Management Adviser

Volume 8 | Number 2 Article 8

3-1971

Sales Variances: A Further Look

Robert E. Malcom

Cost variances have been discussed from every angle, but sales variances have been comparatively neglected in accounting literature. Current conditions require much closer analysis, this article suggests —

SALES VARIANCES: A FURTHER LOOK

by Robert E. Malcom
The Pennsylvania State University

SALES VARIANCE methods, like cost variance methods, have been discussed in the accounting literature for several decades.[1] Sales variances have never received the detailed attention accorded cost variances, however. Perhaps because of this, an orthodox sales variance methodology does not seem to have evolved as has happened with cost variances.

This article will examine possible reasons for the lack of attention to sales variances and suggest why these reasons may no longer be valid. One of these reasons applies to differences between the orthodox variances used for cost analyses and alternate variances developed for revenue analyses. In this regard, an illustration will be presented in which only the price-quantity variances of cost accounting are considered appropriate for revenues and the price-volume-mix variances generally shown are actually inappropriate.

Three reasons may be discerned to explain the relative lack of attention accorded sales variances as compared to cost variances. First, the emphasis on cost variances over sales variances may be a carryover from a period when the bulk of manufactured products had not too much to differentiate them from competitive items. Sales variances were therefore subject to little control. This is in notable contrast to today's market-oriented economy. Now product differences are highly advertised, and even slight innovations may result in substantial sales changes. The increase in controllability of sales variances from environmental changes would alone seem to call for more attention to sales variance analysis than is evident in accounting literature.

A second reason for the relative lack of attention to sales variances may be the wish of companies to avoid the costs of maintaining records for sales at standard as well as actual prices and quantities. The use of cost standards by manufacturers can actually simplify the recordkeeping system by having all units of given items at a single

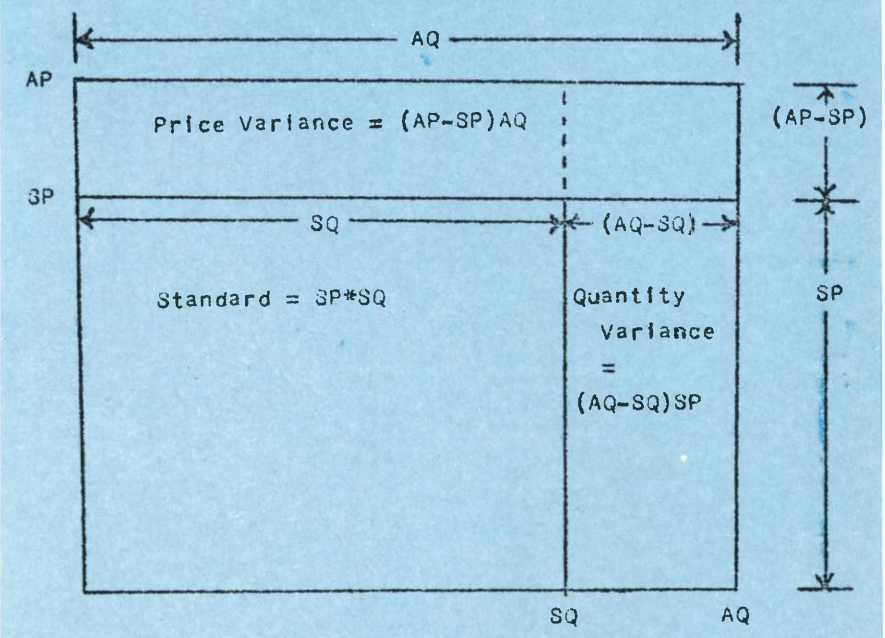
price, but this is not true in the sales situation. Since sales are taken to the income statement as they occur, there is no complex Lifo or Fifo system to simplify. However, with the extensive use of computers the incremental processing cost of sales standards should now be only a fraction of its former amount. This will especially be true where budget reports are already computerized.

Finally, the greater apparent complexity of sales variances may be a point of concern. Whereas the standard price and quantity variances for direct material and direct labor are relatively easy concepts for operating persons to grasp, the usual sales analysis includes a mix variance as well.[2] The calculation of a mix variance not only means increased complexity in the variance analysis but may lead to erroneous actions when misapplied.

Happily, in some circumstances, the basic two-way analysis as used in standard cost techniques is both more appropriate than the analysis using a mix variance and less confusing to the user. This will be demonstrated by the use of examples with hypothetical data.

Figure 1

Basic Cost Accounting Variances



AP = Actual Price
SP = Standard Price
AQ = Actual Quantity
SQ = Standard Quantity
* Indicates multiplication

Basic analyses

The basic analyses to be performed are the calculation of price variances and quantity, or volume (used interchangeably), variances. These are shown graphically in Figure 1, above right, for the case where actuals exceed standards for both items. The two variances are as defined in orthodox standard cost analysis (with symbols as keyed in Figure 1):

$$\text{Price Variance} = (AP - SP)AQ$$
$$\text{Quantity Variance} = (AQ - SQ)SP$$

While some writers have argued that the joint price-quantity variance should be set forth separately, this is generally not done, and the arguments will not be repeated here.

One departure from the conventional application of the formulas will be made. Instead of working with gross sales price per unit, the contribution margin per unit will be used.[3] As standard costs are assumed, the price variance will be unchanged by this substitution. The substitution does act to simplify the interpretation of the quantity variance, however. The effect of a quantity change in sales on profit is the quantity change extended at the contribution margin per unit, *not* the full sales price per unit. (In the absorption costing context, gross profit rather than contribution margin applies equally well, of course.)

Quantity and price variances

Proceeding on this basis, individual variances for each product are computed in Exhibit 1, page 50 (with F indicating favorable and U indicating unfavorable variance).

As can be seen, quantity variances are in opposite directions for each product. The quantity variance is unfavorable for Product A and favorable for Product B. The price variance is favorable for Product A and zero for Product B.

Adding both of the same types of variances together, we obtain a total unfavorable quantity variance of $550 and a total favorable price variance of $50, explaining the unfavorable difference between budgeted and actual profit of $500.

Now let us go a bit beyond the usual cost method of analysis and compute price and quantity variances on a grouped, or product line, basis. This computation is shown in Exhibit 2, page 50. The same basic formulas are used, but with combined quantities and average prices (weighted) for both products.

The results are not equivalent. Whereas the item analysis of Exhibit 1 gives a favorable price vari-

EXHIBIT 1

Sales Variances per Orthodox Cost Analysis

Price = contribution margin dollars per unit
Quantity = unit volume

	Product A	Product B	(A + B)
Actual Quantity	1,000	1,000	
Standard Quantity	1,200	900	
AQ — SQ	—200	100	
Actual Price	$3.80	$2.00	
Standard Price	3.75	2.00	
AP — SP	$ .05	$0.00	
Quantity Variance	—$750 U	+$200 F	—$550 U
Price Variance	+50 F	—0—	+50 F
Total Variance	—$700 U	+$200 F	—$500 U

EXHIBIT 2

Sales Variances—Grouped Basis Versus Added Basis

	Product Line AB (Grouped Data)	A + B, or Added Basis (Per Exhibit 1)
Actual Quantity	2,000	
Standard Quantity	2,100	
AQ — SQ	—100	
Actual Price	$2.90	
Standard Price	3.00	
AP — SP	—$ .10	
Quantity Variance	—$300 U	—$550 U
Price Variance	— 200 U	+ 50 F
Total Variance	—$500 U	—$500 U

EXHIBIT 3

Item Mix Variances for Products A and B

	(1) Actual Units Proportion	(2) Budgeted Units Proportion	(3) Proportion Difference (1) — (2)	(4) ΣAQ	(5) SP/unit	(6) Mix Variance (3) × (4) × (5)
A	.5000	.5714	—.0714	2000	$3.75	—$535 U
B	.5000	.4286	+.0714	2000	2.00	+ 285 F
	1.0000	1.0000	0.0000			—$250 U

ance, the grouped analysis gives an unfavorable price variance, and of large relative size.

This paradoxical result is caused by the fact that the product mix has changed from that budgeted. Higher-margin Product A sold in lower volume than planned, and lower-margin Product B sold in higher volume than planned. The overall result was a decrease in the *average* unit margin of product line AB from a budgeted $3.00 to an actual $2.90. Thus an apparent unit price variance can occur in one direction for a product line while the prices for the items which make up the line can change in opposite directions. This illustration demonstrates that great care must be used in interpreting results for grouped data. Only the added item method yields the correct interpretation about unit prices achieved.

The question follows as to whether the use of grouped data is ever appropriate. The answer is a qualified yes. Some managements might wish sales variance analyses for products lines or groups of product lines, but not for individual products. In these instances only the grouped calculations need be made, evaluating each product line as a single item. In fact, much of the available literature suggests only product line analysis. Some information is lost in the grouping process, but management's judgment may be that the cost of the detail will not be worth the benefit from it.

A second comparison between the added and grouped calculations is also of interest. It turns out that the difference between quantity variances as calculated by the added and grouped methods is exactly the same as the only mix variance judged proper by J. B. Hobbs.[4] This latter variance will now be examined further.

As defined by Hobbs, the mix variance for each item is the difference between the actual proportion of the item sold and the budgeted proportion sold, which is multiplied by the total of all units sold and

the standard price for the item. For this formula, the data for Products A and B yield the results of Exhibit 3, page 50.

It is submitted that the variance for Product B shown in Exhibit 3 is actually misleading. Product B has a reported favorable mix variance even though its standard price of $2.00 is below the group standard price of $3.00 and the effect of selling a higher proportion of Product B is to lower the group margin. Product A's variance is unfavorable, as indicated, as less has been sold of an above-average-price item. Whether any *item's* mix variance is truly favorable or not depends on its effect on the group margin.

With the Exhibit 3 analysis, however, an increase in proportion of *any* item, whether above average profit or below average profit, will show a favorable mix variance, even though there are opposite effects on group margin. Similarly, a decrease in proportion of any item will show an unfavorable mix variance, even though the effect on group margin may be to raise or lower it.[5]

The use of an *item mix* variance becomes even less desirable when the resulting *item volume* variance is examined.[6] With a mix variance inserted, the resulting item volume variance becomes the difference between the standard quantity of the item and the planned proportion of the item multiplied by the total of all units sold, extended at the standard price of the item as in Exhibit 4, above right.

Exhibit 4 gives a strange result!

EXHIBIT 4

Item Volume Variations for Products A and B (with Mix Variance)

	(1) Budgeted Units Proportion	(2) ΣAQ	(3) Product (1) × (2)	(4) SQ	(5) Difference (3) — (4)	(6) SP	(7) Volume Variance (5) × (6)
A	.5714	2000	1143	1200	—57	$3.75	—$214
B	.4286	2000	857	900	—43	2.00	— 86
	1.0000		2000	2100	—100		—$300

Both item volume variances are unfavorable, even though the actual quantity sold of Product B was more than budgeted. A second look at the formula illustrates why. Since the planned proportion of each item is multiplied by the total actual quantity of *all* items before comparison to the item standard, the item volume variance *only* reflects the *overall volume variance*. As noted by L. S. Drake in regard to his somewhat similar item analysis, "Unless volume is regarded as an effect which, on an *overall basis*, indicates performance above or below budget, it cannot be separated from product mix."[7] However, there is no point in computing an *item* volume variance, as above, when the only result is to allocate the overall volume effect to each item.

The sales mix variance can be helpful and deserves a further look, but only on a total basis. An equivalent formulation of the *total* mix variance is the difference between the average of the standard item prices weighted for the *actual* mix as compared to the *budgeted mix*, extended by the actual total quantity of all items. This is illustrated for Products A and B in Exhibit 5, below.

Note that the calculation does not give the actual average price of $2.90 of Exhibit 2. Exhibit 5 yields the same total unfavorable mix variance of $250 as obtained by summing the item mix variances in Exhibit 3.

The interpretation of the Exhibit 5 formulation is very different from the Exhibit 3 formulation, however.

EXHIBIT 5

Total Mix Variance for Products A and B (Via Comparative Standard Prices)

Actual Mix Weights
$\Sigma(AQ \times SP)/\Sigma AQ$

	AQ	SP	AQ × SP	
Product A	1,000	$3.75	$3,750	
Product B	1,000	2.00	2,000	
Total	2,000		$5,750	
Average				$2.875

Budgeted Mix Weights
$\Sigma(SQ \times SP)/\Sigma SQ$

	SQ	SP	SQ × SP	
Product A	1,200	$3.75	$4,500	
Product B	900	2.00	1,800	
Total	2,100		$6,300	
Average				3.000
Actual Mix Average less Budgeted Mix Average				—$ .125
Actual Total Quantity				×2,000
Total Mix Variance				—$ 250 U

ROBERT E. MALCOM, CPA, is an associate professor of accounting at The Pennsylvania State University. He previously was on the Ohio State University faculty and a staff accountant with Lybrand, Ross Bros. & Montgomery. Dr. Malcom is author and coauthor of several professional books and articles. He received his B.S. from Miami University, Ohio, and his M.B.A. and Ph.D. from Ohio State.

EXHIBIT 6

Summary of Sales Variances for Products A and B
(Unit Volume Basis)

Mix Variance (from Exhibit 5)	—$250 U
Other Volume Variance (imputed)	— 300 U
Total Volume Variance (from Exhibit 1)	—$550 U
Price Variance (from Exhibit 1)	+ 50 F
Total Sales Variance	—$500 U

In Exhibit 5 the mix variance can be seen as the effect of mix on the average standard price, the effect being caused by disproportionate changes in the volumes of the various items which make up the group. Then an item *on its own* has no mix, but only volume, change.

This total mix variance may be a key figure for many managements. For example, many product lines include a lower-margin price leader model, and often a higher-margin very de luxe model. Management naturally wishes to emphasize the higher-margin items, but salesmen may find it easier going to emphasize lower-margin items. Thus a salesman might meet his unit quota, with each item at its standard price, but because of mix shifts he could be far short of contributing his share of planned profit. The total mix variance will highlight this situation.

Even on a total basis, however, it appears desirable to label mix variance as a part of volume variance, since it is in fact due to volume changes of individual items. The presentation could be as in Exhibit 6, above, for Products A and B.

Note that the total volume variance in Exhibit 6 is exactly the same as the sum of the item quantity variances of Exhibit 1. *This means that the total mix variance can be tied in to the summed item quantity variances from the orthodox cost analysis formulation.* Price variance is also the same as in Exhibit 1. Thus the best features of both orthodox cost analysis and revenue analysis can be combined together.

So far all sales variance analyses have been based on quantity measured as physical units of output. This seems to be the method described in the majority of the literature and is the basic methodology of standard cost analysis. As noted by C. T. Devine,[8] however, "If 100 wrenches were sold in one period and 100 boilers were sold in another, no volume variance appears. A desirable modification measures volume changes in terms of dollars of sales." R. Beyer[9] and L. S. Drake[10] are other writers who make use of volumes measured by dollars, although in differing presentations.

The example data of Exhibit 1 for Products A and B are recast in this alternate analysis in Exhibit 7, below. All formulas used are exactly as in Exhibits 1 and 2, but price is now measured by percentage contribution margin per unit, while volume is measured by sales dollars. The contribution margin percentages are based on actual full sales prices per unit of $10.05 and $8 for Products A and B, respectively, and standard full sales prices per unit of $10 and $8 for Products A and B, respectively. Note that the data are again shown under both an added basis and a grouped basis.

Although several figures have changed, the overall interpretation of the data is still the same as in Exhibits 1 and 2. This includes the differing results for the added basis and grouped basis price variance. However, it is easy to think of situations where unit volume might increase and dollar volume decrease, or vice versa, due to simultaneous price changes. The mix variance, if calculated, can also change in sign. Thus the change in units' definition can give vastly different results.

There may be some users who would wish to receive reports on both unit volume and dollar volume bases. The dollar measure of volume especially seems more appropriate to higher levels of management. The diversity of a company's output would be a consideration as well as the management level, however. Also to be considered is the desirability of having reports at a given level articulate with reports above and/or below that level.

Enough report possibilities have been presented in this discussion to see that there is no such thing as "the" proper analysis. Additional report possibilities are also advocated in the references cited. This does not mean that the type of

EXHIBIT 7

Sales Variance Analysis
Price = contribution margin percentage
Quantity = dollar volume of sales

	Product A	Product B	A + B (Added)	AB (grouped)
Actual quantity	$10,050	$8,000		$18,050
Standard quantity	12,000	7,200		19,200
AQ — SQ	—$ 1,950	$ 800		—$ 1,150
Actual Price	37.811%	25.000%		32.133%
Standard Price	37.500%	25.000%		23.813%
AP — SP	.311%	—0—		—.680%
Quantity Variance	—$731 U	$200 F	—$531 U	—$377 U
Price Variance	31 F	—0—	31 F	—123 U
Total Variance	—$700 U	$200 F	—$500 U	—$500 U

sales variance analysis can be chosen without care. As demonstrated by J. B. Hobbs[11] and in the previous discussion, some methods may lead to dysfunctional results.

On the other hand, as pointed out by Beyer,[12] the major point about sales variances "is not the absolute correctness of one particular method of calculating them, but the inherent advantages of reporting this kind of data, even if based on rather crude calculations." He further notes that the use of sales variances acts to increase the precision of sales planning,[13] which may be as important as the attention-focusing function of the variance reports.

All of the analyses considered above may be faulted somewhat because the different variances are treated as if they were independent when, in fact, they are interrelated. Price changes, for example, affect profit not only in a direct manner but also through their effect on mix and volume. Jointness has not proven a serious deterrent in the use of cost variances, however, and the practical benefits of the latter are well established.

Practicality is also the key in determining which sales variances should be reported and in what form they should be reported. The reports will be useful only as they influence employee and management behavior toward furthering company objectives. Sales variance reporting may eventually prove even more useful than cost variance reporting in this regard.

Today's business environment is more marketing-oriented than ever before. Computers are making detailed data analyses relatively cheaper than ever before. Management is more attuned to the use of readily comprehensible control reports than ever before. All of this suggests that the time is ripe for the extensive use of variance reports for sales.

In the past, the typical analysis for sales variances has separated out three variances: price, quantity, and mix. For higher-level reports, this is still desirable. For lower-level operating reports, this is not only fairly confusing, but may be misleading. For single products, a mix variance should not be calculated. Reports instead should give only a two-way, price-quantity analysis, as is done in the customary standard cost analysis.

Sales variance reports may also be prepared using dollar volume rather than unit volume to measure quantity. This yields different results from the traditional cost method of analysis, even though the basic formulas are the same. For higher management levels and where a diverse output is reported, dollar volume seems especially appropriate.

For any method of analysis the important point is the usefulness of the report to management. Sales variance reports may be useful in two basic ways: (1) in focusing attention on situations in possible need of management action and (2) in increasing the precision of sales planning.

---

[1] Early writers were G. C. Harrison (G. Charter Harrison, *Standard Costs: Installation, Operation, and Use*, Ronald Press Company, New York, 1930, pp. 68-72) and E. A. Cammon (Eric A. Cammon, *Basic Standard Costs*, American Institute Publishing Company, New York, 1932, pp. 119-150). The methods of both have been summarized by C. T. Devine (Carl Thomas Devine, *Cost Accounting and Analysis*, The Macmillan Company, New York, 1950, pp. 506-524, and Carl Thomas Devine, "Variations from Standards and Technical Considerations of Variation Analysis," *Handbook of Cost Accounting Methods*, J. K. Lasser, ed., D. Van Nostrand Company, Inc., New York, 1949, pp. 93-112).

[2] The methods of Cammon and Harrison both included mix variances. The method discussed in this article is the one evaluated as proper by J. B. Hobbs in 1964 (James B. Hobbs, "Volume-Mix-Price/Cost Budget Variance Analysis: A Proper Approach," *Accounting Review*, October, 1964, pp. 905-913). This formulation was demonstrated in 1935 by C. Gillespie (Cecil Gillespie, *Accounting Procedures for Standard Costs*, Ronald Press Company, New York, 1935, pp. 181-183). Equivalent analyses, although in substantially different formats, are made by C. A. Smith and J. G. Ashburne (C. Aubrey Smith and Jim G. Ashburne, *Financial and Administrative Accounting*, Second Edition, McGraw-Hill Book Company, Inc., New York, 1960, pp. 457-462), C. T. Horngren (Charles T. Horngren, *Cost Accounting: A Managerial Emphasis*, Second Edition, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1967, pp. 683-686), M. Schiff and L. J. Benninger—but only "Case II" of six variations shown—(Michael Schiff and Lawrence J. Benninger, *Cost Accounting*, Second Edition, The Ronald Press Company, New York, 1963, p. 501), and Fred M. Kirby (Fred M. Kirby, "Variance Analysis—The 'Step-Through' Method," *Management Services*, March-April, 1970, pp. 52-53).

[3] This type of adjustment is common. For this reason, references to sales variances are sometimes found under the label of contribution margin analysis in the more current literature and gross margin analysis in the older literature.

If gross sales prices are used to compute the sales volume variance, then budget cost volume variance of opposite effect must also be computed. This budget cost volume variance is due to sales volume effects rather than manufacturing effects; thus further interpretative confusion may result. For an analysis that uses the gross sales price approach see M. Schiff and L. J. Benninger (*op. cit.*, pp. 498-504) or J. B. Hobbs (*op. cit.*, pp. 905-910), who demonstrates both approaches.

[4] James B. Hobbs, *op. cit.*, p. 907.

[5] This has been noted in a cost context by C. R. Hasseldine (C. R. Hasseldine, "Mix and Yield Variances," *Accounting Review*, July, 1967, pp. 508-509).

[6] Hobbs does not present an item volume variance formula. The one used here is that given by C. T. Horngren (*op. cit.*, p. 684) in his equivalent analysis.

[7] Drake's formulation varies from that of Hobbs, but the general approach is the same. See Louis S. Drake, "Effect of Product Mix Changes on Profit Variance," *N.A.A. Bulletin*, October, 1961, p. 64 (emphasis added). This observation is also made in a cost context by C. R. Hasseldine (*op. cit.*, p. 500).

[8] Carl Thomas Devine, *Handbook of Cost Accounting Methods* article cited in footnote 1, p. 112.

[9] Robert Beyer, *Profitability Accounting for Planning and Control*, Ronald Press Company, New York, 1963, p. 337.

[10] Louis S. Drake, *op. cit.*, pp. 67-70.

[11] James B. Hobbs, *op. cit.*, pp. 910-912.

[12] Robert Beyer, *op. cit.*, p. 338.

[13] *Ibid.*, p. 339.