SIMPLIFICATION OF ECONOMIC PRODUCTION QUANTITY MODEL BY EQUIVALENT HOLDING COST

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ABSTRACT
In customary Economic Order Quantity (EOQ) model, renewal is in one parcel anyway in Economic Production Quantity (EPQ) model the supply of request amount is at uniform rate(Widyadana & Wee, 2012). The EPQ model is minimal increasingly unpredictable and formulae for figuring of EPS, Total expense, and Holding cost are progressively perplexing and troublesome (as contrast with EOQ). We utilize the idea of Equivalent Holding Cost (EHC) or Equivalent Carrying Cost. With this idea EPQ model is the same as EOQ model as far as formulae(Zellweger, 2007). All formulae of EOQ model could be utilized for EPQ model just setting up Equivalent Holding cost of holding cost! It has truly disentangled the EPQ model.

Key Words: ELS, EPQ, Holding, Equivalent holding cost, EHS .

INTRODUCTION

Monetary Order Quantity (EOQ) model is shown in practically all the writing. A few creators utilizes EPQ (Economic Lot Size) while numerous creators incline toward EPQ (Economic Production Quantity) for the model where underway of part is initiates when stock position arrives at zero stock and things are additionally provided at uniform interest rate(Çorbacioğlu & van der Laan, 2007). Normally, generation rate ought to be substantially more than interest rate. Stock is squander and ought to be limited, as it couldn't be dispensed with. Stock models for the most part: EOQ, EPQ, EOQ with arranged deficiencies and EPQ with arranged deficiencies.

CALCULATIONS AND METHODOLOGY

1. EQUIVALENT HOLDING COST (EHC)

During production period 't_p' inventory built up rate is 'p - d'
Maximum Inventory level, M

$$M = t_p(p-d) \qquad (1)$$

As minimum inventory is zero and $t_p = \frac{Q}{p}$ we have
(figure 1)

$$Average\ inventory = t_p\left(\frac{p-d}{2}\right)$$
$$= \left(\frac{Q}{p}\right)\left(\frac{p-d}{2}\right)$$

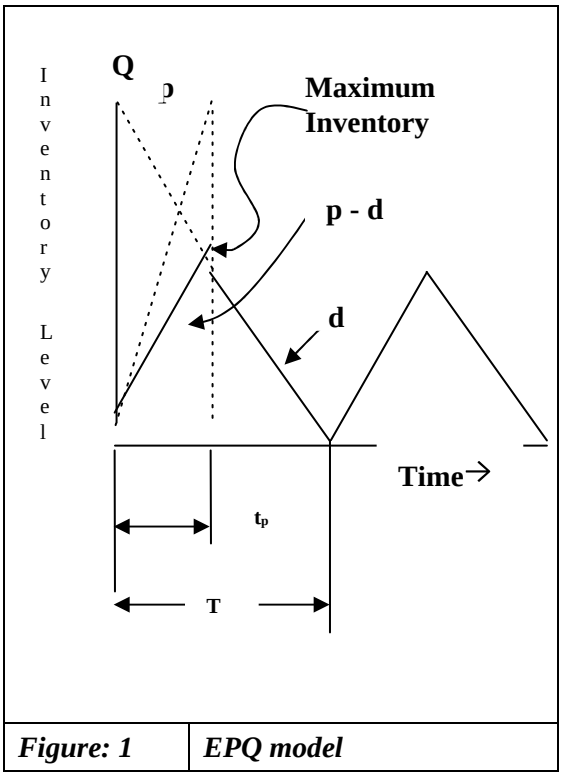

Figure: 1	*EPQ model*

In this model average inventory is different by factor (p – d)/p. In EOQ model average inventory is only Q/2. This factor is a factor for change in the inventory level of ERL model from EOQ model.

Annual Holding cost

$$H(Q) = (average\ inventory)(holding\ cost\ per\ unit\ per\ year)$$

$$= \left(\frac{Q}{p}\right)\left(\frac{p-d}{2}\right)H$$

$$H(Q) = \left(\frac{Q}{2}\right)\left(\frac{p-d}{p}\right)H \qquad (2)$$

Factor for uniform production

We define factor $\mathbf{K_p}$ as Factor for *Uniform Production*

$$K_p = \left(\frac{p-d}{p}\right)$$

Then from equation (2) and (3)

$$H(Q) = \left(\frac{Q}{2}\right)(K_p)H$$

In EOQ model Annual inventory cost is

$$H(Q) = \left(\frac{Q}{2}\right)H$$

Here K_p* H is just an equivalent holding cost in ERL model when compared with EOQ

Equivalent Holding Cost (EHC)

Defining Equivalent Holding Cost (EHC) in ERL model

The factor is denoted by H_{ep} i.e. equivalent holding cost for production or ERL model.

$$H_{ep} = K_p H \qquad (5)$$

Then from equation (4) and (5), the Annual Holding Cost for ERL model is

$$H(Q) = \left(\frac{Q}{2}\right) H_{ep}$$

EPQ MODEL DERIVATION WITH EHC

Annual set-up cost

$$O(Q) = (number\ of\ setups\ per\ year)(setup\ cost\ per\ setup)$$

$$O(Q) = \left(\frac{D}{Q}\right) O \qquad (7)$$

Total annual inventory cost

From equation (6) and (7), we get

$$T(Q) = H(Q) + O(Q)$$

$$T(Q) = \left(\frac{Q}{2}\right) H_{ep} + \left(\frac{D}{Q}\right) O \qquad (8)$$

In order to minimize the annual total cost, take derivative w.r.t. Q and equate it to zero.

$$\frac{dT(Q)}{dQ} = \frac{d}{dQ}\left(\left(\frac{Q}{2}\right) H_{ep} + \left(\frac{D}{Q}\right) O\right)$$

$$0 = \left(\frac{1}{2}\right) H_{ep} + (-1)\left(\frac{D}{Q^2}\right) O$$

$$Q^2 = \frac{2D.O}{H_{ep}}$$

$$Q = \left(\frac{2D.O}{H_{ep}}\right)^{0.5} \qquad (9)$$

This value is optimal, but to confirm for minimum, second derivative must be positive.

$$\frac{d^2T(Q)}{dQ^2} = \frac{d}{dQ}\left(\left(\frac{1}{2}\right) H_{ep} + (-1)\left(\frac{D}{Q^2}\right) O\right)$$

$$= 0 - (-2)\left(\frac{D}{Q^3}\right) O$$

$$= 2\left(\frac{D}{Q^3}\right) O$$

As all quantities on RHS are positive (O, D and Q); RHS is greater than zero

$$= 2\left(\frac{D}{Q^3}\right) O > 0$$

Hence the quantity (Q) found is the optimum quantity to give minimum total cost point; denoting as Q^*

Hence for ERN or EPQ model from equation (9)

$$Q^* = \left(\frac{2D.O}{H_{ep}}\right)^{0.5}$$

For classical EOQ model this formula is:

$$Q^* = \left(\frac{2D.O}{H}\right)^{0.5}$$

It is confirmed that only EHC should be used instead of holding cost and formula remains unchanged.

Total Optimum Annual Inventory cost

Taking equation (8) and putting the value of Q^*

$$T(Q) = \left(\frac{Q}{2}\right) H_{ep} + \left(\frac{D}{Q}\right) O$$

$$= \left(\frac{H_{ep}}{2}\right)\left(\frac{2D.O}{H_{ep}}\right)^{0.5} + \frac{D.O}{\left(\frac{2D.O}{H_{ep}}\right)^{0.5}}$$

$$T(Q) = (2D.OH_{ep})^{0.5}$$

(Lavoie, Gharbi, & Kenné, 2010)

CONCLUSION

Factor for comparable holding cost for uniform generation is easy to ascertain. The Equivalent Holding Cost (EHC) for EPQ model can be determined from this factor. The idea of EHC has improved the EPQ or EPQ model to EOQ model. All formulae for EOQ model can be utilized for EPQ with "EHC' instead of 'H'. Staggering rearrangements is come about because of this idea of EHC. No need from now on to utilize the confused formulae of old EPQ model as given in all writing(Teng, Lou, & Wang, 2014). The documentations utilized in this paper are straightforward and could be utilized as standard.

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