

The Loss-averse Newsvendor Solutions via Conditional Value-at-Risk Measure

Chan, Felix T. S.

Department of Industrial and Systems Engineering,
The Hong Kong Polytechnic University,
Kowloon, Hong Kong
f.chan@polyu.edu.hk

Xu, Xincheng

Department of Mathematics,
Binzhou University,
Binzhou, China
xxs0905@163.com

Wang, Xuping

Faculty of Management and Economics,
Dalian University of Technology,
Dalian, China
wxp@dlut.edu.cn

Ruan, Junhu

College of Economics and Management,
Northwest A&F University,
Yangling, China
junhu.uan@polyu.edu.hk

Abstract

This paper studies the optimal order quantity in the loss-averse newsvendor model with shortage cost. The retailer's loss aversion is characterized by introducing a loss version coefficient and then a novel utility functions proposed for the retailer. The optimal order quantity for the retailer has been obtained to maximize the expected utility. In order to reduce the risk arising from the uncertainty in market demand, the CVaR measure has been introduced and the optimal order quantity for the retailer has been obtained to maximize the CVaR objective about utility. It is found that the optimal order quantity with CVaR objective decreased in the retail price under certain conditions. This significant finding has never been reported in the previous newsvendor literature. Under the optimal order quantity with CVaR objective, it is proved that the retailer's expected utility is decreasing in the confidence level. This confirms the fact that low risk means low return while high return comes with high risk. A numerical example is given to illustrate the results and some management insights are suggested for the loss-averse newsvendor model.

Keywords

Newsvendor model; CVaR measure; Expected utility

Acknowledgements

This work was supported by grants from the Natural Science Foundation of China (Grant number 71471158); the Research Grants Council of the Hong Kong Special Administrative Region, China (Project No. PolyU15201414); the Natural Science of Shandong Province (Grant number ZR2014GQ0050); and the China Postdoctoral Science Foundation (Grant number 2016M590697).

Biography

Felix T.S. Chan received his BSc Degree in Mechanical Engineering from Brighton Polytechnic (now University), UK, and obtained his MSc and PhD in Manufacturing Engineering from the Imperial College of Science and Technology, University of London, UK. Professor Chan is now working at the Department of Industrial and Systems Engineering, The Hong Kong Polytechnic University. He is also the Associate Dean (Research) serving the Faculty of Engineering. His current research interests are Logistics and Supply Chain Management, Operations Management, Distribution Coordination, Systems Modelling and Simulation, Supplier Selection. To date, he has published 16 book chapters, over 310 refereed international journal papers and 270 peer reviewed international conference papers, h index= 33 under the Web of Science. He is a chartered member of the Chartered Institute of Logistics and Transport in Hong Kong.

Xinsheng Xu received his BS in Applied mathematics (2004), MS in Operations Research (2007) from Qufu Normal University and Ph.D. degree in management science from Zhejiang University of Technology. He is now a lecturer in Binzhou University. He has authored and coauthored over 20 papers published in International Journal of Production Economics, International Journal of Production Research, etc. His research interests include supply chain management and risk analysis in finance.

Xuping Wang received the Ph.D. degree in management science and engineering from Dalian University of Technology, Dalian, China, in 2010. He visited the DeGroot School of Business, McMaster University, Hamilton, Canada, from Oct. 2011 to Oct. 2012. He is currently a professor with the Faculty of Management and Economics and an associate dean with the School of Business, Dalian University of Technology, Dalian, China. He has authored and coauthored over 100 papers published in Information Sciences, Applied Soft Computing, International Journal of Production Economics, International Journal of Production Research, etc. His current research interests include management science and engineering, e-commerce and logistics, and emergency management.

Junhu Ruan received the B.Sc. degree in information management and information system and the M.Sc. degree in management science and engineering from Hebei University of Engineering, Handan, China, in 2007 and 2010, respectively, and the Ph.D. degree in management science and engineering from Dalian University of Technology, Dalian, China, in 2015. When pursuing the Ph.D. degree, he visited the School of Electrical and Electronic Engineering, The University of Adelaide, Australia, from Nov. 2013 to Nov. 2014. He is currently a lecturer with the College of Economics and Management, Northwest A&F University, Yangling, China, and a Post-Doctoral Research Associate with the Department of Industrial and Systems Engineering, The Hong Kong Polytechnic University. He has authored and coauthored over 30 papers published in Information Sciences, Applied Soft Computing, International Journal of Production Economics, International Journal of Production Research, etc. His current research interests include management science and engineering, e-commerce and logistics, and emergency management.