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An EOQ model and pricing for perishable goods when the demand depends on freshness and discount rate

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Keywords: perishable goods; dependent demand; inventory control; pricing; ordering; discount rate.

1 Introduction

In recent times the interest in reducing spoilage, especially of food products, has increased not only because of its economic significance but also because of its social and environmental impact (Adenso-Daz, 2014).
Liu and et al. (2008) reported that more than 81% of America's retail sales in 2009 were related to food and drink, and 63% of them are products with limited shelf life. In other words, 50% of the sales in this industry are perishable products. Many perishable goods like raspberries, fruits, vegetables, donuts, milk, meat, etc. have a few days of shelf life, so their demand decrease to zero as their expiration dates approach and consumers prefer to choose fresh products (Chung & Li, 2013).
Since the demand rate of perishable products is affected by price and freshness, in order to motivate consumers to buy less-fresher products, retailers are using dynamic pricing. Offering units less fresh units at a lower price than fresh units, are an effective method to encourage customers to demand less fresh but cheaper units.
In the research of the combined field of ordering and pricing for the perishable products, only a few models have been developed that are either certainty or random models with known distribution (Wang and Li, 2012).

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2 Objectives

This paper develops an EOQ inventory model for inventoried perishable products such as meat, fruits and cooked foods to maximize the retailer's total profit with considering the following facts: (1) Consumers prefer to buy fresh products that could store in a long time, (2) Pricing strategy is an important competitive tool to encourage consumers to sale less fresh products and increase profits.
This paper proposes a mathematical model the to determine jointly replenishment cycle time and the rate of discounting the selling price to maximize the total profit.

3 Methods

In this study, by considering the fact that customers usually prefer to buy fresh goods like vegetables, fruits, baked goods, bread, milk, meat and seafood, the coefficient of elasticity of demand with freshness is applied the model, and also by applying other factor affecting customer demand, such as the coefficient of demand elasticity of the price, time and the amount of discount is determined such that the objective function is optimized. By proofing that the total profit is strictly pseudo-concave in all decision variables, which the area search to find a unique local maximum reduced. Consequently, an algorithm is proposed to find the optimal decision variables.

5 Conclusion

In this paper, an EOQ inventory model has been developed to achieve the following important relationships and facts:

1) Customer purchasing decisions depend on product's freshness.
2) Pricing strategy is an important competitive tool for increasing sales and profits.
3) The demand for a perishable product decreases as the product expires.

To achieve the above, we present an inventory model in which demand is presented explicitly as a multiple function of price and freshness. In this situation, the policy will be profitable to reduce the price. The objective of proposed model is to determine jointly replenishment cycle time and the rate of discounting the selling price to maximize the total profit. We proved that the total profit in decision variables is strictly pseudo-concave, which reduce the area search to a unique local maximum, and, by presenting the example, we clarify the theoretical results.