



VARIANCE ANALYSIS

When there is a variance in the budget, how and why is it there? Say we were setting up Standard Costs, setting up a Cost Accounting System. First this we would have to do is set up standard costs for each product. The way we do this is we conduct time and motion studies looking at how the efficient use of time and materials would result in result in a cost for each product. So we would end up saying, for example, that we have certain direct labor and material as well as certain variable overhead and that there was a quantity of each which was used to set the standard cost of items ABC. That for one unit of item ABC we used 5 pounds of D/M and 1.5 hours of D/L and variable overhead is allocated on the basis of D/L so it also gets a 1.5 hours entry. Now we will multiply these by some rate. It turns out that our labor rate on average is \$15 per hour, D/M rate is \$.50 per pound, and Var. O/H is \$7.50 per hour. This results in a total variable cost per unit of \$36.25.

Standard Costs of item ABC					
	<u>Quantity</u>	x	<u>Rate</u>	=	<u>Total</u>
D/L	1.5 Hrs		\$ 15.00 /Hr		\$ 22.50
D/M	5 Lbs		\$ 0.50 /Lb		\$ 2.50
Variable O/H	1.5 Hrs		\$ 7.50 /HR		\$ 11.25
	Total Variable Costs per Unit:				\$ 36.25

This is how we would set the standard. But we are confronted with a problem. When we made up the Master Budget we assumed a certain Volume level. Before we can create a budget we must know how many units we are going to produce/sell. Lets say we plan on producing 12,000 units and we make all our forecast around this volume (sales, costs, income statement, balance sheet). Now say the actuals come out at only 10,000 units. Instead of selling 12,000 you only sell 10,000. So now we must do a Variance Analysis.

Sales will show an unfavorable variance because we sold less units than planned. How is our costs variance going to look? Budgeted for 12,000 but made less so our costs will be less and this will be reflected as a favorable cost variance. But this is not necessarily good because the company did not make what it had planned on making. These variance numbers can be deceptive. The reduction in costs, in this case, does not mean the company controlled cost better.

We can see that comparing actuals against the master budget can be somewhat deceptive because there is a volume differential between the master budget and the actuals.

Instead, what we really want to do is say “Hey, if I had had a budget for 10,000 units I would compare my budget for 10,000 units against my actuals for 10,000 units and that would tell me if I controlled my costs or not”. This type of budget is called a Flexible Budget. A budget which is flexible enough so that you can adjust it to whatever the actual unit of sale is for purposes of making a valid comparison.

Now actuals come in for 10,000 units. The actual for the 10,000 units which were really produced and sold have a direct labor charge of 17,500 hours and spent \$280,000. On direct material 55,000 pounds were used at a cost of \$24,750. And the actual variable overhead cost was \$105,000.

(?) Direct Labor: Actuals for 10,000 Units Produced & Sold

	Actuals	Rate	Cost/Unit
D/L	17,500 Hrs @	\$ 280,000	\$ 16.00
D/M	55,000 Lbs @	\$ 24,750	\$ 0.45
Variable O/H	105,000		\$ 11.25
Total Variable Costs per Unit:			\$ 27.70

Now we perform a Variance Analysis. Above we have the actual money spent. We could compare it to the master budget but what we have seen above is that that comparison is not a good comparison. What we want to know is weather or not we have controlled our costs. To do this we must go to a Flexible Budget. The method below is called the Cannon Method and is the industry standard. The book uses a formula method.

The Cannon Method allows for analysis on 3 fronts:

1. Hours
2. Total Dollars
3. Rate

The method compares the Actuals to the Flexible Budget. How do we come up with the flexible budget? The definition of the Flexible Budget is actual units produced and sold multiplied by the standard cost factors. In this case our analysis said for every unit produced we should have spent 1.5 hours (spreadsheet entry first page).

$$\text{Flexible Budget} = \text{Actual Units Produced \& Sold} * \text{Standard Cost Factors}$$

$$\text{Flexible Budget} = 10,000 \times 1.5 = 15,000$$

This says we should have expended 15,000 hours. What should our rate have been? Standard cost said rate was \$15.00 per hour. Now we take the product and find that we should have spent \$225,000. Now take the difference between the two and get 2,500 and 55,000 and \$1 and they are all **unfavorable** (spent more money than in the budget). Unfavorable variances are shown in brackets.

DIRECT LABOR			
D/L	Hours	\$	Rate
Actuals	17,500	280,000	16.00
Flex Budget	15,000	225,000	15.00
Differential	(2,500)	(55,000)	(1.00)

EXAM GIVEN ANY TWO IN CANNON SCHEDULE SOLVE FOR THIRD

Now we will create two variances. One is called the **Efficiency Variance** and the other is called the **Rate Variance** or **Price Variance**. These variances are made from the Actuals/Flex schedule above.

The Efficiency Variance deals with how much resource was used. In this example we used up 2,500 hours more of our labor resource than was originally budgeted. That difference gets multiplied by the standard rate. KEEP THE BRACKETS! In this case we have an unfavorable variance.

$$\text{Efficiency Variance} = (2,500) \times 15.00 = (37,500)$$

The Rate or Price Variance deals with what my variance in the rate is multiplied by the actual hours. In this example we also have an unfavorable variance.

$$\text{Rate or Price Variance} = (1.00) \times 17,500 = (17,500)$$

Now we look at them together and take the sum to find the Total Variance. Showing the whole schedule:

DIRECT LABOR			
D/L	Hours	\$	Rate
Actuals	17,500	280,000	16.00
Flex Budget	15,000	225,000	15.00
Differential	(2,500)	(55,000)	(1.00)

Efficiency Variance	=	(2,500) x	15.00	=	(37,500)
Rate or Price Variance	=	(1.00) x	17,500	=	(17,500)
Total Variance:					(55,000)

This is called the Cannon Method. Solve using formulas such as flexible budget minus actual hours times the standard rate should give the variance for the efficiencies. More complicated.

Direct Material.

Note that we are not longer talking about hours, talking about material. So our schedule changes from Hours to Quantity. We have an Actual given and a total so we solve for the rate. Remember, **unfavorable is bracketed**.

DIRECT MATERIAL			
D/M	Lbs Quantity	\$	Rate
Actuals	55,000	24,750	0.45 /Lb
Flex Budget	50,000	25,000	0.50
Differential	(5,000)	250	0.05

Efficiency Variance	=	(5,000) x	0.50	=	(2,500)
Rate or Price Variance	=	0.05 x	55,000	=	2,750
Total Variance:					250

The Rate or Price Variance is \$0.05 above, it's the difference between the two rates.

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Must know who to go to for an explanation of each of these variances. Must also know Plausible Explanations.

Efficiency Variance: the guy to go to to ask why there is a variance, favorable or unfavorable, is the **Production Manager**. He controls the labor in the shop and also controls the usage of material in the shop.

Material Price: the price you are paying for material is a topic for the **Purchasing Manager**.

Labor Price: this is the venue of the **Human Resources Department**.

Now what would be plausible explanations for these conditions? Why did we use a lot more labor for the units than was originally budgeted? Maybe we had lower trained personnel. Problems on the line. A short period of down-time. Over runs in payroll could be a mix issue, older more experienced employees being paid more than younger. Maybe the average rate turned out to be a dollar or so different. How about material usage? Here we used more than the "standard" budget called for. Why? Production Manager provides the estimate. It is not enough for him to say "well the budget is wrong". Must be able to say what went wrong. What assumption in the budget is different than what the actuals turned out to be? Maybe assumed they were going to use 5 pounds of material per product but maybe it turned out that the material was coming in at different grades so some was unusable or the machine was not cutting efficiently. Also, the Purchasing Manager may have paid less than expected for the material. Why? Could be world prices changed, volume discount, different supplier. All are plausible explanations.

Variable Overhead

Set it up pretty much the same way. In this case the variable parameter is budgeted for 1.5 hours per unit at \$7.50 per hour. Actual Variable overhead costs came in at \$105,000. Direct labor on the actuals was 17,500 hours for 10,000 units actually made and sold.

Key here is the hours for the actuals. The actual hours must be the same as direct labor because they are allocated on the basis of direct labor. Solve for rate of \$6.00. The Flexible budget says we would have used 1.5 hours for each one of these 10,000 units which gives us the 15,000. The standard rate was \$7.50 so it works out that the dollars for flexible budget comes to \$112,500. Take the differences and use the brackets to indicate the unfavorable. Solve the Efficiency and Rate/Price Variance.

Variable Overhead			
Var O/H	Hours	\$	Rate
Actuals	17,500	105,000	6.00 /Lb
Flex Budget	15,000	112,500	7.50
Differential	(2,500)	7,500	1.50

Efficiency Variance	=	(2,500) x	7.50	=	(18,750)
Rate or Price Variance	=	1.50 x	17,500	=	26,250
		Total Variance:			<u>7,500</u>

Hour/Efficiency variance is the domain of the production manager because he is the guy who deals with the number of hours expended. The Rate Variance is from a lot of difference sources is from a lot of different sources because variable overhead is accumulating a lot of different pockets of variable types of costs. Examples include indirect materials, indirect labor, utility costs, things that are variable. To find the cause of Rate Variance you really have to go line item by line item.

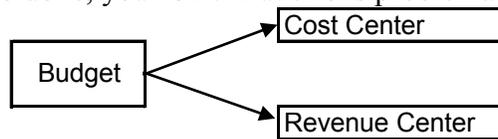
EXAM

In all cases above, review the cases and trace where the schedule entries came from with respect to the problem statement.

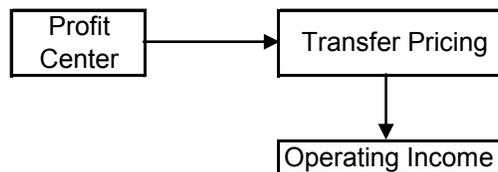
TRANSFER PRICING

Here's the situation with transfer pricing. Really it is a technique. The last two topics above really deal with performance evaluation. In most cases the president of the company cannot possibly manage and oversee all of the operations of the company worldwide (although some do try). On the other hand some corporations delegate decision making down to the lowest local level but maintain a strong coordinating capability. The end result is that it is necessary to have a way to evaluate the end performance of operating managers. There are several ways of doing this.

One method is the Budget. Either cost centers or revenue centers are evaluated using the budget. Meet the budget, get your job done, your OK. But this is problematic, it is not motivational.



On the hand a guy who is in charge of both Revenues and Cost is a Profit Center. Profit Centers are more motivated because their responsibilities are to increase profit and it can clearly be seen weather they are or are not doing well. But the problem with profit centers in a company is that in reality a lot of units are selling to other units within the company. If a unit is selling to another unit in a company they are really not selling as much as they are just Transferring from one unit to another unit. Only at the end point when that unit or the company sells to the outside world is there an actual sale. Moving money from one pocket of the company to another pocket of the company is really not making any profit. Only when we make a sale have we increased the wealth of the entity.



Profit Centers are a great concept because it is a highly motivational concept. You get an opportunity to let people manage at a smaller level and make decisions which they will be responsible for which makes them more highly motivated.

But the problem remains that they are well motivated but may be making, and claiming credit for, sales which are for the most part within the company. We reconcile these two things through a mechanism called Transfer Pricing in an Operating Income environment. What we can do is establish a method to value their transfers to the next unit, call that value a internal sales value called a Transfer Price, and give them a comparison of what that value is against what their costs were and then we can show them an Operating Income.

For example, payroll department, say we want to change it from a cost center to a operating profit center. Basically we would look a company which specializes in this activity, payroll, find out what their method is for pricing their payroll activity, take this model and use it to develop a

price for everything the payroll department does and call that the transfer price. Then we compare these prices with the actual costs of operating the payroll department, and that completes the transformation of the payroll department from a cost center to a profit center. Now they are more motivated to cut their costs and increase their volume. As a result the operation will be more efficient.

We will look at 3 different types of transfer pricing models for divisions A, B, and C.

First, **Transfer Price is 200% of Variable Costs.**

① **Transfer Price is 200% of Variable Costs**

Division A	X-Fer Sales 400 Var. Costs (200) Fixed Costs (150) <hr/> Oper. Income <u>50</u>	Transfers in are always considered a Variable Cost. Internal transfer sales prices are computed.
Division B	X-Fer Sales 1,400 X-Fers In (400) Var. Costs (300) Fixed Costs (250) <hr/> Oper. Income <u>450</u>	
Division C	External Sales 2,000 X-Fers In (1,400) Var. Costs (175) Fixed Costs (225) <hr/> Oper. Income <u>200</u>	
Overall Company		<u>700</u>

Ultimate External Sales Value. What the market will bear.

We enter the fixed and variable costs of division A 200% of Variable Costs, if that were their transfer price (transfer sales) they would end up with \$400 as a sales value. This \$400 is the amount which was exchanged from division B to division A for this transfer sale. Division A ends up with an Operating Income of \$50.

Division B now adds the transfers in from division A to its fixed and variable costs. This sum is subtracted from its own transfer sales of 1,400 for an operating income of \$450. Note that internal transfer sale prices are calculated by the company.

Division C goes through the same procedure except it has EXTERNAL SALES. The value assigned to External Sales is based on the market price of the product. What the market will bear.

Second, Transfer Price is 150% of **Full Costs.**

Transfer Price is

②

		<u>150% of</u> <u>Full Costs</u>	
<u>Division A</u>	X-Fer Sales	525	Sum is \$350, this is the Full Costs. 150% of this is \$525.
	Var. Costs	(200)	
	Fixed Costs	(150)	
	Oper. Income	<u>175</u>	
<u>Division B</u>	X-Fer Sales	1,612.50	Sum is \$1075, this is the Full Costs. 150% is \$1612.50
	X-Fers In	(525)	
	Var. Costs	(300)	
	Fixed Costs	(250)	
	Oper. Income	<u>537.50</u>	
<u>Division C</u>	External Sales	2,000	Ultimate External Sales Price. What the market will bare.
	X-Fers In	(1,612.50)	
	Var. Costs	(175)	
	Fixed Costs	(225)	
	Oper. Income	<u>(12.50)</u>	
	Overall Company	<u>700</u>	

EXAM Transfers In are always considered a Variable Cost.

This means we have two types of variable costs in our expression, traditional variable costs and transfers in.

External Sales value does not change because it is driven by the market. In this example Division A is the winner at Division C's expense.

The problem with the above two methods is that they represent Cost Based Transfer Pricing Systems which can lead to a lack of Goal Congruence.

Third, Transfer Price is Market Value.

This is considered to be the best way to implement Transfer Pricing Systems. In this case the transfer price is set at the market value.

③

		<u>Market Value</u>	
Division A	X-Fer Sales	450	
	Var. Costs	(200)	
	Fixed Costs	(150)	
	Oper. Income	<u>100</u>	
Division B	X-Fer Sales	1,500	
	X-Fers In	(450)	
	Var. Costs	(300)	
	Fixed Costs	(250)	
	Oper. Income	<u>500</u>	
Division C	External Sales	2,000	<div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p style="text-align: center;">BEST !</p> <p style="text-align: center;">Ultimate External Sales Price. What the market will bare.</p> </div>
	X-Fers In	(1,500)	
	Var. Costs	(175)	
	Fixed Costs	(225)	
	Oper. Income	<u>100</u>	
Overall Company		<u>700</u>	

The Market Value being used as the transfer in price cannot be computed, it must be given.

In all three of the above methods the Overall Company profit remained the same at \$700. There is a reason for this. These methods only examine the transfer of money within the company. In this sense the differences between the various methods cancel each other out. The purchase of one and the sale of another cancel each other. The only things that survive are the sale externally and the internally generated fixed and variable costs.

Investment Center Method

Now we are going to look at one method of evaluating the performance of individuals through profit center measurement based on transfer pricing.

Say it is the case that a manager is not only in charge of the profit center but also in charge of the investments or assets then he would be evaluating using the investment center method. This would be return on assets and return on investment.

DuPont Method

The DuPont Method of evaluating return on investment which also means Return on Asset. Return on Investment is really a very misused term in industry, it could mean a lot of thing, return on assets, return on equity, internal rate of return...

In this context when we speak of Return on Investment we are speaking of Return on Assets.

What DuPont said is if you look at the return on sales and compare that to the asset turn over ratio and multiply the two you will get Return On Investment (ROI).

$$\text{Return on Investment} = \frac{\text{Income}}{\text{Assets}}$$

$$\text{Return on Sales} = \frac{\text{Income}}{\text{Sales}}$$

$$\text{Asset Turnover Ratio} = \frac{\text{Sales}}{\text{Assets}}$$

This gives us the expression:

$$\frac{\text{Income}}{\text{Assets}} = \frac{\text{Income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Assets}}$$

What this is saying is that you are investing in assets in order to generate sales. For example, for a manufacturer as sales demand grows more machines must be bought. So in theory what is suppose to happen is that for every dollar I invest in this new equipment there should be a direct relationship to the sales level. That should enhance the ability to generate more sales because it increases the productive capacity.

That being the case this is a measure of the efficiency of the relationship between what I've invested to how many sales are being generated. I shouldn't over invest in assets if there is no sales growth. On the other hand once we have those sales, how much of those sales are we keeping on the bottom line? How much of those sales are being expended in costs deducting in order to arrive at the income figure? How much is my return on the sales? How much is Income as a percent of Sales?

$$\frac{\text{Income}}{\text{Assets}} = \frac{\text{Income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Assets}}$$

So this is a measure of how many sales you've just generated per dollar of asset times the income is being generated per dollar of sales. The sales terms cancel during multiplication leaving the dollars of income per dollar of asset.

Take an example:

Company has 20% ROI with \$1,000 Income and \$5,000 Assets with \$10,000 Sales..
Plugging in the numbers...

$$\frac{1,000}{5,000} = \frac{1,000}{10,000} \times \frac{10,000}{5,000}$$

$$20\% \text{ ROI} = 10\% \times 200\%$$

Here we see that we have a 200% asset turnover ratio, we are generating \$2.00 of sales for every \$1.00 of asset investment. We also see that we have a 10% Return on Investment meaning that 90% of sales income are being eaten up in expenses. Which means we have a really good efficiency ratio in terms of dollar invested to sales generated, but cost control is eating way too much profit. This is why we end up with a 20% return on investment.

Point is that the DuPont Method gives us more information than just looking at Return on Investment.

But here is the problem. Someone using ROI to evaluate their managers will find that the managers will never want to invest in a new project that is going to provide a rate of return less than their existing ROI. Why? Because if you invest in a project which has a 15% ROI and you currently have a 20% ROI your going to see your ROI go down.

Example, project A has \$100 income for \$700 asset investment:

$$\text{Project A} = \frac{100}{700} = 14\% \text{ ROI}$$

The manager will not want to take this project if he is currently making 20% ROI. But this may be bad. Lets say the company wants it's divisions to invest in anything over 10% ROI. Yet this guy is turning down a 14% investment. No Good. This is called **Goal Incongruence**. This model is going to make this organization make a decision which is not congruent with the goals of the organization. But there is another model the company could use for evaluation purposes ...

Residual Income Method

Basically, look at the income of the organization, the base case. Say now they have \$1,000 income. Subtract from that a required return on investment.

<u>Residual Income</u>	<u>Base</u>		<u>New Project</u>	
Income	<u>1,000</u>		<u>100</u>	
Asset		5,000		700
x Req Rate of Return		<u>10%</u>		<u>10%</u>
- Req. Return on Inv	(500)	<u>500</u>	(70)	<u>70</u>
Residual Income	<u>500</u>		<u>30</u>	

The difference gives us Residual Income over and above any required return on assets. This example says that they must get 500 on their assets just to break even with what the company wants to achieve overall. If they were to invest in the new project which has \$100 income and \$700 of assets and a required return of 70. That's going to result in an increment of 30 in their residual income. That will be good for the division, they will be motivated to invest in this new project because it will enhance their residual income measurement.

We see two examples, one of which motivates managers to make decisions which are congruent with the goals of the organization. And another which results in possible decisions by managers which are not congruent with the goals of the company.

HOMEWORK**7-25 parts 1 & 3 pg 247**

Notice they give us the standards. They also give the fact that the number of units budgeted was 10,000 but that's not what we are after. We are after the actual units produced and sold. That was 9,810. They also give us the actual results, the only thing they do not give us is the price for the materials which were purchased. But we can work out the rate from the information: 100,000 pounds materials purchased at a cost of \$310,000. The rate was \$3.10. They also say that they isolate variances based on purchases. We are not going to do that, we will isolate variances based on usage just as we did in class.

We are required to note who we would go to for a plausible explanation of direct materials and direct labor variances. Also list a plausible explanation.

7-27 part 1 pg 247

Similar to 7-25, standards given. Also give the information regarding actuals.

22-handout (29 with handout mods)

Transfer pricing problem. They have 3 divisions. Make sure we do all of our transfer pricing not in a per unit fashion but instead in TOTAL DOLLARS. Use the additional columns he gave us. Do all 3 methods, 200% of the variable, 100% of full, and market value to determine what the transfer pricing would be under the three scenarios.

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2 divisions. Use DuPont method for roi for 2006. why would they not want to accept the new project? Then use residual income for each division and the new project and see if that decision will change.