline decides it doesn't want to commit to giving all if its services and fares, but wants to save some for its own direct channels? What if an airline decides the booking fees being charged are too high? Currently, we're at the point in which airlines and GDSs are arguing over these points and airlines, GDSs, travel agents, and online travel agencies are trying to decide who needs who more. If an airline pulls out of an agency, who loses? Is the bigger problem due to the fact the airline loses sales because it is no longer in that channel, or is the bigger problem due to the fact the agency loses sales because it no longer has that airline's products in its system? In the short term, the airline will probably lose more business as travel agents didn't realize that airline was an option. In the long term, airlines will likely be able to turn this around, and direct travel agencies to other channels that have their full schedules.

The increasing reliance on ancillary revenue streams is also contributing to the distribution wars. Ancillary revenues refer to fees that airline charge for selling services (baggage fees, ticket exchange fees, early standby fees, seat reservation fees). Ancillary fees greatly complicate the purchase process. It has been difficult for generic sites to compare these fees across airlines as there is a lot of fine print associated with ancillary revenues that vary from airline to airline. The standards for filing fares are well established in the airline industry, but the standards for filing ancillary fees are in their infancy. Airlines will also need to develop better databases to keep track of who paid ancillary fees, which flight it was tied to, etc. This information will become increasingly important from a RM perspective.

All of these factors have given rise to "distribution wars." The wars have gone through several phases. In the early part of last decade, some airlines that tried to pull out of systems – for example, Northwest pulled out of Expedia for a while. These disagreements were mostly put to bed when GDSs signed three-year full content deals. When these contracts first came up for renewal, a few airlines pushed back and fought hard, but in the end renewed their three-year deals.   All this fell apart about a year ago when American Airlines decided not renew their contract with Orbitz because Orbitz did not agree to go through American's direct booking link. American wanted to have customers make bookings directly on their site so that they could customize information on fees to each customer. Expedia then told American: if you're not in Orbitz, you're not in Expedia either. Sabre told American they would raise their booking fees and bias the display against them.   The outcome of the current distribution wars is awaiting court cases. In the meantime, the Department of Justice decided this was pretty interesting stuff, and is doing an investigation to determine if they are happy with the model in which GDSs pay travel agents a fee for making bookings on their system. That is, GDSs convince travel agents to use their system, collect fees from airlines when these bookings are made, and give some of these fees back to the travel agency as a payment for making the booking in their GDS system. Airlines view this as effectively paying travel agents to make a booking in a particular distribution channel. Airlines have the option of not selling to that channel, but if the channel is very large (such as Expedia), this will be a problem. The Department of Justice is looking at the relationships among travel agencies, GDSs and airlines to determine if we have a free marketplace on sale and distribution of airline tickets. Looking ahead, American
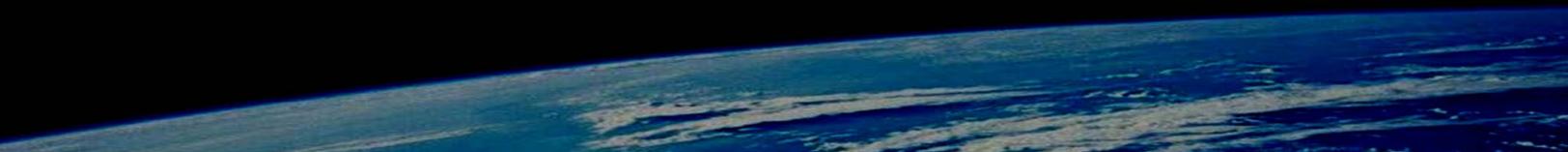
Airlines has set the stage for the ongoing lawsuits, but other airlines have hinted that they may follow American's lead.

Evolving Revenue Management Models

Revenue management models are designed to determine what price to offer to each customer. Prices have to be set independently of who the customer is. The same price, depending on who the customer is, can be too low and too high. It's too low if the customer would have paid more. It's also too low if the airline could have sold it later to a different customer who was willing to pay more. The other way price is too low is if the airline could have moved the passenger to a less valuable itinerary. Assume the price on two flights that depart at noon and 5 pm are both $300, but the 5 pm flight is more valuable. The $300 fare is too low if, by raising the fare, the customer would have purchased the noon flight that wasn't worth as much to the airline. On the other hand, the fare is too high if the customer doesn't buy and, in retrospect, the airlines end up sorry they didn't buy a ticket on one of their flights. That is, the fare is only too high if they didn't buy from the airline and that seat ended up not being sold.

As in many industries, airlines can't price individually for each customer – yet. The optimal price for a particular flight or itinerary is not the same for every customer, but the customer has to post the same price for each customers. In order to offer different prices to different customer segments, airlines have created different products by using fare rules and have offered channel-specific prices. Fare rules refer to restrictions that must be met by the consumer in order to purchase a lower fare. Lower fares are offered to customers who buy a round-trip ticket, purchase 14 days in advance of departure, and stay over a Saturday night. These restrictions are designed to try to make prices higher for business customers who are willing to pay more than leisure travelers who will not purchase if the fare is too high. Airlines are also willing to sell their inventory for deeply discounted (and unpublished fares) through opaque distribution channels, such as Priceline or Hotwire. Customers using these channels are more cost-conscious than other travelers. Coupons are also used to try to create different prices for different people.

Airlines first began to price discriminate more than 30 years ago. Fare restrictions such as minimum/maximum stay rules and advance purchase requirements were used as a way to try to get price-inelastic business customers to pay more than price-elastic leisure customers. Yield management became a science designed to try to optimize price controls using the fare restrictions and inventory controls to maximize revenues. Yield management started out in the early 1980's and has evolved into an elaborate science over the past 30 years. Yield management quantifies the trade-off between selling a lower-priced seat in advance or saving that seat for a potential customer who is willing to pay a higher price.

The first yield management models were leg-based. Initial efforts were focused on developing demand forecast models to understand how much customers were willing to pay for each booking class. Historical data was used as a basis for these forecasts, and were used to optimize inventory controls. Over time, the optimization algorithms also got better and began to incorporate key network linkages in the system. For example, a flight from Savannah to Charlotte may be used to get people from Savannah to London or Savannah to Mexico. If I sell the Savannah-Charlotte flight to a local passenger for $100, I won't be able to sell a more valuable $700 itinerary from Savannah to London through Charlotte. I need to save inventory not only for the highest classes, but also for the more valuable itineraries. However, network optimization algorithms currently do not determine the absolute best use of the seat on a flight. In the Savannah to London example, I didn't consider that there was an alternate path available from Savannah to London through Philadelphia. So I could have sold the Savannah-Charlotte leg to a local passenger, and accommodated the international passenger through Philadelphia instead. Incorporating these network-level interactions are in the early stages of development.

Early demand models estimated how many people want to book a fare class using historical data. These models basically took demand as saying: this is a person who buys full fare Y inventory or this is a person why
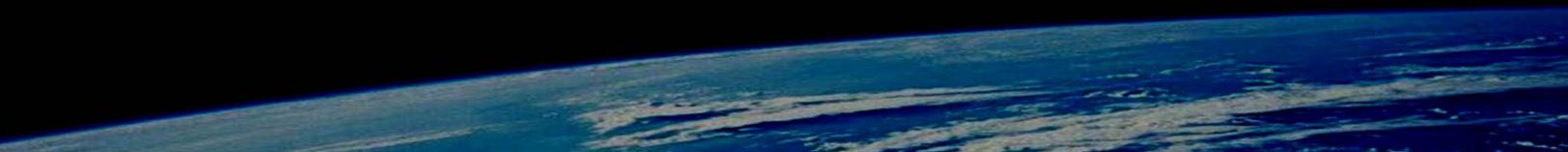
buys a restricted V class inventory. In reality, though, people buy the cheapest seat they can. A person willing to purchase Y will buy V if it is cheaper and available. Demand models began to evolve to bring more complex interactions among booking classes, and recognize that some customers who bought V would have purchased Y.

Airlines have spent a lot of time improving demand forecasts. Demand forecasts are the heart of a RM system… and the optimization models are heavily reliant on the accuracy of the demand model. Airlines improved their demand forecasts by incorporating passenger characteristics and detailed seasonality characteristics: When did the passenger book? What month? What day of the week? What time of day? The better an airline gets at understanding which types of customers are purchasing its flights, the better the airline gets as forecasting demand for its flights.

Demand forecasts are still based primarily on history, although how airlines slice and dice history has gotten more sophisticated. The focus is still on ensuring airlines stop selling cheap seats in order to save for high-yield late arriving customers (along with other subtleties mentioned earlier). Demand models have also gotten better at overbooking and understanding passenger no show and cancellation behavior. No show models account for both passenger behavior as well as operational no shows caused with passengers misconnects due to flight delays or flight cancellations.

To date, price elasticity hasn't been explored too much. Airlines haven't gotten good at recognizing price elasticity or modeling the passenger purchase decisions. How customers decide to purchase a certain ticket, and make tradeoffs among price, carriers, time of day, day of week, etc. is a complicated process. However, as the passenger choice process changes (due to availability of products, or increased visibility of fares in the market), existing demand models have a hard time catching up based on history.

Other behavioral aspects of the customer booking prices are also not captured in the demand models. Today, many customers go to metasearch engines and online travel agencies to do their initial searches, then book directly on airline websites. Airlines also have lots and lots of data about their customers and detailed flight histories for their frequent flyer customer databases. This information has not been used extensively in the RM process.

Demand for airline flights also relies, at least on part, on competition and who is flying itinerary. Current demand models don't really capture this information. To the extent that future competition is the same as historical competition, my models are fine – but what if another airline adds a nonstop flight, or cancels a flight. What my competitors are doing is relevant, but to date there has not been a lot of attention paid to what my competitors are doing. There are multiple aspects of this competition: what schedules are my competitors flying (and is it competitive to mine), what fares have been filed. However, there is a distinction between fares that are filed (which may potentially be sold) and what fares are actually available. Inventory controls decide which fares are available for particular itineraries. Airlines have historically monitored what flights competitors offer, and what fares they have filed, but only now are they monitoring whether competitors are offering particular fares (that is, a filed fare is irrelevant if no one can buy it). Airlines are developing systems based on online screen scrapes and other sources that automatically collecs information about selling fares on specific itineraries and dates. Airlines are beginning to ask what they can do with this competitive information.

Looking ahead, what are airlines trying to do to solve these problems and where are future RM models headed? Airlines will begin to develop behavioral demand models that are less reliant on history. I can't tell you how soon, but some in the audience will see choice models adopted as the basis of RM demand forecasts during their lifetimes. Airlines will continue to monitor competitive information and get a better sense of customers' price elasticities. How airlines use competitor price information remains to be seen. What is one airline
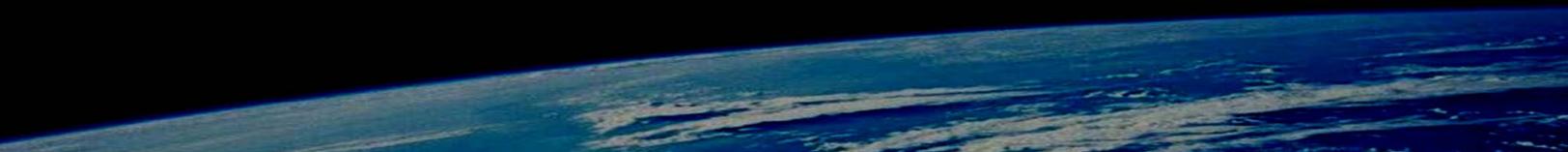
monitors competitive prices and offers a price that is $10 lower than the competitor? What if two airlines do that? Is it beneficial?

Airlines will begin to personalize prices and offers. To date, personalization has focused on showing customers different information when they visit a website or customizing emails to different customers, but there is a lot of potential for using data from frequent flyer databases to customize offers to various people. Airlines will continue to aggressively merchandise and sell not only air travel, but other components of a trip.
At least one airline is going to try to personalize price by taking into account who you are when they offer you a price. I think airlines will fall into a trap, though, as it is their best customers who are probably willing to pay the most. Charging your best customers higher prices is not sustainable, although bland economic theory will tell you that is the way to go. I think personalized pricing is headed for some big mistakes before airlines get it right.

We will also begin to see airlines differentiate price in terms of where you buy a ticket. Today, differences in prices across channels are caused by accident or system glitches. I think differentiation across channels will become more intentional in the future.

Scott Nason is currently a freelance consultant specializing in revenue management, IT systems, operations, and customer relationship management for the airline industry. He was formerly the vice president of Revenue Management at American Airlines, where he worked for almost 30 years at various positions, including chief information officer and vice president of Operations Planning and Performance. Nason holds MS and BA degrees from Massachusetts Institute of Technology and University of California, Berkeley, respectively.