Chapter 11
Substitutable Inventory System with Partial Backlogging under Continuous Review

B. Vigneshwaran
Thiagarajar College of Engineering, India

N. Anbazhagan
Alagappa University, India

V. Perumal
MTN College, India

ABSTRACT
Consider a two-commodity substitutable inventory system with storage capacity $S_i$ for commodity $i$, $(i=1,2)$ under continuous review. The demand time points for each commodity are assumed to form independent Poisson processes. The two commodities are assumed to be substitutable. That is when any one of the commodity’s inventory level reaches zero, then the demand for that commodity will be satisfied by the other commodity. If no substitute is available, then this demand is backlogged up to the level $N_i$, for commodity $i$, $(i=1,2)$. The reordering policy is to place an order for both the commodities, when both inventory levels are less than or equal to their respective reorder levels. If the inventory level drops to $N_1$ or $N_2$ then both inventory levels are pulled back to their maximum levels $S_1$ and $S_2$ immediately and the previous order gets canceled. The lead time is assumed to follow negative exponential distribution. Various stationary measures of system performances have been derived and total expected cost rate is computed. Numerical examples are provided.

INTRODUCTION
Many practical multi-item inventory systems are concentrated on the coordination of replenishment orders for group of items. Presently, it is very much applicable to run a successful business and industries. These systems unlike those dealing with single commodity involve more complexities in the reordering
Substitutable Inventory System with Partial Backlogging under Continuous Review

procedures. The modelling of multi-item inventory system under joint replenishment has been receiving considerable attention for the past three decades.

In highly competitive business environment two branded items even though substitutable commodities like two different brands of super computers have almost same configuration and identical functioning may be sold by a single vendor. Because of brand affinity, some customers may seek a specific brand which is not in the stock in that case backordering is the right choice for the vendor even though the backlogging cost is more. This motivate the authors to consider the substitutable items with partial backlogging provision. Coordinated ordering policy is implemented to reduce the total expected cost rate since it is a vendor managed inventory control system.

In continuous review inventory systems, Ballintfy (1964) and Silver (1974) have considered a coordinated reordering policy which is represented by the triplet \((S,c,s)\), where the three parameters \(S\), \(c\), and \(s\) are specified for each item \(i\) with \(s_i \leq c_i \leq S_i\) under the unit sized Poisson demand and constant lead time. In this policy, if the level of \(i\)-th commodity at any time is below \(s_i\), an order is placed for \(S_i - s_i\) items and at the same time, any other item \(j(\neq i)\) with available inventory at or below its can-order level \(c_j\), an order is placed so as to bring its level back to its maximum capacity \(S_j\). Subsequently many articles have appeared with models involving the above policy and another article of interest is Federgruen, Groenevelt and Tijms (1984), which deals with the general case of compound Poisson demands and non-zero lead times. A review of inventory models under joint replenishment is provided by Goyal and Satir (1989).

Kalpakam and Arivarignan (1993) have introduced \((s,S)\) policy with a single reorder level \(s\) defined in terms of the total number of items in the stock. This policy avoids separate ordering for each commodity and hence a single processing of orders for both commodities has some advantages in situation where in procurement is made from the same supplies, items produced on the same machine, or items have to be supplied by the same transport facility.

Krishnamoorthy, Iqbal Basha and Lakshmy (1994) have considered a two commodity continuous review inventory system without lead time. In their model, each demand is for one unit of first commodity or one unit of second commodity or one unit of each commodity 1 and 2, with prefixed probabilities. Krishnamoorthy and Varghese (1994) have considered a two commodity inventory problem without lead time and with Markov shift in demand for the type of commodity namely “commodity-1”, “commodity-2” or “both commodity”, using the direct Markov renewal theoretical results. And also for the same problem, Sivasamy and Pandiyan (1998) had derived various results by the application of filtering technique.

Anbazhagan and Arivarignan (2000) have considered a two commodity inventory system with Poisson demands and a joint reorder policy which placed fixed ordering quantities for both commodities whenever both inventory levels are less than or equal to their respective reorder levels.

Anbazhagan and Arivarignan (2001) have analysed the model with a joint ordering policy which places orders for both commodities whenever the total net inventory level drops to a prefixed level \(s\).

Anbazhagan and Arivarignan (2003) have also analysed the model with individual and joint ordering policy. For the individual reorder policy, the reorder level for \(i\)-th commodity is fixed as \(r_i\) and whenever the inventory level of \(i\)-th commodity falls on \(r_i\) an order for \(P_i = (S_i - r_i)\) items is placed for that
Related Content

Blockchain in Food and Agriculture Supply Chain: Use-Case of Blockchain in Indonesia
[www.igi-global.com/article/blockchain-in-food-and-agriculture-supply-chain/234725?camid=4v1a](www.igi-global.com/article/blockchain-in-food-and-agriculture-supply-chain/234725?camid=4v1a)

The Social Network of Researchers on the Topic “Hunger”
Luis Saavedra Martinez, Francisco Espasandin Bustelo and Juan Domingo Ganaza-Vargas (2019). *Strategy and Superior Performance of Micro and Small Businesses in Volatile Economies* (pp. 227-238).
[www.igi-global.com/chapter/the-social-network-of-researchers-on-the-topic-hunger/221191?camid=4v1a](www.igi-global.com/chapter/the-social-network-of-researchers-on-the-topic-hunger/221191?camid=4v1a)

How Spiritual Leadership Affects Job Satisfaction and Workplace Deviant Behavior (Study at the Regional Secretariat of the City of Palangkaraya)

The Psychological Capital: A Moderator in Authentic Leadership – Organizational Commitment Relation
[www.igi-global.com/chapter/the-psychological-capital/242406?camid=4v1a](www.igi-global.com/chapter/the-psychological-capital/242406?camid=4v1a)