

Optimal Inventory and Pricing for Products with Increasing Quality Over Time

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Abstract

The paper addresses a gap in the inventory planning literature, focusing on products with quality and value that increase over time. Wine, aged cheese and collectibles are some paragons for this class of products that present unique operational challenges and opportunities. Their market dynamics are characterized by quality improvement that increases demand and consumer willingness to pay, while storage costs also grow. The analytical model presented in this paper aims at optimizing inventory and pricing, assuming a single ordering point, time-dependent quality and linear demand sensitivity to both quality and price. The model determines an optimal order quantity, depletion period and pricing to maximize retailers' profits. By capturing the trade-off between the duration of sales, storage costs and value appreciation, the model provides actionable insights for retailers managing quality-improving inventory. The findings contribute to the literature by offering a tractable, closed-form approach to time-sensitive pricing and inventory optimization, and lay the foundations for future empirical studies on non-linear quality trajectories in goods.

