## Dongwook Shin


**Contact Information**

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**Research Interests**

Dynamic pricing and revenue management with applications in e-commerce; machine learning and sequential decision making in operations research context; business and sports analytics; ordinal optimization

**Education**

**Graduate School of Business, Columbia University**, New York, NY
Ph.D., Decision, Risk, and Operations, 2017 (Expected)
Topic: Dynamic Learning and Pricing with Online Product Reviews
Advisors: Mark Broadie and Assaf Zeevi

**Columbia University**, New York, NY
M.S., Operations Research, Feb 2012

**KAIST**, Daejeon, South Korea
B.S., Industrial and Systems Engineering, Feb 2010

**Job market paper**

**Dynamic Learning and Pricing with Online Product Reviews** with Assaf Zeevi

This paper investigates how the presence of the product review system affects a dynamic-pricing monopolist who is operating without knowing the demand model. A salient feature of our problem is that the demand function evolves over time in conjunction with the dynamics of the review system. We find the optimal pricing policy in a closed-form using fluid, mean-field model, which is a good approximation when the sales volume is large.

We first assume that sellers are relatively well-informed about the parameters of the demand function, in which case we show that a certain form of myopic policy works well. Then we consider a case with more significant uncertainty, where the myopic policy's performance is strictly suboptimal, because the sellers need to implement price experimentation to counter the added uncertainty in the demand model.

**Other research**

**Tractable Dynamic Sampling Strategies for Ordinal Optimization** with Mark Broadie and Assaf Zeevi (Major revision invited by *Operations Research*)

We consider the problem of selecting the best of several competing alternatives ("systems"), where probability distributions of system performance are not known, but can be learned via sampling. The objective is to dynamically allocate a finite sampling budget to ultimately select the best system. We introduce a tractable performance criterion and a sampling policy that seeks to optimize it.

First, we characterize the optimal policy in an ideal "full information" setting where the means and variances of the underlying distributions are fully known. Then we construct a dynamic sampling policy which asymptotically attains the same performance as in the full information setting; this policy eventually allocates samples as if the underlying probability distributions are fully known. We characterize the efficiency of the proposed policy with respect to the probability of false selection, and show via numerical testing that it performs well compared to other benchmark policies.

## Other Research (Continued)

**Tractable Sampling Strategies for Quantile-based Ordinal Optimization** with Mark Broadie and Assaf Zeevi

Given a certain number of stochastic alternatives ("systems"), the goal of our problem is to dynamically allocate a finite sampling budget to minimize the probability of falsely selecting non-best systems, where the selection is based on quantiles of their performances. This paper addresses two major aspects of the problem: (a) the probability of false selection does not possess an analytically tractable form and (b) the lack of knowledge on the underlying probability distributions prevents the exact implementation of optimal strategies since the sampling budget needs to be wasted on estimating those.

To formulate this problem in a tractable form, we introduce a function closely associated with the aforementioned objective using large deviations theory. To address the issue with unknown distributions, we suggest as our point of departure a policy that naively combines sequential estimation and myopic optimization, which is asymptotically optimal but exhibits poor finite-time performance. With the aim of improving finite-time performance, we propose alternative algorithms and show that they retain the asymptotic performance of the former algorithm in some cases, while dramatically improving its finite-time performance.

**A Golf Putting Model for Optimal Targeting Strategies and Attribution Analysis** with Mark Broadie

The integration of a golf putting model and simulation & optimization techniques provides an analytical tool to develop the best strategy to win the game of golf. We calibrate a putting model to the PGA Tour data. Based on the calibrated model, we make two important implications on putting. First, we suggest the optimal targeting strategy and show that this tactic can significantly enhance putting score, without improving intrinsic putting skills. Second, we show via attribution analysis that green reading and direction control abilities are key for better putting performance, while the distance control ability has only minor impact.

## Teaching Experience

**Instructor**, Graduate School of Business, Columbia University
Computing for business research, PhD elective course, 1 semester
Introduction to spreadsheet optimization/simulation, 3-session course

**Teaching assistant**, Graduate School of Business, Columbia University
Foundations of stochastic models, PhD core course, 1 semester
Business analytics, MBA core course, 1 semester
Computing for business research, PhD elective course, 2 semesters

## Fellowships and Awards

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| Jerome A. Chazen Institute for Global Business Doctoral Grants | 2016 |
| Paul and Sandra Montrone Doctoral Fellowship | 2015 |
| Doctoral fellowship, Columbia Business School | 2012-present |
| Full scholarship at KAIST | 2003-2005, 2008-2009 |
| Best bachelor dissertation award at KAIST | 2009 |
| Finance-Treatise Competition Award, Citibank and Korea Institute of Finance | 2009 |

## Conference Presentations

Winter simulation conference, Washington, D.C. (Forthcoming) 2016
*Tractable Sampling Strategies for Quantile-based Ordinal Optimization*

INFORMS annual meeting, Nashville TN (Forthcoming) 2016
*Tractable Sampling Strategies for Quantile-based Ordinal Optimization*

Workshop for data-driven decision making, Ithaca NY 2016
*Dynamic Learning and Pricing with Online Product Reviews*

INFORMS annual meeting, Philadelphia PA 2015
*Tractable Dynamic Sampling Strategies for Ordinal Optimization*

## Professional Experience

**PCA Asset, South Korea** Aug 2009 to Dec 2009
Intern at equity research department

**System optimization lab, KAIST** June 2009 to Aug 2009
Undergraduate Researcher
Topic: Portfolio Management to Minimize Co-movement Value at Risk (CoVaR)

**Boston Consulting Group, South Korea** April 2008
Research assistant

**Korean Army, South Korea** Feb 2006 to Feb 2008
Sergeant at the completion of military service

## Software

**Business Analytics Excel Add-in**, Graduate School of Business, Columbia University
An Excel Add-in that contains useful analytical tools, e.g., multivariate linear/logistic regression, portfolio optimization, and Monte Carlo simulation, that are not natively available in Excel. Developed for use in MBA core and elective courses at Columbia Business School. Joint work with Mark Broadie and Ciamac Moallemi.

## References

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Costis Maglaras
David and Lyn Silfen Professor of Business
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