

## Pricing and Inventory Decisions of Substitutable Products with and without Deterioration Assumption

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*Abstract*— In this research we have developed two models for pricing and inventory decisions of deteriorating and non-deteriorating substitutable products. In both of them, we assumed that the demand function of each product is dependent on own price and the price of another one. The aim of this paper is to optimize the total profit of integrated system such that the optimal values for the price of each product, order quantity and period length are determined.

## Keywords— Pricing; Inventory; EOQ; Substitutable products; Deterioration

## I. INTRODUCTION

Pricing policy has been recognized as a significant tool for maximizing the profit of firms. Many studies have been previously published on pricing decisions of single or multi products in an integrated inventorypricing system. But a few of them have studied pricing decisions for substitutable products. When two products are full substitutability so, any product can be used to satisfy the demand of another product. McGillivray and Silver [1] investigated the effect of full substitutability on inventory control policies and costs in a multi-product model. Parlar and Goyal [2] and Pasternack and Drezner [3] developed two integrated production – pricing model for two fully substitutable products under different assumptions. Birge et al. [4] developed a joint pricing and procurement model for two substitutable products with independent uniform demand distribution.

Gurler and Yilmaz [5] studied a supply chain with two levels and two substitutable products in a newsboy problem. Demands for both products are assumed independent and the aim of this research is to maximize the retailer's and manufacturer's profit. Zhao and et al. [6] considered a fuzzy supply chain with two substitutable products which manufactured by two rivalry producers and then will sell via a joint retailer. And also production cost and value of demand of each product described as fuzzy variables. In this paper producers and retailer determined pricing decisions about wholesale and retail price under four different scenarios. Yadavalli and et al. [7] studied an inventory system for substitutable two-product and also jointordering policy. Rusmevichientong [8] investigated a multi-products pricing problem to substitutable products. For this problem, he presents a noneparametric procedure. Kuyumcu and Popescu [9] developed an inventory-pricing problem for substitutable products. They assumed which demand is deterministic and ditinct and also demand function is linear. Maity and Maiti [10] developed optimum production in an inventory control system with multi complementary or substitutable products. They assumed products are complementary or substitutable and deterioration rate is fixed. Stavrulaki [11] considered two substitutable with stochastic demand and developed an inventory model. They modeled the joint effect of demand stimulation and product substitution on inventory decisions. Netessine and et al. [12] studied an integrated inventory-pricing problem to determine the optimal procurement quantities of multiple substitutable products under competition and exogenous prices. Tang and Yin [13] considered two substitutable products and to study how a buyer determines the order quantity and the selling price of them developed an integrated inventory pricing model with deterministic demand. Levis and Papageorgiou [14] considered several rivalry firms which are selling substitutable products to customers. They offered an algorithm to determine selling decisions to these firms. Also they developed this model for situation which each of firms can be sell collections of substitutable products with different prices.

Balkhi and Benkherouf [15] developed an inventory model for deteriorating items with stock