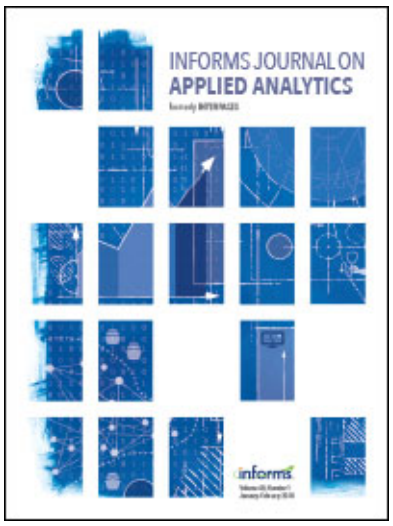
This article was downloaded by: [216.73.216.139] On: 13 July 2026, At: 19:52
Publisher: Institute for Operations Research and the Management Sciences (INFORMS)
INFORMS is located in Maryland, USA



Interfaces

Publication details, including instructions for authors and subscription information:
http://pubsonline.informs.org

The Last Few Words

To cite this article:
(1982) The Last Few Words. Interfaces 12(3):83-87. https://doi.org/10.1287/inte.12.3.83

Full terms and conditions of use: https://pubsonline.informs.org/Publications/Librarians-Portal/PubsOnLine-Terms-and-Conditions

This article may be used only for the purposes of research, teaching, and/or private study. Commercial use or systematic downloading (by robots or other automatic processes) is prohibited without explicit Publisher approval, unless otherwise noted. For more information, contact permissions@informs.org.

The Publisher does not warrant or guarantee the article's accuracy, completeness, merchantability, fitness for a particular purpose, or non-infringement. Descriptions of, or references to, products or publications, or inclusion of an advertisement in this article, neither constitutes nor implies a guarantee, endorsement, or support of claims made of that product, publication, or service.

© 1982 INFORMS

Please scroll down for article—it is on subsequent pages

With 12,500 members from nearly 90 countries, INFORMS is the largest international association of operations research (O.R.) and analytics professionals and students. INFORMS provides unique networking and learning opportunities for individual professionals, and organizations of all types and sizes, to better understand and use O.R. and analytics tools and methods to transform strategic visions and achieve better outcomes.
For more information on INFORMS, its publications, membership, or meetings visit http://www.informs.org

INTERFACES
Vol. 12, No. 3, June 1982
Copyright © 1982, The Institute of Management Sciences
0092-2102/82/1203/0083$01.25

THE LAST FEW WORDS

Editor's Note: Prospective writers to this journal were cautioned in our last issue not to prepare an ambitious, article-length reply to an article which inspired them to respond until they checked with this office to discover if some one else had already submitted such a response. We obviously do not want to print essentially duplicate commentaries, nor to have to construct an amalgam of replies as we did in the April issue. Below, therefore are the Last Words we plan to print on the Aggarwal article in the August 1981 issue and the Zeleny article in the October 1981 issue.

MORE ON "PURCHASE-INVENTORY DECISION MODELS FOR INFLATIONARY CONDITIONS"

(Sumer Aggarwal, *Interfaces*, Vol. 11, No. 4, pp. 18–23)

Four responses to this paper were summarized in Vol. 12, No. 2 of *Interfaces*. A fifth, sent by Professor Edward A. Silver of the Faculty of Management at the University of Calgary, was received too late for inclusion in that issue.

Professor Silver's submission closely paralleled the other four responses in terms of commenting on (a) the bizarre behavior of Aggarwal's results and (b) the inappropriate use of total, as opposed to marginal, economic analyses. With regard to the second point Professor Silver mentioned his related article in the August 1979 issue of *Interfaces*.

For Situation I, namely, a final chance to place a reorder before a step increase in the purchase cost, he used a marginal analysis to obtain the following results:

- Using Aggarwal's approximate expressions for total costs and total savings; the size of the special one-time order is:

$$Q^* = Q_o + pD/i,$$

where Q_o $\left(= \sqrt{2SD/Ci} \right)$ is the EOQ (in units) at the current price, and the other variables are as defined by Aggarwal.

- Using a more exact model (recognizing that future orders will be at a new lower EOQ level because of the price increase),

$$Q^* = Q_o' (1+p) + pD/i,$$

where $Q_o = \sqrt{2SD/(1+p)Ci}$ is the EOQ that would be used on future orders.

This latter Q^* result is the same as that obtained by Naddor [1966], who used a slightly different, but mathematically equivalent, criterion in his derivation. Furthermore, Peterson and Silver [1979] have extended Naddor's model to handle the situation of multiple items subject to a budget constraint on the dollar value of the total special purchase.

Downloaded from informs.org by [216.73.216.139] on 13 July 2026, at 19:52 . For personal use only, all rights reserved.

Downloaded from informs.org by [216.73.216.139] on 13 July 2026, at 19:52 . For personal use only, all rights reserved.

With regard to Situation II, namely, the unit purchase cost is subject to a constant rate of inflation, Professor Silver, using Aggarwal's model but with a marginal analysis, developed the following result for the order quantity to be used (repetitively) under inflation:

$$Q^* = Q_0 (1/2 + P/i),$$

where P is the fractional increase in unit purchase cost (caused by inflation) per year.

For small values of P/i this result says that Q^* is less than Q_0, which is intuitively unappealing. Consistent with the earlier respondees, he then argued that this is a consequence of one or more of several flaws in Aggarwal's model of this situation, namely, (a) it no longer necessarily follows that a fixed-order quantity is appropriate under *continuing* inflationary conditions; (b) Aggarwal allows only the purchase price, and not the setup cost, to be affected by inflation; (c) under continuing inflation the carrying charge i is almost certain to increase as opposed to remaining constant; and (d) a finite horizon model is used when, in fact, conditions continue to change through time because of inflation. Furthermore, he pointed out that Buzacott [1975] has treated this type of situation in considerable detail.

In summary, Professor Silver supported Aggarwal's "philosophy of finding simple, intuitively appealing decision rules ... which would probably be more understandable to the typical inventory manager." However, he argued that these should be based upon sound logical analysis, not upon questionable assumptions and incorrect economic reasoning.

References

Buzacott, J. A., 1975, "Economic Order Quantities with Inflation," *Operational Research Quarterly* Vol. 26, No. 31, pp. 553–558.

Naddor, E., 1966, *Inventory Systems*, John Wiley and Sons, pp. 96–102.

Peterson, R. and Silver, E. A., 1979, *Decision Systems for Inventory Management and Production Planning*, John Wiley and Sons, NY, pp. 191–195.

Silver, E. A., 1979 "A Comment on a Behavioral Derivation of the EOQ," *Interfaces* Vol. 9, No. 4, pp. 146–147.

THE AUTHOR REPLIES

I was glad to receive copies of five letters from the editor of *Interfaces* which were received in relation to my paper, "Purchase-Inventory Decision Models for Inflationary Conditions," that had appeared in *Interfaces*, August 1981, pp. 18–23. Important extracts from these letters appeared in *Interfaces*, April 1982, under the heading "Awful August." I present my counter arguments to each below. (I replied to Mr. Schneider's letter in the April issue.)

Letter from Mr. Chien-Ching Cho, The Mitre Corporation, Bedford, Massachusetts.

For obtaining a mathematically feasible solution, Cho suggests that we should drop the larger part of the expression for carrying cost [i.e., the part $(Q^* - Q_0)\,CPI$] from consideration. We do not have such an easy option, because this part of the carrying costs is significant and hence must be retained.

Following that, Cho makes an unrealistic assumption that Q^* should be an integer multiple of Q_0 and then develops an annual total cost function, assuming unit cost to be equal to the market price at the time of its actual usage. On one hand, he suggests that we should buy in lots of size Q^* at one point of time; on the other hand, he says that for our derivation we should use the *unit* market price at the time of actual usage. His focus seems to be just on obtaining a soluble mathematical expression. A little later he forgets about his annual cost function and suggests that we must update the values of C, D, and S before the next reorder. This means he is suggesting the use of one-cycle calculations only. This is what I have done, and I do not find any improved results in Cho's derivations.

Letter from Professor A. U. Michelson, The Technical University of Denmark.

Professor Michelson's contention that my expressions for extra inventory carrying costs and savings in reordering costs are for a historical period is totally incorrect. We are actually considering the advantage from the old unit cost rate that is still available to us in relation to the higher unit purchase cost rate that would become effective after this last reorder has been issued.

Once again, the problem with Michelson's derivation is that he calculates total inventory-related costs per year, whereas Situation I is supposed to cover the period of the next reorder only. His criterion of total cost per year cannot be applied to a limited period during which this single reorder will fulfill the demand of the period. Michelson is mixing up continued reordering of Q_0 with the single order Q^*.

For Situation II, Michelson is considering an infinite time horizon. My focus is on the next single reorder, because under continuous inflation the values of relevant parameters at the time of the second replenishment order would be altogether didferent. Michelson's main concern seems to be the availability of a mathematical solution; anyone can obtain such a solution using an infinite horizon and an exponential discount rate.

Next, Michelson assumes each of the future reorders to be a stream of investments and obtains their total present value which in turn provides Q^*. It is a smart mathematical manipulation, but he has ignored the inventory carrying costs altogether in developing an inventory model.

Letter from Professor D. Ronen, University of Missouri – St. Louis.

For Situation I, Professor Ronen chooses his criterion to be the maximization of savings from the next single reorder. In practice, the manager is always worried about the possibility of additional price hikes in the near future, and that is why he would be anxious to cover the longest period in the future at the currently available price. That is why I feel my criterion, which keeps the total inventory-related costs with Q^* at those available with Q_0 in the past, is more appealing and realistic under high inflationary conditions. If we use short-term savings as the criterion, irrespective of the length of the future period covered, then Ronen is right. But often the manager's primary concern is to avoid the second price hike of the future.

For Situation II, Ronen again makes the same suggestion of choosing the maximization of savings as the decision criterion, irrespective of the time horizon. In fact, our main concern should be the coverage of the longest period in the future without increasing the total inventory-related cost rate.

Downloaded from informs.org by [216.73.216.139] on 13 July 2026, at 19:52 . For personal use only, all rights reserved.

Letter from Professor E. A. Silver, University of Calgary.

Silver's derivations provide the same results as those of Ronen and have indirectly used the same criterion — i.e., the maximization of savings, irrespective of the length of the future period covered. My reply to Professor Silver's comments is exactly the same as to those of Ronen.

Sumer C. Aggarwal
The Pennsylvania State University, University Park, Pennsylvania 16802.

DE NOVO PROGRAMMING — FINAL ROUND

A fifth and sixth response to the article by Milan Zeleny, "On the Squandering of Resources and Profit via Linear Programming," in the October issue arrived too late to be included with the other replies in the April Letters to the Editor. In the first of these, entitled "It's Delightful, It's Delicious, But It's Not de Novo, or I Got Algorhythm," the writer concurs with the earlier submissions and makes a distinction between an activity analysis program and a design program as developed by Professor Zeleny, concluding with the following observation:

> It is obvious why the design linear-programming problem yields a better solution; it is less restrictive. (The budget constraint is implied in the activity-analysis problem.) If you were the company manager, would you use the design solution? Is it really any good? Note that you do not make any product y. What about those customers that bought some x and some y from you? Where will they take their business? Your sales force and marketing department would never let you use that solution!
>
> What is the correct answer? Who knows? Should we put a lower bound on y to make the marketing department happy? Why not? It will reduce profits, keep the budget at $2,600, but you will keep your customers. Is the budget of $2,600 really fixed? Marginal analysis shows that an extra $1 would yield $1.13 in profit. For every $354 added to the budget, you make $400. A nice business.
>
> How high can the profits go? Depends on how much money you can borrow from the bank. Add to the budget and we can make more profit by producing only x. What is the customer demand for this seasonal product? Can we sell all the x we can make? Can we make all the x we want? Etc., etc., etc. The main lesson of Professor Zeleny's article is for analysts (MBA's or otherwise) to do a complete analysis in conjunction with the managers and operations personnel. In other words, do a good Operations Research study, and learn what it means to be a consultant.
>
> *De novo programming* — the designing of optimal systems — has been an area of linear programming for years; it is usually termed problem synthesis. It was introduced in network analysis by Ford and Fulkerson [*Flows in Networks,* Princeton University Press, 1962] and Gomory and Hu [An Application of Generalized Linear Programming to Network Flows, IBM Research Report, 1960]. It is also implied by Dantzig and Wolfe in their work in generalized programs [see Chapter 22 of Dantzig, *Linear Programming and Extensions,* Princeton University Press, 1963]. I do not think this "supreme problem of optimization theory" has been neglected or avoided in the past, as Professor Zeleny claims. Operations Researchers, like the birds and the bees, just do it.

Saul I. Gass
College of Business and Management
University of Maryland, College Park, Maryland 20742

The sixth and seventh correspondents on this paper, Professors Yash Aneja and A. Hamdi-Noori of the University of New Brunswick, Canada, writing jointly,

Downloaded from informs.org by [216.73.216.139] on 13 July 2026, at 19:52 . For personal use only, all rights reserved.

essentially duplicated the corrections of their predecessors and ended, as we will, with the comment:

> . . . The problem does not lie with the philosophy of linear programming as claimed. The blame has to be shared by managers who develop inadequate models.
>
> If a given system, when optimized, leads to slacks, then attention has to be focused clearly on these underutilized resources. In many situations, however, it may not be feasible to reduce some of these resources in the short run. How various "givens" of the model came into being could be due to market conditions prevailing at the time the system was set up. The conditions now might be different and demand feasible adjustments to these resources. This does not imply squandering of resources.

Downloaded from informs.org by [216.73.216.139] on 13 July 2026, at 19:52 . For personal use only, all rights reserved.