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Editorial

In this issue, N. H. Shah and P. Pandey have contributed a technical paper on *Weibull Distributed Deterioration of Units with Salvage Value Lot-Size Model for a Temporary Price Discount*. Inaddition, L. Wu has contributed a general note on *A New DEA Computer Code with Mixed-Orientation*. We are delighted to be publishing them here for Bulletin readers. In this issue, we have also reported the presentations in the *Recent Advances in OR conference* held in Melbourne in November 2008. The information on 2009 ASOR Ren Potts award amd New Researcher Encouragement medal is also provided.

I am pleased to inform you that the electronic version of ASOR Bulletin is now available at the ASOR national web site: http://www.asor.org.au/. Currently, the electronic version is prepared only as one PDF. We like to thank our web-master Dr Andy Wong for his hard work in redesigning and smoothly managing our national web site. In September alone, our web site has about 950 visitors and 3400 page requests logged. Your comments on the new electronic version, as well as ASOR national web site, is welcome.

ASOR Bulletin is the only national publication of ASOR. I would like to request all ASOR members, ASOR Bulletin readers and OR organizations in the country to contribute to the ASOR Bulletin. The editorial policy is available either from the Bulletin web site or from the inside back cover of the Bulletin. The detailed instructions for preparing the manuscripts is available in the URL: http://www.asor.org.au/.

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Weibull Distributed Deterioration of Units with Salvage Value Lot-Size Model for a Temporary Price Discount

Nita H. Shah[a] and Poonam Pandey[b]

Abstract
A lot – size model is developed for Weibull distribution deterioration of units when a temporary price discount is offered. The salvage value is associated to the deteriorated units. The model is discussed for scenarios of regular and non – regular inventory replenishment. A numerical example is provided to illustrate the theory. The sensitivity analysis of critical parameters is carried out to study the changes in gain due to temporary price discount and discounted cycle time.

Key words: Temporary price discount, lot–size model, Weibull distributed deterioration, salvage value.

1.0 Introduction

The classical EOQ model is derived under the assumption that units in inventory do not loose its utility even if it is stored for infinite time. In practice, medicines, volatile liquids, chemicals, X – ray plates, fruit and vegetables etc. looses its effectiveness with time. In this study, deterioration is assumed to be a function of time. In order to reduce loss due to deterioration, vendor is tempted to offer discount. The strategy of discount is also considered to enhance the demand. However, it may not always be advantageous for buyer to buy more units during the discounted period as he has to pay more for holding inventory and deteriorating cost. The buyer needs to formulate optimal ordering policy to take advantage of the temporary price discount offered by the supplier, in order to maximize total cost savings.

Tersine (1994) derived an EOQ model to study the effect of a temporary discount in sale price. Later Martin (1994) corrected Tersine (1994)'s expression for the average inventory during the temporary price discount time. Shah (1993) and Wee and Fang (1995) developed optimal ordering policy when units in inventory deteriorate at constant rate, or exponentially with time respectively when vendor offers temporary discount sale. Wee and Yu (1995, 1997) studied ordering policy for non – deteriorating and deteriorating items the assumptions of Tersine (1994) and Martin (1994) with three additional assumptions as given below:

1. For the first regular order in case 1 (Fig. 1) the economic order quantity Q_0 is derived using the discounted price (c - d),
2. the number of replenishment must be integer,
3. the temporary price discounted order cycle T_d, is equal to the average of the regular order cycle times and the time period t_1 (Fig. 1) and t_2 (Fig. 2).

In this study, the optimal ordering policy is analyzed to maximize total cost savings for following two cases:

- **Case 1**: A temporary price discount occurs at the regular inventory replenishment cycle time. (Fig. 1)
- **Case 2**: A temporary price discount sale occurs at non – regular inventory replenishment cycle time (Fig. 2).

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2. Assumptions and Notations

The proposed model is developed under the following assumptions and notations:

2.1 Assumptions

- The inventory system deals with single item.
- The demand rate is known and constant.
- The replenishment rate is infinite.
- Lead – time is zero and shortages are not allowed.
- The units in inventory deteriorate with respect to time and follow two parameter Weibull distribution.

$$\theta(t) = \alpha\,\beta\,t^{\beta-1} \tag{2.1}$$

  where α is scale parameter ($0 < \alpha < 1$), β denotes shape parameter ($\beta > 1$) and t is time to deteriorate.
- There is no repair or replacement of deteriorated inventory during the cycle time.
- When there is no temporary discount, regular price EOQ policy is followed.
- For case 1, the temporary price discount occurs at regular replenishment time; and for case 2, the temporary price discount occurs at a non – regular time.
- The temporary price discount time is one time incentive for a special period.

2.2 Notations

The following notations are used in the development of mathematical model :

$\lceil\ \rceil$: integer value equal or greater than its argument.

$\lfloor\ \rfloor$: integer value equal or less than its arguments

C : regular unit purchase cost.
d : unit price discount.
A : ordering cost per order.
I : inventory carrying charge fraction per annum.
R : demand rate.
$\theta(t)$: deterioration rate of units in an inventory.
$Q(t)$: inventory level at any instant of time ‘t’.
t_1 : time between temporary price discount replenishment period and the next regular replenishment cycle.
t_2 : time between the last regular replenishment cycle and the end of T_d.
T^0 : optimal replenishment cycle time for a discount price with no special order.
$Q^0(t)$: inventory level during discount price with no special order cycle.
T^* : optimal replenishment cycle for a regular price order.
$Q_0^*(t)$: inventory level during the replenishment cycle for a regular price order.
T_d : optimal temporary price discount replenishment cycle.
$Q_d(t)$: inventory level during the temporary price discount replenishment cycle.

3. Mathematical Model

The depletion of inventory is due to demand and deterioration of units on hand. The rate of change of inventory at any instant of time ‘t’ is described by the differential equation

$$\frac{dQ(t)}{dt} + \theta(t)\,Q(t) = -R \tag{3.1}$$

with initial condition $Q(0) = Q_0$ and $Q(T) = 0$.

Following Spiegel (1960), the solution of differential equation (3.1) is

$$Q(t) = R\left[T - t + \frac{\alpha\,T^{\beta+1}}{\beta+1} - \alpha\,T\,t^{\beta} + \frac{\alpha\,\beta\,t^{\beta+1}}{\beta+1}\right],\ 0 \le t \le T \tag{3.2}$$

Using $Q(0) = Q_0$, we have

$$Q_0 = R\left[T + \frac{\alpha\, T^{\beta+1}}{\beta+1}\right] \tag{3.3}$$

Purchase cost $PC = CQ_0$ and inventory holding cost is

$$IHC = C\,I\,R\left[\frac{T^2}{2} + \frac{\alpha\,\beta\,T^{\beta+2}}{(\beta+1)(\beta+2)}\right]$$

The number of units deteriorated is $Q_0 - RT = \dfrac{\alpha\,R\,T^{\beta+1}}{\beta+1}$

Hence, salvage value of deteriorated units is $SV = \dfrac{\gamma C\alpha\;R\;T^{\beta+1}}{\beta+1}$

Hence total cost per time unit is

$$TC(T) = \frac{1}{T}(OC + PC + IHC - SV) \tag{3.4}$$

The necessary condition for TC(T) to be minimum, is

$$\frac{\partial TC}{\partial T} = -\frac{A}{T^2} + \frac{C\,(1-\gamma)\,\alpha\,\beta\,R\,T^{\beta-1}}{\beta+1} + C\,I\,R\left[\frac{1}{2} + \frac{\alpha\,\beta\,T^{\beta}}{\beta+2}\right] = 0 \tag{3.5}$$

Denote the optimal replenishment cycle time T by T^* for regular price order. Using (3.2), the periodic inventory level at optimal replenishment cycle T^* is

$$Q^*(t) = R\left[T^* - t + \frac{\alpha\,T^{*\,\beta+1}}{\beta+1} - \alpha T^* t^{\beta} + \frac{\alpha\,\beta\,t^{\beta+1}}{\beta+1}\right],\; 0 \le t \le T^* \tag{3.6}$$

Case 1: When the temporary price discount period occurs at the regular replenishment time.

Arguing as above, the initial purchase units for temporary discount time is

$$Q_d = R\left[T_d + \frac{\alpha\,T_d^{\beta+1}}{\beta+1}\right] \tag{3.7}$$

and inventory level at time t during the replenishment cycle of length T_d is

$$Q_d(t) = R\left[T_d - t + \frac{\alpha\,T_d^{\beta+1}}{\beta+1} - \alpha T_d t^{\beta} + \frac{\alpha\,\beta\,t^{\beta+1}}{\beta+1}\right],\; 0 \le t \le T_d$$

The total cost per cycle for temporary price discount is

$$TC_d = A + (C-d)\;R\;T_d + \frac{(C-d)\;(1-\gamma)\;\alpha\;R\;T_d^{\beta+1}}{\beta+1} + (C-d)\;i\;R\left[\frac{T_d^2}{2} + \frac{\alpha\;\beta\;T_d^{\beta+2}}{(\beta+1)(\beta+2)}\right] \tag{3.8}$$

The inventory level at any instant of time t at the original price is given by (3.6) and corresponding optimal purchase quantity is

$$Q_0^* = R\left[T^* + \frac{\alpha\,T^{*\,\beta+1}}{\beta+1}\right] \tag{3.9}$$

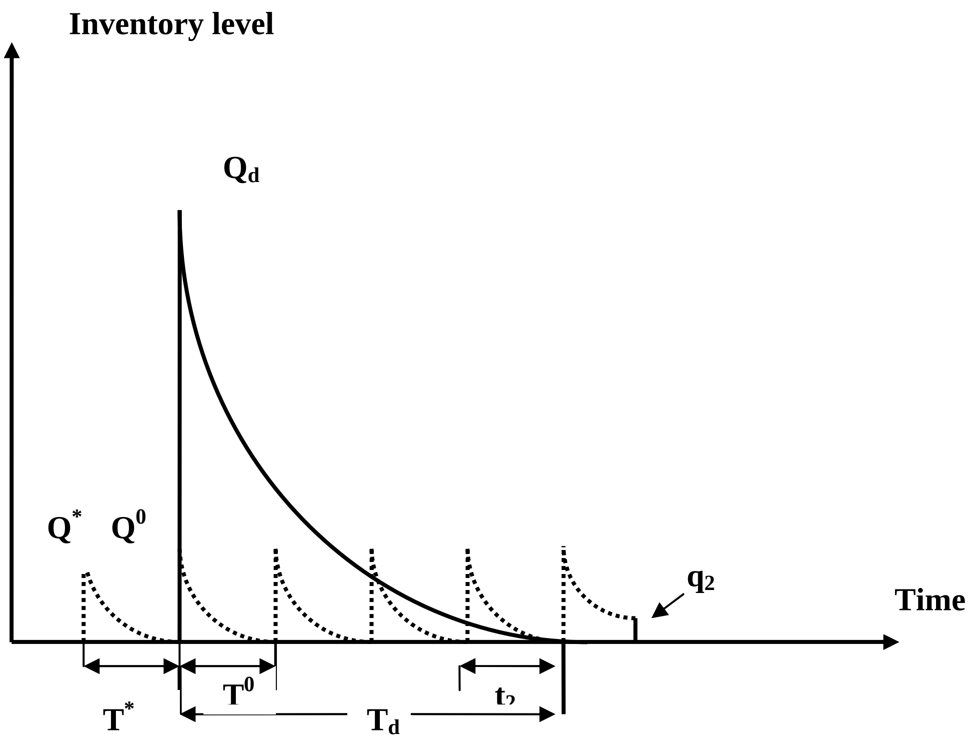

Fig 1. Temporary price discount purchase occurs at the regular inventory replenishment time (Case 1)

During the temporary price discount period items are available at (C - d) instead of at C. The optimal replacement times are related by

$$T^0 = \sqrt{\frac{C}{C-d}}\,T^* \tag{3.10}$$

The optimal lot – size is

$$Q_0^0 = R\left[T^0 + \frac{\alpha\, T^{0^{\beta+1}}}{\beta+1}\right] \tag{3.11}$$

and inventory level during T^0 is

$$Q^0(t) = R\left[T^0 - t + \frac{\alpha\, T^{0^{\beta+1}}}{\beta+1} - \alpha\, T^0\, t^\beta + \frac{\alpha\,\beta\, t^{\beta+1}}{\beta+1}\right],\ 0 \le t \le T^0 \tag{3.12}$$

t_2 is the time interval from the start of the last regular cycle to the end of the special order cycle T_d. The number of replenishments $\left|(T_d - T^0)/T^*\right|$ at the regular price during T_d must be an integer. The remaining inventory (Fig. 1) of the last regular replenishment at the end of the temporary discount per cycle is

$$q_2 = Q^*(t_2) = R\left[T^* - t_2 + \frac{\alpha\,(T^* - t_2)^{\beta+1}}{\beta+1}\right] \tag{3.13}$$

For simplicity, put $\left\lceil \frac{T_d - T^0}{T^*} \right\rceil = n$ and $\left\lfloor \frac{T_d - T^0}{T^*} \right\rfloor = m$

The total cost during cycle of length T_d without special price order is

$$TC_n = (n+1)A + (C-d)\,R\,T^0 + \frac{(C-d)\,(1-\gamma)\,R\,\alpha\,{T^0}^{\beta+1}}{\beta+1} + n\,C\,R\,T^* + \frac{n\,C\,(1-\gamma)\,R\,\alpha\,{T^*}^{\beta+1}}{\beta+1}$$
$$+ (C-d)\,i\,R\left[\frac{{T^0}^2}{2} + \frac{\alpha\,\beta\,{T^0}^{\beta+2}}{(\beta+1)(\beta+2)}\right] - \frac{C\,(1+\gamma)\,R\,\alpha\,(T^*-t_2)^{\beta+1}}{\beta+1} \qquad (3.14)$$
$$+ C\,i\,R\,(m+1)\left[T^*T^0 - \frac{{T^0}^2}{2} + \frac{\alpha T^* T^0}{\beta+1}({T^*}^{\beta} - {T^0}^{\beta}) + \frac{\alpha\beta {T^0}^{\beta+2}}{(\beta+1)(\beta+2)}\right] - C\,R(T^*-t_2)$$

where $t_2 = T_d - T^0 - mT^*$

The cost savings, $G(T_d)$ due to discount in unit price is the difference of total cost due to regular ordering policy and the total cost due to price discount ordering policy i.e.

$$G(T_d) = TC_n - TC_d \qquad (3.15)$$

The optimal value of T_d can be obtained by setting $\frac{dG(T_d)}{dT_d} = 0$ which maximizes savings provided $\frac{d^2G(T_d)}{dT_d} < 0$.

Case2: Temporary price discount sale occurs at non – regular intervals:

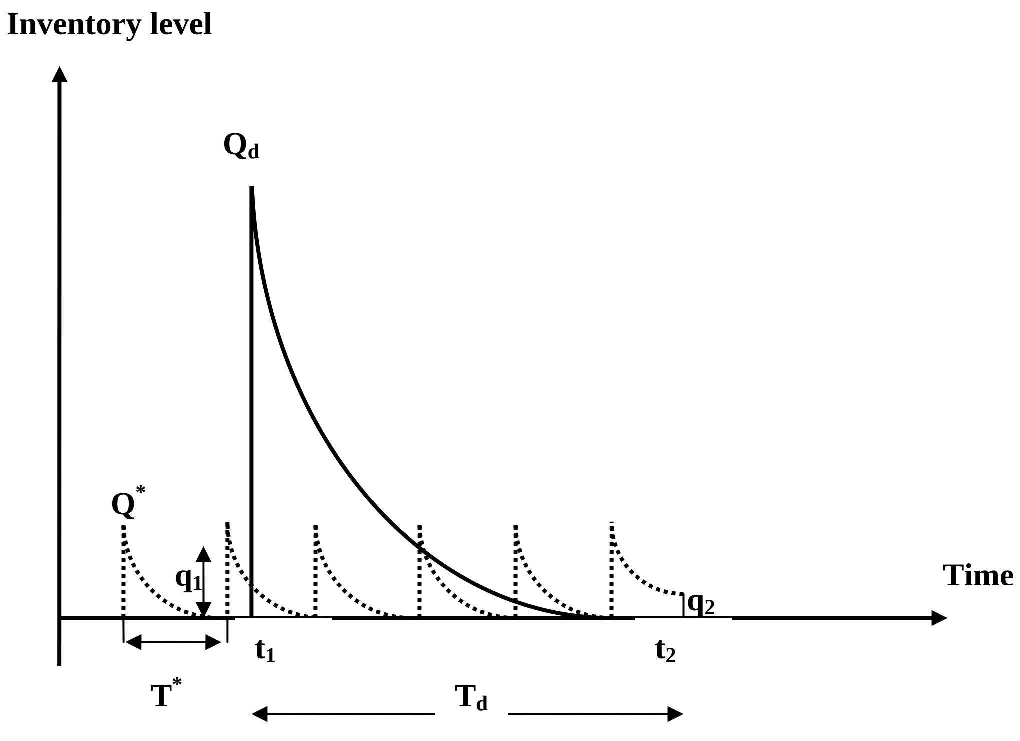

Fig 2. Temporary price discount purchase occurs at the non - regular inventory replenishment time (Case 2)

Here, temporary price discount does not occur at the regular interval (fig 2). The ordering quantity is

$$Q_d - q_1 = R\left[T_d - t_1 + \frac{\alpha}{\beta+1}(T_d^{\beta+1} - t_1^{\beta+1})\right]$$

where q_1 is the number of units in inventory at the start of time of temporary price discount. The total cost during the temporary discount price period is

$$TC_d = A + (C - d)(Q_d - q_1) + (C - d)\, iR\left[\frac{T_d^2}{2} + \frac{\alpha\beta T_d^{\beta+2}}{(\beta+1)(\beta+2)}\right] - \frac{\gamma(C-d)R\alpha}{\beta+1}\left[T_d^{\beta+1} - t_1^{\beta+1}\right] \quad (3.16)$$

q_2 (Fig. 2) is the units left in inventory at the end of cycle time T_d. The number of regular price order during cycle T_d is $\left\lceil \frac{T_d - t_1}{T^*} \right\rceil$ and a total cost is

$$\begin{aligned} TC_n = {} & NA + NCRT^* + \frac{NC\,(1-\gamma)\,R\,\alpha\,T^{*(\beta+1)}}{\beta+1} + M\,C\,i\,R\left[\frac{T^{*^2}}{2} + \frac{\alpha\,\beta\,T^{*^{\beta+2}}}{(\beta+1)(\beta+2)}\right] \\ & + C\,i\,R\left[T^* t_2 - \frac{t_2^2}{2} + \frac{\alpha\,T^{*^{\beta+1}}\,t_2}{\beta+1} - \frac{\alpha\,T^* t_2^{\beta+1}}{\beta+1} + \frac{\alpha\,\beta\,t_2^{\beta+2}}{(\beta+1)(\beta+2)}\right] \\ & + C\,i\,R\left[\frac{t_1^2}{2} - \frac{2\,\alpha\,T^{*^{\beta+2}}}{(\beta+1)(\beta+2)} + \frac{\alpha\,T^{*^{\beta+1}}\,t_1}{\beta+1} + \frac{\alpha\,T^*(T^*-t_1)^{\beta+1}}{\beta+1} - \frac{\alpha\,\beta\,(T^*-t_1)^{\beta+2}}{(\beta+1)(\beta+2)}\right] \\ & - C\,R\left[t_2 + \frac{\alpha\,T_2^{\beta+1}}{\beta+1}\right] - \frac{\gamma\,C\,R\,\alpha\,t_2^{\beta+1}}{\beta+1} \end{aligned} \quad (3.17)$$

where $N = \left\lceil \frac{T_d - t_1}{T^*} \right\rceil$, $M = \left\lfloor \frac{T^*}{T_d - t_1} \right\rfloor$

and $t_2 = T_d - t_1 - MT^*$ (from fig 2). Hence, total cost savings $G(T_d)$ due to discount in sale price of unit is difference of eq. (3.17) and (3.16). i.e.

$$G(T_d) = TC_n - TC_d \quad (3.18)$$

The optimal T_d which maximizes total cost saving can be obtained by solving $\frac{dG(T_d)}{dT_d} = 0$ provided $\frac{d^2G(T_d)}{dT_d} < 0$. In next section, we discuss model by a numerical example.

4. Numerical Example

Consider an inventory system with parametric values as follows in proper units:
[R, C, A, i] = [10000, 10, 100, 0.8]

The remaining parameters are varied.

Table 1: Effect of changes in α and β on decision variable and total cost savings
d = 1.0, γ = 0.00

Case 1				
α ↓	β →	1.01	1.02	1.03
0.005	T_d	0.1598	0.1601	0.1608
	$G(T_d)$	588.40	571.01	553.50
0.006	T_d	0.1652	0.1656	0.1659
	$G(T_d)$	412.79	388.53	364.09
0.007	T_d	0.1724	0.1729	0.1733
	$G(T_d)$	358.46	321.17	283.57
Case 2				
0.005	T_d	0.1571	0.1578	0.1584
	$G(T_d)$	546.28	534.72	516.50
0.006	T_d	0.1596	0.1614	0.1630
	$G(T_d)$	399.03	371.83	357.42
0.007	T_d	0.1629	0.1675	0.1698
	$G(T_d)$	378.12	346.51	324.15

Table 2: Effect of changes in α and d on decision variable and total cost savings
β = 1.01 , γ = 0.10

Case 1				
α ↓	d →	1.0	1.5	2.0
0.005	T_d	0.1621	0.2440	0.3361
	$G(T_d)$	337.47	1116.83	2381.93
0.006	T_d	0.1690	0.2486	0.3407
	$G(T_d)$	261.73	609.53	1902.90
0.007	T_d	0.1792	0.2560	0.3452
	$G(T_d)$	236.51	488.11	1426.45
Case 2				
0.005	T_d	0.1587	0.2832	0.3751
	$G(T_d)$	321.47	1272.00	2651.42
0.006	T_d	0.1676	0.2853	0.3889
	$G(T_d)$	256.71	681.15	1347.89
0.007	T_d	0.1782	0.2941	0.3907
	$G(T_d)$	226.45	527.31	926.14

Table 3: Effect of changes in α and γ on decision variable and total cost savings
β = 1.01 , d = 1.0

Case 1				
α ↓	γ →	0.00	0.10	0.20
0.005	T_d	0.1599	0.1621	0.1644
	$G(T_d)$	588.40	337.47	86.60
0.006	T_d	0.1652	0.1690	0.1729
	$G(T_d)$	412.79	261.73	63.39
0.007	T_d	0.1724	0.1792	0.1871
	$G(T_d)$	358.46	236.51	48.07
Case 2				
0.005	T_d	0.1598	0.1621	0.1647
	$G(T_d)$	588.40	337.47	289.73
0.006	T_d	0.1652	0.1690	0.1724
	$G(T_d)$	412.79	261.73	273.40
0.007	T_d	0.1724	0.1792	0.1811
	$G(T_d)$	358.46	236.51	215.61

It is observed that as deteriorate rate α and shape parameter 'β' increase cycle time increases and savings in total cost decreases. Significant changes are observed when deterioration rate changes. Increase in discount cost increases cycle time and savings in total cost significantly. The salvage parameter is also critical factor in total cost savings.

5. Conclusions

An inventory model is analyzed when units in inventory are subject to time dependent deterioration and vendor announces temporary price discount in sale price for short time. For $\beta = 1$ and $\alpha = \theta$, the derived model reduces to that of Wee and Ye (1997) and again $\theta = 0$, it is model derived by Wee and Ye (1995). When constraint of price discount is neglected, the model coincides with that of Ghare and Schrader (1963). The model suggests that salvage parameter, deterioration rate of units in inventory and discount offered by vendor for short term are significant factors in total cost savings for the cases when temporary price discount occurs at the regular or non – regular replenishment cycle times.

References

- Ghare, P. M. and Schrader, G., 1963. A model for exponential decaying inventory. Journal of Industrial Engineering, 13, 238 – 243.
- Martin, G. E., 1994. Note on an EOQ model with a temporary sale price. International Journal of Production Economics, 37, 241 – 243.
- Shah, Nita H., 1993. An EOQ model for exponentially decaying inventory under temporary price discount. Cahier du CERO, 35 (3 - 4), 227 – 232.
- Spiegel, M. R., 1960. Applied differential Equations. Prentice – Hall, Englewood cliffs, NJ.
- Tersine R. J., 1994. Principles of Inventory and Materials Management. Prentice – Hall, Englewood cliffs, NJ.
- Wee, H-M., Fang, S – S., 1995. Management of a deteriorating inventory model with a special sale price unpublished Report. Department of Industrial Engineering Chung Yuan Christian University, Chungli, Taiwan, ROC.
- Wee, H – M. and Yu, C – P., 1995. A modified EOQ model with temporary sale price. Proceedings of Chinese Institute of Industrial Engineers National Conf., Taiwan, ROC, 1, 520 – 529.
- Wee, H – M. and Yu, J., 1997. A deteriorating inventory model with a temporary price discount. International Journal of Production Economics, 53, 81 – 90.

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Note /Information for Readers

A New DEA Computer Code with Mixed-Orientation[c]

Lifen Wu[d]

Data Envelopment Analysis (DEA) has been extensively applied to measure and improve the efficiency and productivity of Decision Making Unit (DMU) with multiple inputs and multiple outptus for 30 years in many industries world wide.

A new DEA computer code has been programmed. It has following new features:

1. Mixed-orientation in variable returns to scale (VRS) model enables scale inefficient DMUs to be identified and improved as scale efficient and it may be more efficient (optimal) than the Pareto-efficiency (optimality) because the latter is only technical efficiency. This is an improvement over existing methods that involve a single orientation (input or output). These latter methods, when both the VRS and constant returns to scale (CRS) models are estimated, can only measure the degree of scale inefficiency but cannot indicate how to adjust inputs and outputs to improve these DMUs to become scale efficient;
2. Outputs in input-oriented models and inputs in output-oriented models are allowed to be radially increased or decreased to a preset value. Therefore, DMUs can choose their preferred orientation;
3. All the possible solutions for slacks, weights of peering efficient DMUs as well as shadow prices are provided. Therefore, DMUs have options to choose among these solutions and full information of shadow prices. The existing methodology of maximizing slack sum identifies the furthest point and therefore the hardest way for the DMUs to be projected to reach the frontier.

It is well known that when the VRS production possibility set and frontier, which is real, is employed to measure technical efficiency, the CRS frontier, which does not really define a technically feasible production set, can be used to measure aggregate technical and scale efficiency. Scale efficiency then is quotient of CRS efficiency over VRS efficiency.

In input- or output-oriented VRS and CRS models, a DMU with technical inefficiency can be improved by reducing inputs or augmenting outputs using input- or output-oriented VRS model so as to reach the production possibility frontier. However, a DMU with scale inefficiency cannot be improved by input- or output-oriented CRS model to the CRS frontier because it is not real technically feasible and it is located beyond the real VRS production possibility frontier.

To reach scale efficiency, a DMU must be projected to where the CRS hyper-plane is at a tangent to the VRS production possibility frontier. The CRS and VRS models which have only input- and output-orientations are generally unable to do so. Also, a DMU with increasing returns to scale, whether technically efficient or not, can not be improved in input-oriented VRS model

[c] Published as a general note – the editor is not responsible for any claim made in this note

[d] Centre for Efficiency and Productivity Analysis (CEPA), School of Economics, UQ, St Lucia 4067, QLD.

because its inputs can only be reduced. Similarly, DMU with decreasing returns to scale can not be improved in output-oriented VRS model because its outputs can only be augmented. The Pareto-efficiency (optimality) does not care about it!

The DEA model with mixed-orientation must be employed to identify how the DMU can be physically improved so as to become scale efficient. This radial DEA model maximizes a ratio of multiple of the original outputs over that of the original inputs. These multiples are not confined to be above or below one.

CRS and VRS models with input- and output-orientation are enveloped in this mixed-orientation model of CRS and VRS respectively. When the multiple of the original inputs (outputs) is preset to a fixed value, it becomes a parametric input (output)-oriented model. Particularly, when the fixed value is one, the model becomes input (output)-oriented CCR model of CRS or BCC model of VRS.

When both multiples are not fixed, the model is a linear fractional programming (LFP) model and is solved **NOT** by the Charnes-Cooper transformation but by an LFP Simplex algorithm because the former can only result in input- or output-orientation.

A Windows version of this new DEA software package is being developed while the beta version of this new DEA code currently works in DOS environment.

For detailed model formulations or project assistance, please contact Dr Lifen Wu by email l.wu1@uq.edu.au.

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- Highlighting science with the Prime Minister and the Cabinet through the Prime Minister's Science, Engineering and Innovation Council (PMSEIC)
- Organising forums and workshops on key science issues
- Developing science policy at a high level and providing input to Parliamentary Committees, Government Departments and Government reviews and inquiries
- Assisting member societies to raise and develop issues, and
- Distributing information to member societies weekly, and receiving feedback.

Highlights of 2008

- Forums on 'Rights and Obligations of Scientists and Researchers' and 'Supporting Risk-Aware Research'
- A national roadshow to gather inputs to FASTS' submission to the Cutler Review
- Submissions to reviews on Higher Education Research Training, Future Fellowships, Defence, Higher Education Endowment Fund, ERA journal ranking, Questacon, CRC
- Continuation of FASTS' successful request for release of ARC grants in early October
- FASTS' statement on Climate Change – reported in 145 media outlets
- FASTS' Taxonomy paper highlighting this endangered species at SmP 2008.

Ongoing and Future Projects

In 2009 FASTS will:

- Hold 'Science meets Parliament' on 17/18 March – *contact FASTS to attend*
- Provide to Parliament examples of science success stories *from FASTS' members*
- Present 'On the Radar' briefings on upcoming issues in science that need to be addressed by government, industry and the media – *contact FASTS with your ideas*
- Contribute to the development of National Curricula in science and mathematics
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ASOR Recent Advances in OR
Melbourne

The Australian Society for Operations Research (ASOR), Melbourne chapter organises a symposium on the *Recent Advances in OR* every year in Melbourne. In 2008, the symposium was hosted by the School of Engineering and Information Technology, Deakin University which was held on 26th November at their Burwood Campus. For ASOR Bulletin readers, we like to report the list of presentation here.

- Mr. Mehmet Ozmen (PhD Candidate, Monash University), Impact of oil prices and the level of pass through of costs as a proxy for carbon taxation responses
- Prof. Santosh Kumar (Victoria University & University of Melbourne), Some work on Pure Integer Programming
- A Prof. Moshe Sniedovich (The University of Melbourne), The Rise and Rise of Voodoo Decision Theories
- Dr Tristan Barnett (Stategic Games), Gambling Your Way to New York
- Dr. Bruce Craven (The University of Melbourne), Stock market returns, correlations, and what does GARCH mean
- Prof. Kate Smith-Miles (Deakin University), Learning the relationships between optimisation algorithm performance and problem structure
- Mr. Luke Mason (PhD Candidate, Deakin University), An exact method for the minimum cardinality problem in the planning of IMRT
- Miss Daphne Do (Honours, The University of Melbourne), Formulating and modeling robust decision-making problems under severe uncertainty
- Dr. Kerem Akartunali (The University of Melbourne), A heuristic approach for big bucket multi-level production planning problems
- Miss Jackie Rong (PhD Candidate, Deakin University), Extracting effective feature set for speech based emotion recognition

Call for Nominations for
the 'ASOR Ren Potts Award' - 2009

The Ren Potts award of the Australian Society for Operations research is intended to recognise individuals who have made outstanding contributions to theory or practice of OR in Australia. It is a national award restricted to Australian residents only. These awards will be conferred at a special ceremony to be organised as part of the forthcoming ASOR National Conference, which is scheduled to take place on the Gold Coast from 27-30 September, 2009.

ASOR Branches and Chapters are invited to submit nominations with supporting evidence to justify the nomination. Nominations, in first place, will be considered by a Sub-committee, Ren Potts awards, 2000 and approved by the ASOR National Committee.

Completed documentation should reach the Administrative Vice-President (Andrew.Higgins@csiro.au) latest by May 31, 2009.

Call for
ASOR New Researcher Encouragement Medal - 2009

At a recent meeting held on October 17, 2008, the ASOR National Council established an encouragement medal for new researchers who have completed a research degree at Master or PhD level in OR or in a related field with significant contribution to the advancement of OR from any Australian university. Normally candidates will be considered who completed all requirements for their degree between the two consecutive ASOR National conferences. Since this award is offered for the first time, all candidates who have completed their degree requirements after August 2005 are considered eligible to enter this competition. The award will be conferred in a special ceremony to be held at the forthcoming National conference, scheduled to take place on the Gold Coast from September 27-30, 2009.

In general there will be one medal awarded in each category. However, the ASOR National council will make the final decision. There will be no appeal to the decision of the council.

The selection committee will rate work by each applicant on a 5 point scale, considering:

- Originality
- Contribution to Theory
- Contribution to direct application, etc

Final decision will be based on sum of these ratings.

Interested candidate should submit, through their supervisor, an application in the form of a letter addressed to the Administrative Vice-President: Andrew.Higgins@csiro.au so as to reach him latest by May 31, 2009.

An application for the 'NREM Award' will be comprised of a letter with the following three attachments.

- Attachment 1: Proof of completion for the Master/PhD degree.
- Attachment 2. Summery of the thesis (highlighting OR contributions). This statement should not exceed 5 A4 pages in font size 12.
- Attachment 3. A letter from the applicant's supervisor to support his/her claim.
- If necessary, the committee through the VP (Admin) may seek additional information from the applicant before making their recommendations

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Forthcoming Conferences

IEEE Symposium on Computational Intelligence in Scheduling (CI-Sched 2009)
March 30 - April 2, 2009, Sheraton Music City Hotel, Nashville, USA
http://www.ieee-ssci.org/index.php?q=node/13

IEEE Joint Conference on Computational Sciences and Optimization (IEEE-CSO 2009)
24-26 April 2009, Sanya, Hainan Island, China
http://www.gip.hk/cso2009/

INFORMS Conference on OR Practice
April 26-28, 2009, Phoenix, Arizona
http://meetings.informs.org/Practice09

International Conference on Operations Research applications in Engineering and Management (ICOREM), 27-29 May 2009, Anna University Tiruchirappalli, India
http://www.virtourist.com/asia/india/tiruchirappalli/index.html

World Congress on Global Optimization in Engineering & Science (WCGO2009)
June 1-5, 2009, Zhangjiajie, Hunan, China
http://madis1.iss.ac.cn/wcgo2009/

International Conference on Optimization and Control with Applications (OCA2009)
June 6-11, 2009, Harbin and Wudalianchi, Heilongjiang, China
http://oca2009.hit.edu.cn

SimTecT 2009 Simulation Conference
15-16 June 2009, Adelaide
http://www.siaa.asn.au/simtect/2009/2009.htm

Third International Conference on Game Theory and Management (GTM2009)
June 24 - 26, 2009, St. Petersburg, Russia
http://www.gametheorysociety.org/conferences/

Optimisation Techniques at 2009 IEEE 7th Int. Conf. in Industrial Informatics (INDIN), June 24-26, 2009, Cardiff UK
http://www.indin2009.com/

The forth International Symposium on Scheduling (Int.S.S.09)
4 - 6 July 2009, Nagoya, Japan
http://www.fujimoto.mech.nitech.ac.jp/iss2009/

EURO XXIII 2009 Conference
July 5 – 8, 2009, Bonn
http://www.euro-2009.de

International Conference on Computers & Industrial Engineering (CIE39)
July 6 - 8, 2009, Troyes, France
http://www.utt.fr/cie39/

The 7th International Conference on Data Envelopment Analysis
July 10-12, 2009, Philadelphia, USA
http://www.DEAzone.com/DEA2009/info.htm

18th World IMACS Congress and International Congress on Modelling and Simulation
(MODSIM09) 13–17th July 2009, Cairns, Australia
http://www.mssanz.org.au/modsim09/

The 20th National Conference of the Australian Society for Operations Research 2009
28-30 September 2009, Gold Coast, Australia
http://www.asor.org.au/conf2009/index.php?page=1

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THE 20th NATIONAL CONFERENCE of AUSTRALIAN SOCIETY FOR OPERATIONS RESEARCH

incorporating

THE 5th INTERNATIONAL INTELLIGENT LOGISTICS SYSTEM CONFERENCE
Holiday Inn Surfers Paradise, Gold Coast, Australia

September 27th - 30th 2009

Dear colleagues,

On behalf of The Australian Society for Operations Research Inc., we are pleased to invite members and non-members to the ASOR 20th National Conference incorporating the 5th International Intelligent Logistics Systems Conference. We envisage a conference focusing on the broad range of areas in which operations research, logistics and operations research practitioners' work, within the theme "Making the Future Better by Operations Research". ASOR gives you a unique opportunity to keep up-to-date with operations research issues in Australia and overseas. We welcome you to attend the conference and participate in specialized workshops and sessions relating to your specific areas of interest and have informal discussions with researchers and practitioners. We expect everyone who attends this conference to receive value from the program and enjoy the atmosphere and surroundings of this first class venue.

For further information, please visit our conference web-site:
http://www.asor.org.au/conf2009/index.php?page=1

We look forward to seeing you at the Conference.

Yours sincerely,
Erhan Kozan
Chair,
ASOR Conference 2009

ASOR BULLETIN

Editorial Policy

The ASOR Bulletin is published in March, June, September and December by the Australian Society of Operations Research Incorporated.

It aims to provide news, world-wide abstracts, Australian problem descriptions and solution approaches, and a forum on topics of interests to Operations Research practitioners, researchers, academics and students.

Contributions and suggestions are welcomed, however it should be noted that technical articles should be brief and relate to specific applications. Detailed mathematical developments should be omitted from the main body of articles but can be included as an Appendix to the article. Both refereed and non-refereed papers are published. The refereed papers are *peer reviewed* by at least two independent experts in the field and published under the section 'Refereed Paper'.

Articles must contain an abstract of not more than 100 words. The author's correct title, name, position, department, and preferred address must be supplied. References should be specified and numbered in alphabetical order as illustrated in the following examples:

[1] Higgins, J.C. and Finn, R. Managerial Attitudes Towards Computer Models for Planning and Control. Long Range Planning, Vol. 4, pp 107-112. (Dec. 1976).

[2] Simon, H.A. The New Science of Management Decision. Rev. Ed. Prentice-Hall, N.J. (1977).

Contributions should be prepared in MSWord (doc or rtf file), suitable for IBM Compatible PC, and a soft copy should be submitted as an email attachment. The detailed instructions for preparing /formatting your manuscript can be found in the ASOR web site.

Reviews: Books for review should be sent to the book review subeditor A/Prof. G.K.Whymark, c/- the editors. Note that the subeditor is also interested in hearing from companies wishing to arrange reviews of software.

Advertising: The current rate is $300 per page, with layout supplied. Pro-rata rates apply to half and quarter pages and discounts are available for advance bookings over four issues.

Subscriptions: ASOR Bulletin electronic version is free for all members and non-members which is accessible through ASOR web site.

Deadlines: The deadline for each issue (for all items except refereed articles) is the first day of the month preceding the month of publication.

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