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Variance Analysis: A Management-Oriented Approach

John K. Shank and Neil C. Churchill

ABSTRACT: This paper describes and illustrates an approach to teaching variance analysis which the authors have found to be very effective with their students. The approach is based on the dual ideas of profit impact as a unifying theme and a multi-level analysis in which complexity is added sequentially, one layer at a time. The analysis stops when additional complexity is not outweighed by additional "actionable" insights.

MANY students in cost accounting and management accounting courses have considerable difficulty with the general subject area of variance analysis. We believe that much of this difficulty stems from the lack of a clearly established framework for evaluating the significance of individual variances and the lack of a clear perspective regarding how much detail is really necessary. How deep an analysis is "deep enough," and how do we decide how much detail is "useful"?

We believe that the concerns with variance analysis which stem from these causes can be reduced significantly by using the pedagogical approach to the material described in this article.

The approach discussed here organizes all variances in terms of their impact on the reported net income of the business or business unit. In our opinion, this viewpoint provides the student with a clear perspective regarding the importance of individual variances. That importance relates directly to the impact of the variance on the reported "bottom line" results of the business. Students seem to understand and relate well to the concept of profit motivation in business. Tying variance analysis to this idea pro-

vides a useful unifying theme to what otherwise can appear to be a somewhat disjointed set of procedures and concepts.

The level of detail which is appropriate in different circumstances for different cost or revenue variances certainly cannot be prespecified. It is almost a truism that the appropriate level of detail varies in different circumstances. However, the student need not be left floundering with this dilemma. It is possible to organize variance analysis in terms of progressively more complex levels. As each new level is added, the variances calculated at the preceding level are each broken down into finer detail. The process stops when the added complexity at a newly created level is not justified by added useful insights into the causal factors underlying the overall profit variance.

We have found the dual ideas of profit impact as a unifying theme and a multi-level approach to be a very useful way to present variance analysis to our students. In the remainder of this note we will illustrate this management-oriented approach

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with a simple, hypothetical example.
 In the interest of brevity, most of the

calculational detail will be suppressed.
 Since the approach is what is being em-

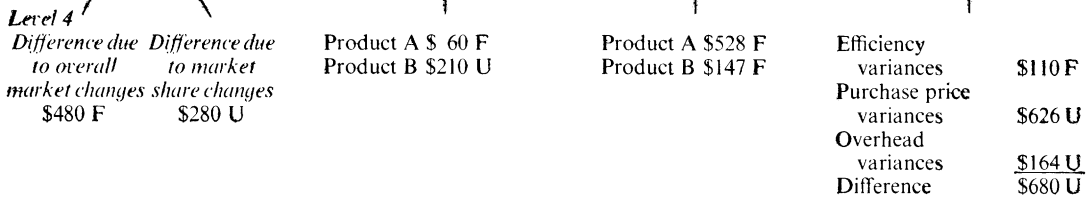
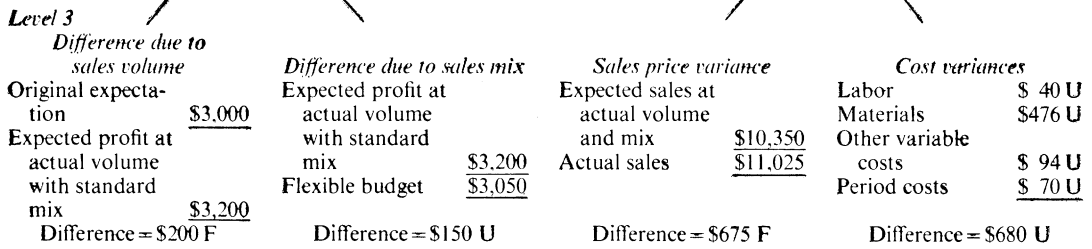
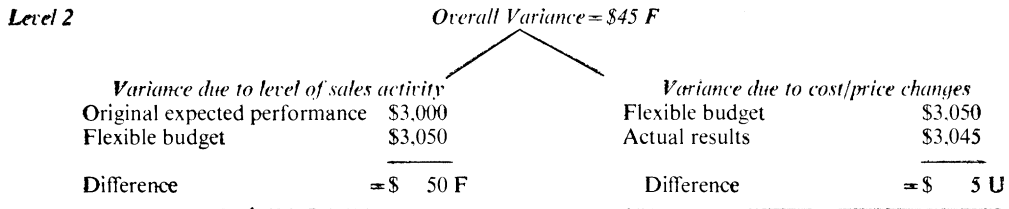
FIGURE 1
 EXPLAINING PROFIT VARIANCES: A SEQUENTIAL ANALYSIS APPROACH

Level 0

Expected Profit	= \$3,000
Actual Profit	= \$3,045
Variance	= \$ 45 F

Level 1

	<i>Expected</i>	<i>Actual</i>	<i>Variance</i>
Sales Revenue	\$10,000	\$11,025	\$1,025 F
Costs	7,000	7,980	980 U
Profit	\$ 3,000	\$ 3,045	\$ 45 F



Level 5

:	:	:	:	:
:	:	:	:	:
:	:	:	:	:

phasized rather than the calculations, and since the calculations are well identified in the literature, we see no need to detail them here.¹ An overview of the example and the approach we are advocating are shown in Figure 1.

THE RECOMMENDED APPROACH ILLUSTRATED

Variance analysis is the term applied to the process of specifying the reasons why actual profits in any given period differ from the expected or planned level of profits.² A variance analysis is the first step in determining what corrective actions are called for by management.

The most crude form of a profit variance analysis is as follows:

Expected profits	\$3,000
Actual profits	3,045
Profit variance	\$ 45 favorable

The first level of analysis (Level 0) identifies the fact that actual profits were \$45, or 1.5 percent, more than expected. Exploring the situation a bit further, we could expand the analysis as follows:

Level 1

	Expected	Actual	Difference	
Revenues	\$10,000	\$11,025	\$1,025	Favorable
Expenses	7,000	7,980	980	Unfavorable
Profit	\$ 3,000	\$ 3,045	\$ 45	Favorable

Here we see a substantial favorable variance in revenues of \$1,025 (10.3 percent) which is largely offset by an unfavorable expense variance of \$980 (14.0 percent). This illustrates one danger in stopping too soon—what appears to be a small total variance actually may be the result of larger but offsetting differences. We will deem as “Level 1” an analysis which compares, on as detailed a basis as desired, actual and expected performance

for the various line items in the earnings statement. This is an important first step, but it is only a first step.

Level 2

The next level of variance analysis is to attempt to isolate the effects of changes in the level of business activity from the effects associated with changes in prices, costs or operating efficiencies. The most useful way to carry this out is to use the concept of a flexible or variable budget. This is simply an intermediate evaluation criterion which specifies what our profit expectations would have been if we could have predicted precisely what the actual level of activity would be, as though we had perfect foresight with respect to sales volume and sales mix.

To our example we add the flexible budget column and expand the detail of expenses to separate variable cost of sales from the relatively fixed period costs. This latter step is not essential but simplifies the presentation in Figure 2.

This way of looking at what happened indicates that profits were \$50 greater than originally expected because of the higher level of sales activity (Column (2) vs. Column (1), varying only the volume of units sold). Standard costs and standard prices still are used. The fact that actual profits were \$5 less than the flexible budget of \$3,050 indicates that, at the actual activity level, price increases did not offset increases in costs. Prices were \$675 above plan (\$11,025–\$10,350) while expenses were \$680 above plan (\$7,980–\$7,300). Of course, price and volume are not independent; it is conceivable that

¹ An expanded version of the note suitable for classroom distribution is available from the authors. In the longer version all calculations are explained in detail and the narrative is expanded to be more helpful to an unsophisticated reader.

² We will use the terms “profits” and “earnings” interchangeably.

FIGURE 2

	(1) <i>Original Expected</i>		(2) <i>Flexible Budget</i>		(3) <i>Actual Results</i>	
Sales	2000 units @ \$5	<u>\$10,000</u>	2100 units	<u>\$10,350*</u>	2100 units @ \$5.25	<u>\$11,025</u>
Variable cost of sales	2000 units @ \$3	<u>6,000</u>	2100 units @ \$3	<u>6,300</u>	2100 units @ \$3.29	<u>6,910</u>
Period costs		<u>1,000</u>		<u>1,000</u>		<u>1,070</u>
Total costs		<u>7,000</u>		<u>7,300</u>		<u>7,980</u>
Profit		<u>\$ 3,000</u>		<u>\$ 3,050</u>		<u>\$ 3,045</u>

* The \$10,350 consists of 1320 units of one product, at standard sale price, and 780 units of a second product, also at standard price. The resulting average price is not quite \$5 due to the fact that the actual mix of sales between the two products differs from the planned mix. This is analyzed in Level 3 below.

more units could have been sold if prices had been raised less. If this had occurred, the favorable sale price variance would have been reduced and the variance due to sales volume would have increased. Even with this lack of independence, isolating volume and mix effects from other factors is important in understanding and evaluating what has occurred. Such a separation of sales-activity-related variances from cost/price-related variances is both powerful in itself and fundamental to the analysis which follows.

Level 3

The cost/price and sales activity variances each can be analyzed further. For the sales activity variance, this involves a

split into the part due to volume changes and the part due to a changed composition or mix of the items sold. For the cost/price variance, Level 3 involves splitting out the sales price variance from the cost variances and decomposing the cost variances by major cost categories.

Sales Activity Differences. If the company sold only one product in one size, the sales activity variance of \$50 calculated would be due entirely to sales volume changes. If, however, more than one product is sold, the difference can be composed of both overall sales volume changes and change in the mix or relative amounts of the different products sold. Consider the following extension of our example.

Product	Expected Sales			Actual Sales		
	Units	Price/Unit	Revenue	Units	Price/Unit	Revenue
A	1200 (60%)	\$4.00	\$ 4,800	1320 (63%)	\$4.40	\$ 5,808
B	800 (40%)	\$6.50	\$ 5,200	780 (37%)	\$6.688	\$ 5,217
Total	<u>2000</u>		<u>\$10,000</u>	<u>2100</u>		<u>\$11,025</u>

Using this information, we can decompose the sales activity variance into two parts. To distinguish the two we compute the expected profit with sales at the actual level of 2100 units but in the mix originally expected (Product A sales = 60 percent or 1260 units, Product B = 40 percent or 840 units). It is easy to verify that these sales figures would lead to expected profits of \$3,200, using standard prices and standard costs. Comparing this expectation with the flexible budget we get a difference of \$150 un-

Cost Price Differences. The sales price variance is actual sales units \times expected prices versus actual sales units \times actual prices. This comparison, as shown above, is \$10,350 versus \$11,025 or \$675 favorable.

The expense differences isolated earlier were 680U (flexible budget of \$7300 versus actual of \$7980). Further analysis of the cost differences can be made if additional information is available on the nature of the costs incurred. Consider the information in the following table.

Categories	Standard Cost per Unit (for both Products A&B) ³	Flexible Budget at 2100 Units	Actual Costs	Variance
Labor	.3 hrs. \times \$5/hr = \$1.50	\$3150	580 hrs \times \$5.50/hr = \$3190	\$ 40U
Direct materials	.5 Units \times \$2/Unit = \$1.00	2100	1120 Units \times 2.30/Unit = 2576	476U
Other variable costs	= .50	1050	1144	94U
Period costs	\$1000 per period	1000	1070	70U
		<u>\$7300</u>	<u>\$7980</u>	<u>680U</u>

³ In a typical company, different products would have different expected costs. Thus, the flexible budget for expenses would involve mix considerations as well as volume. For this analysis we will ignore the mix factor, believing it to be sufficiently well illustrated in the revenue section to permit its application to costs. We will consider Products A and B as costing the same—but sold in different markets.

favorable (\$3200 – \$3050) which is due entirely to product mix. Mix is the only factor which varies between these two calculations. The variance due solely to sales volume (assuming no variation in mix) is \$200 favorable. This is shown by comparing the original expected profit to the revised expectation at actual volume with planned mix (\$3000–\$3200). The only factor varying between these two calculations is the overall sales volume level. The net of these two variances is the \$50 F shown at Level 2. This basic procedure is fundamental to any variance analysis: hold everything constant except one factor to calculate the specific, separable impact of that factor. This is sometimes referred to as “spinning only one dial at a time.”

With this more detailed information, the variance analysis can separate out at Level 3 the labor, material and overhead differences as shown in the last column.

Level 4

The last level we will examine involves decomposing the sales mix variance by products and evaluating the impact of market position on sales volume changes. For cost/price variances, it involves decomposing the sales price variance by products and the cost variances according to efficiency-in-use versus purchase price changes.

Sales Mix Variance. Following well known procedures, the overall \$150 sales mix variance can be broken down by product as follows:

Product	Actual Sales Units		Difference-Units	Expected Profit Contribution/Unit	Mix Variance
	Standard Mix	Actual Mix			
A	1260 (60%)	1320 (63%)	+60	\$1.00	\$ 60 F
B	840 (40%)	780 (37%)	-60	3.50	210 U
Total	2100 (100%)	2100 (100%)	0		\$150 U

Sales Volume Variance. In looking more closely at the \$200 F sales volume variance, we will assume that the company has traditionally captured an 8 percent share of the market and expects this to be the case in the current period during which the market was expected to be approximately 25,000 units. This would produce the original expectation of \$4,000 of profit contribution (25,000 × 8 percent × \$2.00 per unit⁴). If the market increased to 28,000 units while the company's sales went up to 2100 units, the company's market share was actually only 7½ percent. This interplay between the company's growth and that of the market it serves can be decomposed

market would have been \$3480. It did not, however, and the effect of the decrease in market share is as follows:

- (b) *Change in expected profit as a result of market share change*
 = (expected market share – actual market share) × (actual market volume) × (expected profit contribution per unit at expected mix)
 = (.08 – .075) × (28,000 units) × \$2.00 per unit
 = \$280 U

This is the profit lost because of a decrease in market share. The combined result from volume and share changes (\$480F + \$280U) is the total sales volume variance of \$200 F shown at Level 3.

Sales Price Variance. The sales price variance, as calculated at Level 3, was \$675 favorable. Following well-known procedures, this can be detailed in the following table.

Product	Expected Price	Actual Price	Unit Price Difference	Actual Units	Sales Price Variance
A	\$4.00	\$4.40	\$.40 F	1320	\$528 F
B	6.50	6.688	.188 F	780	\$147 F
Total				2100	\$675 F

usefully as follows:

- (a) *Change in expected profit due to market size change*
 = (expected total market – actual total market) × (expected market share) × (expected profit contribution per unit at expected mix)
 = (25,000 – 28,000 × 8 percent × \$2.00)
 = \$480. F

That is, the profit should have gone up by \$480 due just to change in the size of the overall market. If the company could have maintained its market share, its expected profit in a 28,000 unit

Cost Variances. On the cost side the analysis can proceed further by separating out the efficiency-in-use element from the purchase price element for the labor and direct material cost components. Following the normal procedures, the results are as follows:

⁴ Sales price of \$5 less expected variable cost of \$3, at the expected mix.

Labor price variance	$= (\$5 - \$5.50) \times 580$	$= \$290 U$
Labor efficiency variance	$= (630 - 580) \times \$5$	$= \$250 F$
		\$ 40 U
Total labor variance shown at Level 3		\$ 40 U
Material price variance	$= (\$2.00 - \$2.30) \times 1120$	$= \$336 U$
Material efficiency variance	$= (1050 - 1120) \times \$2.00$	$= \$140 U$
		\$476 U
Total material variance shown at Level 3		\$476 U

Alternatively, we could summarize this analysis by nature of the variance, as follows:

Efficiency variances	
Labor	\$250 F
Material	\$140 U
	\$110 F
Subtotal	\$110 F
Purchase price variances	
Labor	\$290 U
Material	\$336 U
	\$626 U
Subtotal	\$626 U
Other (variable \$94, period \$70)	\$164 U
	\$680 U
Total expense variance	\$680 U

Which method of looking at the cost variances is "better" depends on what actions caused them. While labor efficiency was very good, the labor rate increase more than offset the benefits. If this was due to substituting more efficient but higher priced labor for that normally used, showing labor rate and efficiency variances together (or even not separating them at all) could be more useful. If, on the other hand, purchase price increases lead to extra pressure to really use workers and material efficiently, showing the data by type of variance may be more useful. This focuses attention on the fact that expenses were \$626 more than expected because of purchase price increases. Another way of approaching this data would be to say that sales price increases did keep up with purchase price increases (\$675 F vs \$626 U) but

not other cost increases. The methodology is the same; the preferred format depends upon managerial judgment in the specific circumstances.

SUMMARY

We started with actual profit performance of \$3,045 in a period and found first that it was \$45 more than expected. Looking a bit deeper, we found that profit was \$50 better because of increased sales levels but \$5 worse because of increased costs of operation that were not passed on in higher sales prices. Pulling out all stops, we finally determined that the situation was much more complex.

The overall market was 3,000 units larger than planned (28,000 units versus 25,000). This should have yielded a \$480 F profit variance in the period. However, market share slipped $\frac{1}{2}$ percent which caused a \$280 U profit variance. Furthermore, the sales mix included a higher than planned proportion of the low margin product, which led to a \$150 U profit variance. Cost performance was also unfavorable. Materials variance was \$40 U, labor variance \$476 U, other variable costs variance \$94 U and period cost spending variances \$70 U. Considering all these negative factors, the overall profit variance was favorable by \$45 only because of \$675 in sales price increases. A much different picture is thus presented than that suggested by the simple statement that profits were \$45 higher than expected.

OVERVIEW

This multilevel analysis is illustrated in summary form in Figure 1. Further levels could, of course, be added if desired. The overall market change could be decomposed into economy-wide factors and industry-specific factors. The market share change could be broken down by products. The sales mix variance could be decomposed by geographic region or customer class. Sales price changes could be decomposed into "list price" changes and discount changes (either early payment discounts or quantity discounts). Cost variances could be broken into controllable and noncontrollable segments by responsibility center. The analysis should stop any time the next level does not produce useful enough management information to war-

rant the additional complications.

Although this paper focuses on a manufacturing firm, the concept is equally applicable in retail, financial or service organizations. The dual key is to consider separately the profit impact of sales-activity-related variances versus cost/price related variances, and to add complexity gradually, one level at a time. Decomposing the profit variance one level at a time is a very powerful management tool. Understanding the specific impact of the various factors is the first step before management can undertake appropriate corrective actions. When students are exposed to variance analysis in this framework, we find that their understanding of the mechanics and the managerial significance is jointly enhanced.