

An Inventory Model for Complementary Products with Bundling under Consignment Stock Policy

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In a competitive environment, the coordination and integration of the supply chain are essential to achieve an optimal production and inventory policy. This paper aims at studying two-complementary product under a joint economic lot size model in a supply chain consisting of a vendor and a buyer. In this study, the policy is vendor managed inventory with consignment stock (VMI-CS) and the demand is price-dependent. Two models that consider bundling and separate sales have been proposed.

In the separate sales Model the vendor produces two complementary items and sends them separately to the buyer. The buyer places part of the items on the shelf and stores the rest in the warehouse. In the bundling model the vendor sends two complementary items to the buyer simultaneously and in one package. The objective is to maximize profit. The concavity of the objective functions of both models has been studied. Since number of shipments from the vendor to buyer's warehouse and from there to the shelf space are discrete variables, their upper bounds can be obtained through differentiating total profit function. Moreover, it is shown that the profit function is jointly concave with respect to the price and size of the batches and its Hessian matrix is negative definite. Two heuristic algorithms are proposed to find the optimal solutions.

Input data have been used to analyse the problem behaviour numerically. Effects of the variations of the complementarity rate on the problem variables in [0-3.2] interval is studied. Results show as the complementarity rate increases the profitability of bundling model and separate sales model decreases from 4770 to 3241 and from 2502 to 957 respectively. Profitability and demand are always more in bundling than in the separate sales model. In other words, in bundling, the vendor and buyer benefit from the merits of the economies of scale. The variations of the price is less in the bundling sales than in the separate sales which can, in turn, lead to more accurate planning and pricing. Moreover, an increase in the complementarity rate of the two products will reduce the discount rate given to the customer due to their concurrent purchase of both products.

Keywords: Bundling; Complementary products; Pricing; Vendor managed inventory; Consignment