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Management Insights

A Queueing Analysis to Determine How Many Additional Beds Are Needed for the Detention and Removal of Illegal Aliens

Yifan Liu, Lawrence M. Wein

Concerns about the U.S.–Mexico border extend beyond immigration to homeland security. Yet, in the years following the September 11, 2001 attacks, many non-Mexicans that were apprehended while illegally crossing the U.S.–Mexico border were released onto the streets of the United States, rather than returned to their homeland. The reason for this “catch-and-release” state of affairs was lack of detention space; i.e., there was no place to detain the aliens until the government could organize their return. Using government data from fiscal year 2003 and a two-class priority queueing model, in which apprehended non-Mexicans play the role of customers and detention beds play the role of servers, we find that the U.S. government has been significantly underfunding detention beds: 34,500 beds were needed to remove all apprehended detainees in 2003, but only 21,000 beds were funded.

Public Evacuation Decisions and Hurricane Track Uncertainty

Eva Regnier

Public officials threatened by a hurricane face a difficult and dynamic problem in balancing the improving accuracy of updated forecasts against the increasing risk of delaying an evacuation. With hurricane evacuation costs averaging hundreds of millions of dollars a year, the key to preventing Katrina-like tragedies is not simply to order an evacuation every time a hurricane threatens. Rather, the solution lies in fully exploiting available forecasts, taking into account their uncertainty, and balancing the lead time required for evacuation against the lead time at which forecasts are highly accurate. This research defines a framework for quantifying hurricane track uncertainty in decision-relevant terms to support rational assessment of the trade-offs between early, precautionary preparation, and later, more accurate forecasts. For example, when a storm is three days off the Gulf coast, little information value can be gained by waiting an additional day. By contrast, in Miami, there is a substantial option value for delaying costly evacuations to await more accurate forecasts. These insights can help public officials—and other managers with

hurricane-vulnerable assets—to identify and target critical lead times. The implication for New Orleans, for example, is that managers should develop preparation options that can be initiated with just 24 hours’ lead time.

A Path-Based Approach for Hazmat Transport Network Design

Vedat Verter, Bahar Y. Kara

The transportation industry is largely deregulated. A notable exception is transportation of hazardous materials (hazmats), mainly due to their public and environmental risks. Most hazmats, such as gasoline, fuel oil, and petroleum, are an integral part of our daily lives and industrial development, and their transportation is regulated by municipal, state/provincial, and federal government agencies. In order to reduce the risk in densely populated areas, the government can ban the use of certain road segments by hazmat carriers. In effect, the road network available for the carriers’ operations is determined by the regulator. In this paper, we provide an analytical approach to the problem of determining the road links that should be closed to hazmat shipments. The main advantage of the proposed model is that it enables the regulator to limit the cost implications of risk-reduction policies. Application of our method to hazmat transportation problems in both Western Ontario and Quebec-Ontario allow us to determine the trade-off between cost, as measured by transport path length, and risk, as measured by population exposure. The cost-risk trade-off, however, depends on the topology of the existing road network, the spatial distribution of population centers, the location of the origin-destination pairs, and the type of hazmats being shipped.

Structural Estimation of the Newsvendor Model: An Application to Reserving Operating Room Time

Marcelo Olivares, Christian Terwiesch, Lydia Cassorla

Many business decisions require a manager to make a commitment before the occurrence of a random event. Such decisions are common in inventory management, but also occur in other business settings. For example, a hospital unit preparing for surgery on a cardiac patient needs to reserve operating room time and book expensive care resources in the face of uncertainty about the actual procedure duration. Such decisions are supported by mathematical models, many of which have their roots in inventory manage-

ment, yet decision making under uncertainty remains partly an art. Instead of providing the decision makers with a mathematical model that prescribes an optimal decision, in this paper, we offer a different approach. We present a tool that enables management to analyze their historical decisions and derive accurate estimates of the relative costs of reserving too much capacity versus reserving too little capacity. These data are easily interpreted by management and can facilitate a discussion about the optimality of the current decision-making process. There are many management applications of our model, including use by hospital management to evaluate the performance of an existing reservation system and identify potential inefficiencies in the reservation process. Our model can also be applied to traditional inventory management decisions. In this case, decision makers can analyze how much value their supply chain currently places on intangible variables, such as customer dissatisfaction resulting from stockouts.

Generating Objectives: Can Decision Makers Articulate What They Want?

[Samuel D. Bond](#), [Kurt A. Carlson](#), [Ralph L. Keeney](#)

Managerial decision making is fundamentally about organizing firm resources and capabilities in order to meet strategic objectives. This implies that articulating specific decision objectives is essential. However, our research shows that individuals are not always able to specify the objectives that are important for a given decision. Indeed, we demonstrate that even when decision makers should possess the knowledge required to form a comprehensive set of objectives, they are unable to bring to mind a complete list of objectives at any point in time. Across three empirical studies involving realistic, important decisions, we found that respondents failed to articulate approximately half of the objectives that they later identified as relevant, or even crucially important. In order to improve the articulation of objectives, we recommend that managers (a) adopt a wider perspective in framing the decisions that they face (e.g., by involving multiple individuals, thinking independently, when structuring the decision problem), and (b) consider the same decision from several viewpoints (e.g., by consulting others who have faced a similar decision and by generating objectives at multiple points in time). However, our research clearly indicates that managers should not rely on one-shot assessments as a means of comprehensively delineating decision objectives.

Predicting Product Purchase from Inferred Customer Similarity: An Autologistic Model Approach

[Sangkil Moon](#), [Gary J. Russell](#)

Product recommendation models are important tools for database marketing firms interested in customer

relationship management. This research develops a product recommendation model that infers customer preference for a target product on the basis of customer similarity measures derived from past purchase behavior. The model implicitly divides the customer database into preference-based segments and then exploits this segmentation structure in forecasting the likelihood that a new customer will buy a target product. Using transaction records collected by an insurance firm, we compare the forecast accuracy of the proposed model to a number of benchmark models taken from the data mining literature. Empirical results show that the new approach works well in correctly ranking customers in terms of purchase probability and generates an accurate estimate of the purchase probability for each customer in the database. This finding is important because knowledge of customer rank order and customer purchase probability is essential in developing database-marketing strategies that focus marketing actions on receptive customer segments. The proposed recommendation model is easily calibrated and can be scaled to work with large customer databases.

On the Recoverability of Choice Behaviors with Random Coefficients Choice Models in the Context of Limited Data and Unobserved Effects

[Rick L. Andrews](#), [Andrew Ainslie](#), [Imran S. Currim](#)

Managers and academics frequently apply customer choice models to data generated by supermarket scanners in order to describe household-level choice behaviors for frequently purchased packaged goods categories. The models link data on prices, promotions, and a household's past choices to the household's current choice. Managers use the model results to describe household decision-making processes, forecast market responses to changes in price and promotional policies, and segment and target markets. If the models describe and forecast household choice behaviors incorrectly, managerial decision making based on these results could be inaccurate. Our main message for managers is that the models typically used in application settings describe and forecast household choice behaviors correctly in only 34% of simulated decision-making conditions. We suggest a model-building strategy that is able to correctly describe household choice behaviors in about 81% of conditions, including those for which little data is available for analysis.

Customer Lifetime Value Measurement

[Sharad Borle](#), [Siddharth S. Singh](#), [Dipak C. Jain](#)

This paper develops a model for measuring the expected value of individual customers of a firm. The model makes use of customer purchase behavior data (i.e., interpurchase time, purchase amount, and

customer defection) from a membership-based direct marketing company. It is useful for firms that have knowledge of customer defections and past purchase behavior of customers. We empirically demonstrate the superiority of our model over other methods in both measuring customer lifetime value and in targeting valuable customers based on their lifetime value.

Cultivating Trust and Harvesting Value in Virtual Communities

Constance Elise Porter, Naveen Donthu

A virtual community is an aggregation of individuals or business partners who interact based on a shared interest, where the interaction is at least partially supported and/or mediated by technology and guided by certain protocols and norms. Recent statistics show that more people participate in virtual communities than in Internet commerce. In this research, we focus solely on firm-sponsored virtual communities that are organized and controlled by a commercial firm, and study what the sponsoring firm can do to enhance members trust in the community. Examples of firms that sponsor virtual communities are Dell, Saab, Apple, and many others. We found that a firm's efforts to provide quality content and foster member feeling of belonging (embeddedness) in the community leads to members trusting the sponsor. Although previous studies have shown that customers value interaction in virtual communities, our findings suggest that firms must do more than just encourage interaction among community members if they hope to create value from their virtual communities. We found that members who trust the sponsor of the virtual community are likely to be loyal, share personal information with the sponsor, and help the sponsor in new product development activities.

Building Brand Awareness in Dynamic Oligopoly Markets

Prasad A. Naik, Ashutosh Prasad, Suresh P. Sethi

Can brands build awareness in the presence of competing brands? What are the effects of a brand's advertising: To raise its own awareness, and/or to enhance attrition of competing brands' awareness, and/or to increase another brand's awareness due to confusion? To answer such questions, marketing managers collect awareness data every week, but they need analytical models and estimation methods to tease apart various effects in noisy data from dynamic markets. This paper develops a model and method that managers can apply to their particular product markets to assess own ad effectiveness, determine competing ads effectiveness, and predict future awareness levels for own and competitors' brands. Our analysis also reveals that large brands should advertise proportionally less than small brands. This

inverse allocation principle furnishes two insights: first, managers should advertise heavily to build dominant brands because they can afford to spend less in the future; second, small up-and-coming brands should spend more on advertising to build awareness, whereas large brands may advertise less heavily by relying on brand purchase and consumption experience to maintain awareness.

Inventory Management with Auctions and Other Sales Channels: Optimality of (s, S) Policies

Woonghee Tim Huh, Ganesh Janakiraman

With the advent of e-commerce, firms increasingly find creative ways to sell their products. For instance, managers of firms in today's business environment have to contemplate selling through multiple sales channels such as eBay-like auctions and priceline.com-like "name-your-own-price" web portals, as well as online and brick-and-mortar retail outlets. Within the store itself, the advent of technology like electronic shelf labeling makes it possible to change retail prices frequently. Managing such a myriad of potential channels poses new challenges to the firms as they try to strike a balance between (1) generating the maximum possible revenue and (2) reducing logistics and inventory costs. In this paper, we show how a company should manage its inventory, and demonstrate that this can be done effectively by using a simple two-bin policy (also called an (s, S) policy), regardless of the specific characteristics or configuration of the sales channel. The robustness and adaptability of the two-bin policy implies that managers do not have to dramatically alter their inventory management practices to accommodate new channels and can use a standardized approach across different channels.

Financing the Entrepreneurial Venture

Jean-Etienne de Bettignies

What type of financial contract should entrepreneurs negotiate with potential investors? This is an important but difficult question, because financial contracts vary greatly across entrepreneurial ventures. For example, although the two main types of startups—high-growth ventures (classic startups) and lifestyle ventures (restaurants, hair salons, etc.)—both use a variety of financial instruments, the former predominantly use equity-type instruments, whereas the latter mainly use debt-type instruments. This paper proposes a unifying theory of entrepreneurial finance, which explains contractual choices in both types of venture. Importantly, it suggests that the profit-sharing feature of equity-type contracts makes them more favorable to simultaneous, collaborative efforts by both the entrepreneur and the investor. Debt-type contracts are less amenable to joint efforts

because (a) if the entrepreneur repays the debt, the investor has no claim on profits and thus has little incentive to exert effort, and (b) in case of default, the investor takes control and it is the entrepreneur who loses incentives to exert effort. Because entrepreneur/investor collaboration is often vital in high-growth ventures, this result explains the prevalence of equity-type financing in startups.

Is the Tendency to Engage in Entrepreneurship Genetic?

Nicos Nicolaou, Scott Shane, Lynn Cherkas, Janice Hunkin, Tim D. Spector

Managers need to understand why some people pursue entrepreneurial activities if they are to influence the tendency of their employees to engage in corporate venturing activities. Our study indicates that the tendency to engage in entrepreneurial activity is influenced by both genetic and environmental factors, suggesting that companies might be able to influence the likelihood that their employees will engage in entrepreneurial activities through the work environment that they provide. Our research also suggests that, while the decision to engage in entrepreneurial activities is, in part, affected by a person's genetic composition, attitudes toward entrepreneurship as a career are not heritable. Hence, entrepreneurship courses might be an effective tool to changing people's attitudes toward entrepreneurship as a career.

Code Reuse in Open Source Software

Stefan Haeffliger, Georg von Krogh, Sebastian Spaeth

Knowledge and software reuse in firms usually requires organization-wide, corporate reuse programs and substantial investments in order to yield the expected payoffs. Open source software projects do not have similar programs available, or funds to create them. However, code reuse is extensive among developers of open source software, suggesting that an organization-wide corporate reuse program is not a prerequisite for extensive reuse of software code. Based on an in-depth study of reuse in six projects, we argue that popularity of software may serve as a substitute for a costly certification process and enhance the developer's trust in the code. We observe that software developers who are rewarded for task achievement, rather than time spent, have incentives to cut development costs and to reuse existing functionality. The option of not having to write a component from scratch, plus the free (external) maintenance, provides incentives for reuse. Firms that allow developers to self-assign tasks may, thus, further facilitate reuse by separating the maintenance of components from the developers reusing an existing component. We conclude that managers of software firms should encourage developers to study and

learn from open source software and save time and costs through reuse of software components wherever licenses allow.

Maximum Commonality Problems: Applications and Analysis

Milind Dewande, Subodha Kumar, Vijay Mookerjee, Chelliah Sriskandarajah

The need to deliver software under increasingly tightening deadlines has motivated industry experts to explore the extremes of different development practices, resulting in a novel software development paradigm called *extreme programming*. A central practice of extreme programming is *pair programming*, in which two developers work on the same piece of code. An interesting feature of pair programming is *pair splitting*, a practice in which developers work with different partners. Pair programming together with pair splitting is claimed to reduce system level faults because the developers are "more in synch." This paper addresses the problem of assigning pairs of developers to modules so as to maximize the commonality—a measure of the extent to which common developers work on related modules. We address two variants of the problem that differ in whether or not pair splitting is allowed. Our analysis provides several implications for managers. In the absence of cyclic dependencies between the software development activities, there are no commonality gains from pair splitting. For more general systems, pair splitting can increase the maximum commonality by at most 50%. These results allow managers to trade-off the reduction in costs from pair splitting with the additional overhead of making developers frequently change their work partners during the course of the project.

Risk Aversion in Cumulative Prospect Theory

Ulrich Schmidt, Horst Zank

Research on individual decision making involving risk has shown that people evaluate risks in a much more complex fashion than is suggested by the classical economic analysis of expected utility theory. Cumulative prospect theory is increasingly favored as the most accurate description of how people actually behave when faced with risky choices. Our analysis of risk aversion within this theory may improve our understanding of how customers make their decisions in insurance and financial markets or how managers respond to reward schemes. Additionally, our results may help to detect inconsistencies in one's own choice behavior.

Research Note: Should Consumers Use the Halo to Form Product Evaluations?

Peter Boatwright, Ajay Kalra, Wei Zhang

In purchase situations where information on some product attributes is unavailable or difficult to judge, consumers tend to make inferences using attribute information that is available. For example, a toothpaste brand may advertise excellence in fighting cavities and whitening teeth, while not mentioning its gum-disease prevention ability. Here, consumers would tend to infer that the toothpaste also is reasonably good in preventing gum disease. This tendency to infer missing attribute levels similarly to the known attribute levels is termed the “halo effect.” Conventional wisdom is that the use of the halo heuristic is not rational or optimal. Using a decision theoretic framework, we show that consumers are actually better off using the halo. Essentially, the notion is that to form inferences about missing attributes, use of more information is better even if it appears to be unrelated to those attributes. Contrary to the prevailing view that unrelated information is irrelevant; we show that the use of the halo improves the decision process. For marketing communications to consumers, our results imply that communicating information about more attributes is generally better than for fewer attributes, but only if the quality levels of the advertised attributes are similar to each other.

Research Note: The Impact of Information Technology Investments and Diversification Strategies on Firm Performance

Murali D. R. Chari, Sarv Devaraj, Parthiban David

Given the size and growth of corporate investments in information technology (IT), knowledge about when such investments contribute to performance and when they may represent overinvestment is important for managers. This paper investigates the performance payoff to IT investment in the context of corporate diversification strategy. Our study finds that the contribution of IT investment to firm performance (specifically, the market to book value of the firm) is greater in more diversified firms, reflecting opportunities for sharing and transferring IT assets across businesses and the contribution of information technologies in improving coordination and control of diversified businesses. In addition, we find that the performance contribution of IT investment is greater when the corporation is diversified across more related businesses, but that it is not affected by the extent of diversification across unrelated businesses. The main managerial implication of this finding is that while greater IT investment in related diversification can be justified with the greater returns, greater IT investment in unrelated diversification cannot be similarly justified.