

## Chapter 5

# Optimal Pricing and Inventory Decisions for Fashion Retailers Under Value-At-Risk Objective: Applications and Review

**Chun-Hung Chiu**

*City University of Hong Kong, Hong Kong*

**Jin-Hui Zheng**

*The Hong Kong Polytechnic University, Hong Kong*

**Tsan-Ming Choi**

*The Hong Kong Polytechnic University, Hong Kong*

### ABSTRACT

*Motivated by the popularity of Value-at-Risk (VaR) objective in finance, this chapter reviews and studies its application in fashion retail operations management. First, a formal optimization model is reviewed in which the fashion retailer aims at optimizing a VaR objective with both pricing and inventory decisions. Second, the detailed solution schemes are explored. Third, numerical examples are included to illustrate applications of the proposed models. Fourth, the performance of pure buyback contract and pure wholesale pricing contract in enhancing supply chain efficiency is examined. Insights are generated and future research directions are outlined.*

### INTRODUCTION

The fashion retailing problem and the newsvendor problem share many common features. The fashion retailer faces uncertain demands in selling fashion products. The purchase cost of a specific fashion

product is fixed, the selling season is short, the end-of-season markdown will clear the unsold leftover, and the fashion retailer needs to determine the order quantity of the fashion product from his supplier before the selling season starts. If we check the classical newsvendor problem (see, e.g., Lau, 1980), we can see that the problem faced by

DOI: 10.4018/978-1-60960-756-2.ch005

a fashion retailer is very close to the newsvendor problem. As a result, there are quite a number of studies which employ the newsvendor model to investigate supply chain management problems in fashion retailing. Examples include an investigation of trade promotion scan-back rebate scheme in fashion supply chains (Kurata & Yue, 2008), a mean-variance analysis of quick response fashion supply chains (Choi & Chow, 2008), and a study on risk hedging problem in multi-product fashion supply chains (Vaagen & Wallace, 2008).

Over the past few years, there are extensive studies of inventory models with the consideration of risk in the literature (see, e.g., Wu et al., 2009; Tapiero, 2005; Choi and Ruszczyrski, 2008). However, most of these studies do not consider pricing and only explore the corresponding optimal inventory policies. In addition, for those which include both inventory and pricing decisions, they only illustrate the technical details but do not show the applications of the algorithms (e.g. Chiu & Choi 2010). Since retail pricing is undoubtedly a crucial decision for fashion retailers and applications are important, we explore in this chapter the joint optimal pricing and stocking algorithms with an optimization objective based on the Value-at-Risk (VaR) function for a single-period product with price-dependent demand. We propose detailed algorithms to illustrate how the optimal pricing and stocking policies can be determined for different forms of price-dependent demand functions. This chapter can be taken as a review plus extended works supplementing the related literature (such as Gotoh & Takano, 2007; Chiu & Choi, 2010) with detailed algorithms, numerical analysis and discussions on channel coordination challenge.

The rest of the chapter is organized as follows. A literature review is first provided. The basic model is then discussed. Afterwards, the solution schemes are proposed and numerical examples are provided to further illustrate the findings. The performance of pure buyback contract and pure wholesale pricing contract in enhancing supply chain efficiency is examined. We finally

conclude with a discussion on probable future research directions.

## **LITERATURE REVIEW**

As we mentioned earlier, the newsvendor problem, despite being simple, has been employed widely to study stochastic supply chain inventory problems for fashion products. One of the major differences between the fashion retailing problem and the classical newsvendor problem is that the fashion retailer can (and actually will) decide the retail price by his own while the selling price of newspapers is fixed for the newsvendor in the classical newsvendor problem. In the literature, there are several extensions investigating pricing issue for newsvendor problem. For example, Petruzzi and Dada (1999) review and extend the newsvendor model with price-dependent demands. Under the respective analytical models, they study the newsvendor problem in which the optimal stocking quantity and selling price are jointly determined. Important theoretical insights and structural properties of the “price-setting” newsvendors are hence developed. Later on, Dana and Petruzzi (2001) extend the price-dependent demand newsvendor problem by considering the expected utility maximizing consumers who would choose between the firm’s product and the competitor’s product. Other related works which make use of price-dependent newsvendor models include a study of the supply chain coordination problem between a newsvendor and its supplier with price-dependent demand (Chiu et al., 2010), and a study of newsvendor model which captures the joint pricing and procurement of fashion products in the existence of clearance markets (Karakul, 2008). All these works include the joint optimal decisions in both inventory and price, and they are known to be more challenging than the works that focus solely on the inventory (i.e., quantity) decision. In fact, notice that even for the expected profit maximizing newsvendor

8 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:

[www.igi-global.com/chapter/optimal-pricing-inventory-decisions-fashion/55206](http://www.igi-global.com/chapter/optimal-pricing-inventory-decisions-fashion/55206)

## Related Content

---

### Supply-Side: Mapping High Capacity Suppliers of Goods and Services

Brenner Lopes, Luander Falcão and Thiago Canellas (2020). *Supply Chain and Logistics Management: Concepts, Methodologies, Tools, and Applications* (pp. 1246-1264).

[www.irma-international.org/chapter/supply-side/239326](http://www.irma-international.org/chapter/supply-side/239326)

### Adopting Identification Standards in the Medical Device Supply Chain

Yousef Abdulsalam, Dari Alhuwailand Eugene S. Schneller (2020). *International Journal of Information Systems and Supply Chain Management* (pp. 1-14).

[www.irma-international.org/article/adopting-identification-standards-in-the-medical-device-supply-chain/246053](http://www.irma-international.org/article/adopting-identification-standards-in-the-medical-device-supply-chain/246053)

### The Strategic Role of Human Collaboration in Supply Chain Management

Kenneth Saban and John Mawhinney (2010). *International Journal of Information Systems and Supply Chain Management* (pp. 43-57).

[www.irma-international.org/article/strategic-role-human-collaboration-supply/39066](http://www.irma-international.org/article/strategic-role-human-collaboration-supply/39066)

### Logistic Management in the Supply Chain Market Using Bio-Inspired Models With IoT Assistance

Hongyun Liu (2022). *International Journal of Information Systems and Supply Chain Management* (pp. 1-20).

[www.irma-international.org/article/logistic-management-in-the-supply-chain-market-using-bio-inspired-models-with-iot-assistance/305849](http://www.irma-international.org/article/logistic-management-in-the-supply-chain-market-using-bio-inspired-models-with-iot-assistance/305849)

### GUI Toolbox for Approximation of Fractional Order Parameters With Application to Control of pH Neutralization Process

Bingi Kishore, Rosdiazli Ibrahim, Mohd Noh Karsiti, Sabo Miya Hassan and Vivekananda Rajah Harindran (2019). *Optimizing Current Strategies and Applications in Industrial Engineering* (pp. 260-286).

[www.irma-international.org/chapter/gui-toolbox-for-approximation-of-fractional-order-parameters-with-application-to-control-of-ph-neutralization-process/221235](http://www.irma-international.org/chapter/gui-toolbox-for-approximation-of-fractional-order-parameters-with-application-to-control-of-ph-neutralization-process/221235)