REVENUE MANAGEMENT VS. SOCIAL NETWORKING

Counter-measures aimed at Internet-connected customers

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These words could serve as a cautionary note to any managers who ignore the importance of analytics in their industry. They are attributed to Donald Burr, the entrepreneur who helped found People Express Airlines in 1981 and, over the next four years, led it through exceptional growth to revenues nearing $1 billion – reportedly the fastest growth of a U.S. company in history to that time [Cross, 1997]. The company worked with a lean workforce and minimal overhead while providing “no-frills” service. This allowed it to offer airfares significantly lower than those of any major competitor. By 1985, People Express was the fifth largest U.S. passenger carrier and was directly challenging major U.S. airlines in many of their key markets.

What Burr needed to “invent an answer to” was an extraordinary action taken by American Airlines. In January 1985, American introduced deep discount fares across its flight network, including every route flown by People Express. American was a full-service airline with much higher fixed costs than those of People Express. How could it sustain these prices without threatening its own survival?

American’s secret was its new “yield management” system, which permitted it to maintain or increase its profitability while lowering fares for significant amounts of seat inventory on nearly every flight. This was not short-term “predatory pricing” at a loss – the airline could sustain these prices until competitors either responded by...
increasing their service levels (and prices) or went out of business. People Express did attempt to change its business model but ultimately failed, and the airline was forced out of business two years later.

This is a classic example of what has been called strategic analytics [Davenport, 2009]—detailed, data-driven analyses supporting outcomes of strategic importance for a company. In the case of American Airlines, the analysis involved careful calculation of the number of discount seats on each flight that could be sold early without excessive revenue loss from late-booking, high-fare customers. These calculations depended critically on the probabilities or “odds” of future levels of passenger demand for full and discount fares based on computer records from thousands of past flights. In effect, Dallas-based American played a winning game of “Texas Hold-em” against an ill-equipped competitor.

American subsequently reported revenue gains of $1.4 billion over three years directly attributable to its yield management system [Smith, Leimkuhler and Darrow, 1992]. Such publicized successes in the airline industry were soon followed by expansions into related businesses in the travel and hospitality industries and, later, into areas like broadcasting, event ticket sales and seasonal goods retailing. Yield management is now more commonly called revenue management (RM) or its newer counterpart, dynamic pricing.

The growth of the Internet and other information technologies has had obvious and important impacts on the spread of RM for producers. There are, however, interesting implications for RM in the spread of Internet applications for consumers. Managers of existing RM systems face genuine challenges from customer-based systems in the age of “social networking.” A variety of responses are possible, but the key is to recognize the need.

What is revenue management? The usual answer is something along these lines: “Charge the right price to the right customer at the right time”; however, this sounds more like a slogan than an answer. Many managers would rightfully ask: “What’s new about that?” Indeed, this matching of price, customer and time is the outcome of good —fashioned haggling — if all goes well, the customer receives something for less than they would have been willing to pay, and the seller receives more than their minimum acceptable price. An economist would say that the customer receives a “consumer surplus” and the seller a “producer surplus.” A skilled negotiator on the producer’s side can maximize his or her surplus by minimizing each customer’s surplus (while leaving customers somewhat satisfied). This, of course, means that prices are likely to be different for every consumer.

Revenue management aims to maximize a producer’s surplus in modern markets, where prices cannot be determined once you’ve sold a seat. Instead, different prices are charged to different segments of customers according to their estimated willingness to pay. Negotiation is replaced with “fencing” that aims to limit switching of customers from high-priced to discounted products. In most settings, economic surplus translates directly to revenues, and, in industries like the airlines, high fixed and low marginal costs, revenues mean profits.

Firms practicing RM are not the only winners — differential pricing can extend the possibility of purchase to a much wider population of consumers who were formerly priced-out of the market. In effect, there is a partial transfer of consumer surplus from well-healed consumers to those less fortunate — a form of free-market socialism!

Conditions appropriate for RM are typically based on the airline and hotel situations: “perishable” assets, finite capacity, low marginal costs and ability to use differential pricing. Recent expansions into areas such as retail sales have blurred the distinction between RM and other pricing practices, but regardless of the terms used, the basic objectives remain the same. For further details of RM theory, many excellent references are available, including [Phillips, 2005] or [Talluri and van Ryzin, 2004].

How are RM and dynamic pricing related? In its early days RM was an inventory control technique. Prices for different market segments were announced by marketing departments, and operational decisions were limited to deciding how many assets to allocate to each price class. As the strategic importance of RM grew, the need for coordination of prices and the quantities became apparent. In modern systems, price fluctuations can occur either because different predetermined price classes are opened or closed (inventory control) or because prices are being adjusted over time within market segments (dynamic pricing). The choice to use inventory control, dynamic pricing or both gives analysts significant flexibility. The result looks the same to the customer — prices that fluctuate over time — but the differences can be substantial in implementation.

Where is RM practiced today? RM developments have been reported in
all of the following areas: air, rail and cruise travel; lodging, hotels and casinos; car rentals; sporting and entertainment event ticket sales; retail sales, particularly seasonal or short-life-cycle goods; Internet search (click and ad pricing); broadcasting (advertising time); Internet service providers; cellular telephone services; cable television; manufacturing; energy markets; sea and air cargo and freight; financial services; and health services.

Given the scope of this expansion, it might be more sensible to ask where it has not been applied. Good overviews for most of these can be found in the general RM references listed earlier.

Social networking and Strategic Consumers – what today’s RM managers need to “figure out an answer to.”

Consumers can become aware of the patterns of price reductions practiced by producers, particularly if these are “systematized” by RM practices, and become strategic; for example, delaying their purchases to times of anticipated lower price. There is nothing really new here; some cost-conscious purchasers can always be counted on to wait to the end of a “model run” for a lower price. However, the capabilities of the Internet open up the possibility of entirely new levels of sophistication for consumers. We classify these opportunities under the general heading “social networking,” but potential developments certainly extend beyond the range of Facebook and Twitter. Here are some examples:

- **Buyers’ cooperatives** are an old phenomenon with new potential. In their traditional form, such co-ops aggregate purchase requests for individual consumers or small retailers and then use increased buyer power to seek quantity discounts or other favorable terms. It is now feasible for consumers who are informally linked on the Web to quickly form a buyers’ club and exercise similar power. Such co-ops could form and dissolve in a matter of days for the sole purpose of acquiring the latest “hot” product at a discount, or they could become a permanent – and expanding – reality. RM systems that use bulk purchasing as a fence for their market segments beware!

- **Online markets** such as E-Bay or Craigslist are widely used for exchange of both old and new assets. They are also used for exchange of tickets for entertainment or sporting events – perhaps an...
innocent transfer for someone who can’t use the tickets, but more often, high-tech “scalping.” It is well known that holders of season passes to popular venues can make more than pay for their passes in the secondary market. Essentially, social networking can create an informal futures market for virtually any good or service that can be transferred. (Airlines are protected from this because airline reservations are linked to purchasers and, with heightened security, particularly difficult to transfer.) These consumer behaviors can be likened to tunneling under the fences that suppliers have created to segment their markets; for example, a late-purchaser who gets a ticket for something close to an advance purchase price.

Managers of venues and ticket brokers are well aware of these practices and have been trying to devise strategies to combat them, but it is not yet clear what success they are having. (Efforts of suppliers to enter the unofficial markets themselves have led to howls of unethical conduct [see, for example, MusicFiX, 2009].) The key conclusion is that any proposed or existing RM system that involves transferable assets needs to be alert to the possibility of an unofficial futures market in their business. All that is needed for such developments are prices that vary over time in a manner that is “somewhat” predictable.

• Transparency of pricing is perhaps the most immediate impact of the internet and social networking. Firms accustomed to practicing differential pricing selectively and opaquely may now have their prices exposed either officially through their own Web sites or unofficially, through consumer networking. This can have the unintended effect of making some consumers aware of more appealing market segments for themselves.

• Online pricing advisors amplify price transparency. Companies such as Expedia, Travelocity and Priceline currently give consumers free passive information about prices across the travel and hospitality industries. We say “passive” because such sites mainly summarize current prices, or in the case of Priceline, offer the possibility of bidding for preferred prices. However, there are also companies such as Farecast (acquired by Microsoft in 2008) that boast: “Unlike other travel companies, Farecast predicts when a user should buy a ticket based upon 175 billion points of previous airfare data. Its engine can currently predict whether airfare goes up or down up to a week into the future with a claimed success rate of 70%-75%. While Farecast has a lot of competition, they claim it is the only company which can predict future prices” [Crunchbase, 2010].

Evidently, it is possible to predict future prices with a reasonable degree of accuracy by simply studying the “outputs” of RM systems in the form of their prices over time. How much longer will it be until a pricing advisor moves to the next level: developing “counter-RM” analytical tools to model a producer’s RM policies and improve consumers’ purchasing strategies even more? A company with such capabilities could charge a subscription or other fee and be a commercially viable enterprise doing nothing but “undoing” RM systems!

A variant of this is exemplified by BidLessTravel.com (BidLessTravel), a free Web service that simply shares user’s information about successful bids on Priceline. This is perhaps the best current example of the potential of social networking applications to increase consumer surplus.

PARTIAL ANSWERS?

Strategic consumers and consumer choice modeling. One answer to the complicated consumer reactions involved in RM decisions is to explicitly model the...
reactions of consumers to system actions. The area of consumer choice modeling is very active and likely to grow. For example, discrete-choice models developed in the 1960s to model travelers’ choices in urban transport have been generalized for much more complex settings. No individual consumer can be “pinned-down” by a model, but average behaviors can be captured, and the law of large numbers can take over after that. Such models, integrated with RM control systems, are being used effectively, and these applications will likely increase rapidly as both computer power and data-capture technologies expand.

Can such modeling actually encompass strategic consumer behavior? Our own research on this question is consistent with intuition; strategic consumers can significantly lower the revenues obtainable with an RM system, in some cases below levels that can be achieved with no RM at all. However, companies that adjust for consumer responses to their RM systems can regain significant amounts of the lost revenue. In some cases, they can do better than that; for example, the adroit use of price matching guarantees can actually increase revenues beyond those achieved without strategic consumers [Aviv, Levin and Nediak, 2010]. In effect, strategic consumers can be treated like a new market segment that can be accommodated, with positive outcomes on both sides.

SPIRAL-DOWN EFFECTS

It would seem that we have laid out enough concerns to satisfy the most avid worrier, but there is one more issue that deserves mention. An influential paper [Cooper, Homem-de-Mello and Kleywegt, 2006] details the implications of an RM system that imperfectly models consumer reactions to RM policies. Under the right circumstances, such a system’s pricing or inventory decisions can cause subsequent shifts in consumer demand that lead to policies that reinforce those shifts, leading to further policy changes and so on. The end result can be seriously degraded policies.

When consumers’ responses are being guided by counter-RM systems, is there a possibility that such situations can be exploited by those systems? This needs not be a deliberate reaction “designed into” the counter-RM system; it could simply result from that system’s quick and consistent reactions to the changes it detects on the “other side.” A slow spiral-down could be converted to a death-spiral! At the very least, this reinforces the need for appropriate modeling of consumer reactions. Also, the use of intelligent “reality checks” in any system should catch such system failures before they progress too far.

CONCLUSION

Revenue management is widely recognized as a major success story for analytics. Our cautionary notes here are not meant to suggest that RM systems will soon be a thing of the past. To the contrary, we expect RM applications to continue thriving and expanding as more organizations reach the levels of awareness and analytical capability they need. By properly adjusting for increasing capabilities on the consumer side, organizations can still achieve significant gains. They may have to give back some of that producer surplus, but not so much that RM will fail to be worth the trouble. However, Donald Burr’s fateful warning could now be sounded for managers of existing RM systems who ignore the importance of consumer reactions in the age of social networking.

Yuri Levin ([ylevin@business.queensu.ca] is an associate professor and Distinguished Faculty Fellow in operations management at Queen’s School of Business in Kingston, Ontario, Canada. He has published widely in the general areas of revenue management and dynamic pricing and currently serves as an associate editor of Management Science. Levin was guest editor (with Jeff McGill) of a 2009 special issue of the European Journal of Operational Research on revenue management and dynamic pricing, has consulted widely on consumer choice models and optimization of pricing, and serves on advisory boards of several companies.)

Jeff McGill (mcgillj@queensu.ca) is a professor of management science and Distinguished Faculty Professor of Operations Management at Queen’s School of Business. McGill has researched revenue management and related areas for more than 20 years and has eight years of full-time industrial experience in product development and operations research. He is former associate editor at Transportation Science, associate editor at Operations Research and senior editor at POMS Journal. McGill was the 2008 winner of the INFORMS Revenue Management and Pricing Section historical prize.

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WORKS CITED


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