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A REVIEW ON FIXED-COST & NEWSVENDOR MODELS FOR INVENTORY CONTROL

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A Review on Fixed-Cost & Newsvendor Models for Inventory Control

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Abstract – In this paper we investigate the single period inventory in a general uncertain environment. Here it is assumed that the uncertainty appears in the market demand of the product. Uncertain demand is used to describe a subjective estimate [14].

Keywords: Single Period Inventory, Financial, Company

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INTRODUCTION

The importance of inventory to a firm stems from two points of view: financial and operational. First, inventory represents a major financial investment for any company. Inventories represent of 25 to 50 per cent of total assets in manufacturing firms and 75 to 80 per cent in wholesalers and retailers. On the other hand, from the operational perspective, inventories add an operating flexibility. Adequate inventories kept in manufacturing companies will smooth the production process. The wholesalers and retailers can offer good customer services and gain good public image by holding sufficient inventories. The basic objective of inventory management is to achieve a balance between the low inventory and high return on investment (ROI).

Single period inventory problem, also known as the newsboy problem, is very significant in terms of both theoretical and practical consideration. In real life, many products have a limited selling period, so newsboy problem provides a very useful framework for making decisions on advanced booking of orders in a number of practical contexts, such as in fashion, sporting and various service industries. Hadley and Whitin [1] were the first researchers to introduce the newsboy problem, developing a numerical dynamic programming based approach to solve it. Gallego and Moon [2,3] defined the newsboy problem as a tool to decide the stock of an item when [14]

(1) There is a single purchasing opportunity before the start of the selling period and

(2) The demand for the item is random. The classical newsboy model assumes that if the order quantity is larger than the realized demand, a single discount is used to sell excess inventory or that excess inventory is disposed of.

The purpose of inventory modeling is to derive an operating doctrine. The methodology for modeling inventory situations is straightforward and three simple steps are involved:

1. Examine the inventory situation carefully, listing characteristics and assumptions concerning the situation.

2. Develop the total annual relevant cost equation.

3. Optimize the cost equation to find the optimum for how much to order (order quantity) and when to reorder (reorder point).

The mathematical techniques and other methods are only aids to management decision-making. They cannot replace the judgment of human experts. A manager may have several inventory models available to him, but if he is not sure which is the best one for the situation, obviously, he may not be able to solve the problem effectively. It is clear that when a manager is faced with an inventory problem and he has an expert available for choosing the right model then he can be confident that the efforts put into analysis will be efficient and successful.

The fundamental cornerstones of modern inventory theory are the papers by the economists Arrow, Harris, and Marschak, and the mathematicians Dvoretzky, Kiefer, and Wolfowitz. In 1958, A full length book devoted to the mathematical properties of inventory models was published by Arrow, Kerlin, and Scarf. From this point on, inventory theory became a full-blown academic discipline, and many hundreds of researches representing developments and improvement have been published.

REVIEW OF LITERATURE:

Operations Research can be defined as the science of decision-making. It has been successful in providing a systematic and scientific approach to all kinds of government, military, manufacturing, and service operations. Operations Research is a splendid area for graduates of mathematics to use their knowledge and skills in creative ways to solve complex problems and have an impact on critical decisions. The term Operations Research is known as operation Research in Britain and other parts of Europe. Other terms used are Management Science, Industrial Engineering, and Decision Sciences. The multiplicity of names comes primarily from the different academic departments that have hosted courses in this field. The subject is frequently referred to simply as OR, and includes both the application of past research results and new research to develop improved solution methods.

If the order quantity is less than demand, then profit is lost. Several extensions to the newsboy model have been done in the literatures [4-7] for the single item considering random demands. More recently, single item newsboy problem is considered with random lot-size [8]. Lau and Lau [5-6], Khouja and Meherz studied the multiproduct newsboy problem with different constraint, Khouja [9] suggested a comprehensive extension of the single period inventory problems. Eppen [10] studied a multi-location newsboy problem, Vairaktarakis [11] and Erlebacher [12] studied multi-item newsboy problem.

FIXED-COST MODELS:

Optimality of the (s, S) Policy , D, and v(q) leading to (1), plus the additionalπConsider the same cost structure of c, h, setup cost K for placing an order (i.e., q > 0). The objective is still to minimize the total cost in the period. In this case, what should the optimal inventory policy be? In the newsvendor model without any setup cost, the base-stock policy is always to order up to q* if I0 < q* , and order nothing otherwise. However, with the setup cost, the optimal ordering policy can be different. Let S* be the optimal on-hand stock in this case, no matter how S* is found. If I0 is only "slightly" less than S* , i.e., the benefit of having on-hand S* over I0 is not too big, it may not be worthwhile to pay the setup cost K (and additional variable cost on ordering) to change the on-hand inventory to S* . The following analysis expresses the above idea rigorous and derivates the optimal inventory policy. First let v(q) = cq + hE[q-D] + E[D-q]π+ + be the sum of the variable cost in ordering, the expected inventory holding cost, and the expected shortage cost. Recall that v (q) is a convex function with a well-defined minimum. Let S* be the value of q that minimizes v (q). Let s * < S* such that v (q*) = K+v(S*). Refer to Figure 1 for the definitions of s * and S*. We claim that the optimal inventory (production) policy is of (s, S) type,

NEWSVENDOR MODELS:

Optimality of the Base-Stock Policy A newsvendor problem is a single-period stochastic inventory problem. First assume that there is no initial inventory, i.e., I0 = 0. Let c be the cost to buy each unit; h be the holding cost for each unit of inventory left over at the end of the period; be the shortage cost for each unit of unsatisfied demand in the period;π D be the demand of the period such that D is a continuous random variable ~ F; v(q) be the expected cost of the period for order quantity q. The objective is to minimize the total cost of the period, i.e., D]–min v(q) = cq + hE[q + q]–E[Dπ+ + . (1) As shown in the second set of notes, v (q) is a differentiable#1 convex function in q. The first-order necessary condition, which is also sufficient, gives Fcπ –c + hF(q) (q) = 0, (2) i.e., F(q*) = . h c + π (3)–π The minimum cost is achieved at ordering q* that satisfies (3). q*≥Suppose that I0. If we order any quantity y, the expected total cost per period = v (q*≥v (I0+y) + CY q*≥). Therefore, it is optimal not to order if I0. Now consider 0 < I0 < q*. Let us compare the two policies of ordering q* q*≠I0 and ordering y – I0. The expected– I0 = v(q*–total cost of ordering q* cq*–) + c(q* I0) = v(q*– c I0, while the expected total–) v(q*≥ cI0 – c(I0+y) + cy = v(I0+y) –cost ordering y = v(I0+y) c I0. It is optimal to order–) q*≥I0. The result shows that the otpimal policy in (3) is of base-stock type: If I0 –q* , order nothing; otherwise, order q* -I0

SCIENTIFIC INVENTORY CONTROL PROVIDES THE FOLLOWING BENEFITS:

1. It improves the liquidity position of the firm by reducing unnecessary tying up of capital in excess inventories.
2. It ensures smooth production operations by maintaining reasonable stocks of materials.
3. It facilitates regular and timely supply to customers through adequate stocks of finished products.
4. It protects the firm against variations in raw materials delivery time.
5. It facilitates production scheduling, avoids shortage of materials and duplicates ordering.
6. It helps to minimize loss by obsolescence, deterioration, damage, etc.
7. It enables the firms to take advantage of price fluctuations through economic lot buying when prices are low.

- Reduce your cost of inventory obsolescence
- Become truly responsive to your customers' real needs
- Make your scheduling and shop loading more efficient
- Narrow the gap between sales and stock replacement
- Fine-tune your record-keeping accuracy for better inventory management
- Determine your exact material status and inventory dollar burden

Limitations of Inventory Control:

(i) Efficient inventory control methods can reduce but cannot eliminate business risk.

(ii) The objectives of better sales through improved service to customer; reduction in inventories to reduce size of investment and reducing cost of production by smoother production operations are conflicting with each other.

(iii) The control of inventories is complex because of the many functions it performs. It should be viewed as shared responsibilities.

CONCLUSION:

For dealing with general uncertain single period model an uncertain measure is proposed which provides the mechanism to characterize the uncertain parameter 'demand' [14].

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