STUDY UNIT TWENTY
STANDARD COSTS AND VARIANCE ANALYSIS

20.1	*Static and Flexible Budgeting*	*1*
20.2	*Direct Materials Variances*	*7*
20.3	*Direct Labor Variances*	*9*
20.4	*Overhead Variances*	*10*
20.5	*Comprehensive Example of Variance Analysis*	*14*

This study unit is the last of three relating to cost measurement. A standard cost is an estimate of what a cost should be under normal operating conditions based on accounting and engineering studies. Standard costs are used to control actual costs. Comparing actual and standard costs permits evaluation of managerial performance.

20.1 STATIC AND FLEXIBLE BUDGETING

1. One of the **uses of a budget** is to communicate to employees what an organization's **operational and strategic goals** are. The budget quantifies the operational steps that ultimately lead to achievement of the strategic goals.
    a. A budget is useless without a performance evaluation system to monitor progress toward the budget's objectives.
        1) The measures in any performance evaluation system must therefore be directly related to the organization's strategic and operational goals.
        2) The system must give timely feedback so that managers can take corrective action.
    b. These are aspects of a **management-by-objectives (MBO)** system. MBO requires the establishment of specific, measurable goals and the provision of ongoing feedback.
2. **Variance analysis** is the foundation of any performance evaluation system based on a budget.
    a. Variances are the calculated differences between the amounts budgeted and the amounts actually incurred (or, in the case of revenues, earned).
        1) On the cost side, a **favorable variance** occurs when actual costs are less than standard; an **unfavorable variance** occurs when actual costs are greater than standard.
        2) On the revenue side, a **favorable variance** occurs when actual revenues are greater than budgeted; an **unfavorable variance** occurs when actual revenues are less than budgeted.
    b. Variance analysis enables **management-by-exception**, the practice of giving attention primarily to significant deviations from expectations (whether favorable or unfavorable). When a variance occurs, management is signaled that corrective action may be needed.
        1) Attending to operations not performing within expected limits is likely to yield the best ratio of the benefits of investigation to costs.
    c. The significance of variances depends not only on their amount but also on their direction, frequency, and trend. Moreover, persistent variances may indicate that standards need to be reevaluated.

3. Variances usually **do not appear on the financial statements** of a firm. They are recorded in the ledger accounts but are only used for managerial control.
   a. **Immaterial variances** are customarily closed to cost of goods sold or income summary.
   b. **Material variances** may be prorated. A simple approach is to allocate the total net variance to work-in-process, finished goods, and cost of goods sold based on the balances in those accounts.
4. A crucial part of variance analysis is the **assignment of responsibility**.
   a. The performance measures on which managers are judged should be directly related to the factors that drive the element being measured, e.g., cost drivers and revenue drivers.
   b. The goal is to assign responsibility for variances to those most likely to have information that will enable management to find solutions.
      1) A manager who does not control an activity may nevertheless be the individual who is best informed about it. Thus, a purchasing agent may be in the best position to explain price variances even though (s)he cannot control them.
   c. The constructive approach is to promote learning and continuous improvement in manufacturing operations, not to assign blame. However, information about variances may be useful in evaluating managers' performance.
5. **Algebraic conventions** make the calculation of input variances simpler.
   a. AQ = Actual quantity of inputs consumed; SQ = Standard quantity of inputs consumed
      AP = Actual price of inputs consumed; SP = Standard price of inputs consumed
   b. When analyzing costs, **subtracting actual from budget** always results in a favorable variance being a positive number.
6. The **starting point** for variance analysis is the **static (master) budget**. The static budget is management's best estimate about sales, production levels, and costs for the upcoming period.

   Static budget = (Standard quantity × Standard price) = (SQ × SP)

   a. After the end of the period, the **actual results** of revenues earned, output produced, and costs incurred can be compiled.

      Actual results = (Actual quantity × Actual price) = (AQ × AP)

   b. The **static budget variance** is the **total variance to be explained**.

      Static budget variance = Static budget – Actual results
      = (SQ × SP) – (AQ × AP)

      1) Note that the static budget variance **holds neither quantity nor price constant**. The total variance to be explained consists of the difference in both elements.
   c. EXAMPLE: A manufacturer's production process uses a single direct material, and the planned consumption was 100 pounds costing $10 per pound last month. The total budgeted for raw materials cost was therefore $1,000 (100 pounds × $10).
      1) At month end, it was determined that the company used only 80 pounds of raw material but had to pay $12.50 per pound for it. Total cost of raw materials was therefore $1,000 (80 pounds × $12.50).
      2) The static budget variance for direct materials was $0 ($1,000 static budgeted cost – $1,000 actual cost incurred).

7. Variance analysis becomes much more meaningful when the static budget variance is decomposed into its two component variances. In order to do this, the flexible budget must be prepared.
   a. **Flexible budgeting** captures the complexity of the relationships among input, output, and resource prices.
      1) **Three major variables** in the production process are the quantity of inputs consumed, the price paid for inputs, and the quantity of outputs produced. A difference in any one of these renders the static budget less useful.
   b. The **flexible budget** consists of the costs that **should have been** incurred given the actual level of production achieved. It is calculated as follows:

      Flexible budget = Actual number of outputs produced (AO)
      × Standard number of inputs per unit of output (SI/O)
      × Standard price per unit of input (SP)

      1) The product of the first two elements of this equation makes up the **"expected" quantity (EQ) of inputs**.

         Expected quantity = (AO × SI/O)

   c. EXAMPLE: The company planned to produce 90 units of output during the month. Since 100 pounds of raw material were budgeted for this level of output, the standard input usage per unit of output was 1.1111 (100 pounds ÷ 90 outputs).
      1) The actual level of production for the month was 94 units.
         a) The expected quantity of direct materials was thus 104.4434 units (94 outputs × 1.1111).
         b) The flexible budget was thus $1,044 (104.4434 units × $10).
      2) In other words, given its standard cost for raw materials, the company would have expected to spend $1,044, not $1,000, to produce 94 units of output.
8. The two component variances of the static budget variance can now be derived.
   a. The **sales volume variance** reveals how the number of inputs codified in the master budget before the period began compares to the inputs that should have been used given the achieved level of output (holding price constant).
      1) A more accurate name for this variance, therefore, would be production volume variance.

         Sales volume variance = Static budget – Flexible budget

      2) The formula can be simplified algebraically as follows:

         Sales volume variance = Static budget – Flexible budget
         = (SQ × SP) – (EQ × SP)
         = (SQ – EQ) × SP

      3) EXAMPLE: The company planned to spend only $1,000 on direct materials during the month but, given its standard cost and actual level of production, would have expected to spend $1,044.
         a) Therefore, the company experienced an unfavorable sales volume variance of $44 on direct materials ($1,000 static budget – $1,044 flexible budget).

b. The **flexible budget variance** reveals how both the price paid for inputs and the quantity of inputs consumed compares to the price and quantity that should have been paid and consumed given the actual level of output.

1) What was codified in the master budget is not relevant to this side of the calculation.

Flexible budget variance = Flexible budget – Actual results

2) The formula is stated algebraically as follows:

Flexible budget variance = (EQ × SP) – (AQ × AP)

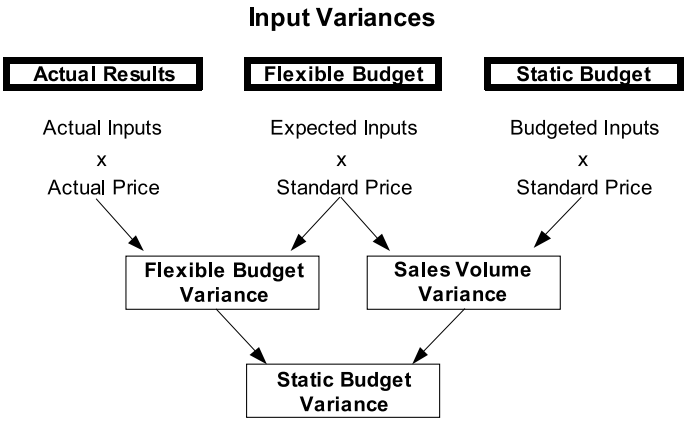
3) EXAMPLE: The company actually spent $1,000 on direct materials during the month, but, given its standard cost and actual level of production, would have expected to spend $1,044.

a) Therefore, the company experienced a favorable flexible budget variance of $44 on direct materials ($1,044 flexible budget – $1,000 actual cost incurred).

c. By definition, the sales volume and flexible budget variances **net to the static budget variance**.

Static budget variance = Sales volume variance + Flexible budget variance
= $44 F + $44 U
= $0

9. The relationships between the budget amounts and the resulting variances can be depicted graphically as follows:



a. Note that **expected quantity** is derived by **combining an actual component and a standard component**.

b. This model can be **applied to any of the three variable inputs** to the production process (direct materials, direct labor, and variable overhead).

1) Fixed overhead is dealt with slightly differently, as discussed in item 4. in Subunit 4.

10. **Overview Example of Manufacturing Variance Analysis**

a. A pet products manufacturer is beginning its budgeting cycle for the upcoming month, and the company projects that it will produce 700 tons of dog food.

1) The company combines three different raw materials in its production process and so uses a weighted-average standard cost for calculating its direct materials budget.

Static Budget:		
Direct materials	1,000 tons used × $54 per ton	$54,000

2) The company employs workers at three different skill levels and so uses a weighted-average standard rate for calculating its direct labor budget.

Static Budget:		
Direct labor	900 hours spent × $17 per hour	$15,300

3) The application rates for the two components of manufacturing overhead can only be calculated after selecting an appropriate allocation base for each.

a) Management chooses machine hours as the driver for variable overhead. Total variable overhead costs for the period are projected to be $9,600, and total machine usage is projected to be 200 hours.

Static Budget Driver:		
Variable overhead	$9,600 total ÷ 200 machine hours	$48 per machine hour

b) Management also chooses machine hours as the driver for fixed overhead as well. Total fixed overhead costs for the period are projected to be $8,000.

Static Budget Driver:		
Fixed overhead	$8,000 total ÷ 200 machine hours	$40 per machine hour

b. During the month, the company experienced different market conditions from those expected. Only 660 tons of dog food were produced, and actual input usage was as follows:

Actual Results:		
Direct materials	1,078 tons used × $50 per ton	$53,900
Direct labor	880 hours spent × $16 per hour	$14,080
Variable overhead	Actual costs incurred	$ 9,702
Fixed overhead	Actual costs incurred	$ 9,496

c. The static budget variance for each of these elements can now be derived:

	Actual Results	**Static Budget Variances**		Static Budget
Direct materials	$53,900	**$ 100**	**F**	$54,000
Direct labor	14,080	**1,220**	**F**	15,300
Variable overhead	9,702	**(102)**	**U**	9,600
Fixed overhead	9,496	**(1,496)**	**U**	8,000
Total	$87,178	**$ (278)**	**U**	$86,900

1) The company did better than planned in its outlays for materials and labor but worse than planned for both components of overhead.

a) These results only report the difference between actual costs and the master budget in absolute terms. They reveal nothing about how the prices of inputs or the level of production varied from what was planned for at the time the master budget was prepared.

d. To enable further analysis, the flexible budget amounts must be calculated.

1) The flexible budget for direct materials consists of the actual number of outputs produced, times the standard input per ton of output, times the standard price for the input.

a) As noted on the previous page, the company actually produced only 660 tons of dog food instead of the 700 projected.

b) The standard input quantity per unit of output can be derived from the static budget (1,000 tons standard input ÷ 700 tons budgeted output = 1.42857 tons in per ton out).

Flexible Budget:		
Direct materials	660 tons produced × 1.42857 × $54 per ton	$50,914

2) Likewise, the flexible budget for direct labor consists of the actual number of outputs produced, times the standard input per ton of output, times the standard price for the input.

a) The standard input quantity per unit of output can be derived from the static budget (900 hours standard input ÷ 700 tons budgeted output = 1.28571 hours spent per ton out).

Flexible Budget:		
Direct labor	660 tons produced × 1.28571 × $17 per hour	$14,426

3) The flexible budget for variable overhead consists of the actual number of outputs produced, times the budgeted number of allocation-base units per ton of output, times the budgeted allocation rate.

a) The standard allocation-base driver per unit of output can be derived from the static budget (200 machine hours standard input ÷ 700 tons output budgeted = 0.28571 machine hours per ton out).

Flexible Budget:		
Variable overhead	660 tons produced × 0.28571 × $48 per machine hour	$9,051

4) The flexible budget amount for fixed overhead is identical to the static budget. This is because fixed costs are by their nature unchanging over the relevant range.

Flexible Budget:		
Fixed overhead	Same as static budget	$8,000

e. The static budget variance for each of the inputs can now be decomposed into the flexible budget variance and the sales volume variance.

	Actual Results	**Flexible Budget Variances**		Flexible Budget	**Sales Volume Variances**		Static Budget
Direct materials	$53,900	**$(2,986)**	**U**	$50,914	**$3,086**	**F**	$54,000
Direct labor	14,080	**346**	**F**	14,426	**874**	**F**	15,300
Variable overhead	9,702	**(651)**	**U**	9,051	**549**	**F**	9,600
Fixed overhead	9,496	**(1,496)**	**U**	8,000	**----**		8,000
Total	$87,178	**$(4,787)**	**U**	$82,391	**$4,509**	**F**	$86,900

1) The situation is obviously more complex than the static budget variances alone reveal.

2) For instance, the **small total variance in direct materials** was caused by (a) the amount that "should" have been spent being substantially **lower** than what was originally planned on and (b) the amount actually spent being substantially **higher** than what "should" have been spent.

20.2 DIRECT MATERIALS VARIANCES

1. The **flexible budget variance** portion of the total variance for any of the three variable production inputs (direct materials, direct labor, and variable overhead) can be **subdivided** into two component variances.

   a. In the case of direct materials, the two components are the price variance and the quantity (also called the efficiency or usage) variance.

   b. The **materials price variance** is a pure measure of how much the actual price paid for inputs deviated from the standard (holding quantity constant).

      Materials price variance = AQ × (SP – AP)

      1) EXAMPLE: The materials price variance for the month is calculated as follows:

         Materials price variance = AQ × (SP – AP)
         = 1,078 tons used × ($54 per ton – $50 per ton)
         = **$4,312 F**

   c. The **materials quantity variance** measures how efficiently direct materials were used given the actual level of production (holding price constant).

      Materials quantity variance = (EQ – AQ) × SP

      1) EXAMPLE: The materials quantity variance for the month is calculated as follows:

         Materials quantity variance = (EQ – AQ) × SP
         = [(660 tons produced × 1.42857) – 1,078 tons] × $54 per ton
         = (942.8562 tons – 1,078 tons) × $54 per ton
         = **$7,298 U**

      2) The calculations are confirmed by the fact that the net of the two equals the flexible budget variance.

         Materials flexible budget variance = Price variance + Quantity variance
         = $4,312 + (–$7,298)
         = **$2,986 U**

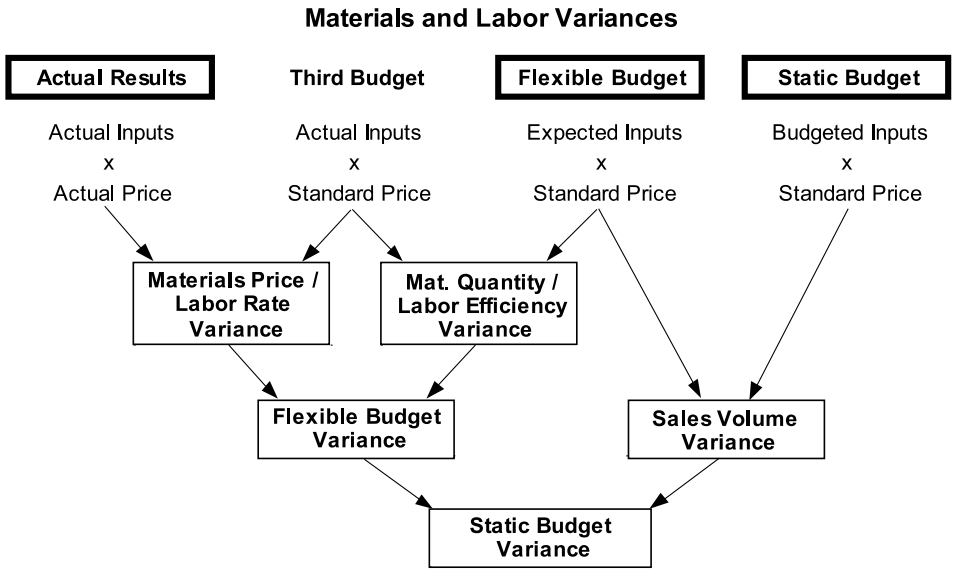
   d. Conceptually, the price and quantity (rate and efficiency in the case of direct labor) variances can be thought of as resulting from the insertion into the schematic of a **"third" budget amount**, consisting of the actual inputs used times the standard price.

      1) The algebraic formulas can be restated in terms of the budget amounts

         Materials price variance = AQ × (SP – AP)
         = (AQ × SP) – (AQ × AP)
         = "Third" budget – Actual results

         Materials quantity variance = (EQ – AQ) × SP
         = (EQ × SP) – (AQ × SP)
         = Flexible budget – "Third" budget

2) These relationships can be depicted graphically as follows:



2. The interpretation of **unfavorable materials variances** is straightforward.
   a. An **unfavorable price variance** means that the actual price paid for inputs was higher than expected.
   b. An **unfavorable quantity variance** means that the actual number of inputs consumed was higher than expected.
      1) An unfavorable materials quantity variance is usually caused by waste, shrinkage, or theft. It may be the responsibility of the production department supervisor because the excess usage occurred while the materials were under that person's supervision.
3. **Favorable materials variances** are more ambiguous.
   a. A **favorable price variance** could be caused by the purchasing manager dealing effectively with the company's suppliers.
      1) Unfortunately, the purchasing manager could also engineer a favorable price variance for him/herself by contracting for a quantity discount on materials that results in the company carrying excess inventory.
      2) Alternatively, the purchasing manager could have bought from the low bidder without regard for the quality of the materials.
   b. A **favorable quantity variance** is also subject to varying interpretations.
      1) A favorable materials quantity variance indicates that the workers either have been unusually efficient or are producing lower-quality products with less than the standard quantity of materials.
         a) A favorable quantity variance, therefore, may suggest that costs have been reduced at the expense of product quality.
   c. These aspects of variance analysis emphasize the point that variances cannot be interpreted in isolation. No variance by itself is either "good" or "bad" news.

20.3 DIRECT LABOR VARIANCES

1. As with direct materials, the **flexible budget variance** portion of the total variance for direct labor can be **subdivided** into two component variances.
   a. In the case of direct labor, the two components are the rate variance and the efficiency variance.
   b. The **labor rate variance** is a pure measure of how much the actual price paid for labor deviated from the standard (holding hours worked constant).

      Labor rate variance = AQ × (SP – AP)

      1) EXAMPLE: The labor rate variance for the month is calculated as follows:

         Labor rate variance = AQ × (SP – AP)
         = 880 hours spent × ($17.00 per hour – $16.00 per hour)
         = **$880 F**

   c. The **labor efficiency variance** measures how efficiently direct labor was employed given the actual level of production (holding the wage rate constant).

      Labor efficiency variance = (EQ – AQ) × SP

      1) EXAMPLE: The labor rate variance for the month is calculated as follows:

         Labor efficiency variance = (EQ – AQ) × SP
         = [(660 tons output × 1.28571) – 880 hours] × $17.00 per hour
         = (848.5686 – 880 hours) × $17.00 per hour
         = **$534 U**

      2) The calculations are confirmed by the fact that the net of the two equals the flexible budget variance.

         Labor flexible budget variance = Rate variance + Efficiency variance
         = $880 F + $534 U
         = **$346 F**

   d. Once again, it is helpful to conceive of the rate and efficiency variances as resulting from the insertion of a "third" budget, consisting of the actual hours worked times the standard wage.

      1) These relationships can be depicted algebraically as follows:

         Labor rate variance = (AQ × SP) – (AQ × AP)
         = "Third" budget – Actual results

         Labor efficiency variance = (EQ × SP) – (AQ × SP)
         = Flexible budget – "Third" budget

2. The interpretation of **unfavorable labor variances** is straightforward.
   a. An **unfavorable rate variance** means that the actual wages paid for labor were higher than expected.
   b. An **unfavorable efficiency variance** means that the actual number of hours worked was higher than expected.

      1) An unfavorable labor efficiency variance may be caused by workers taking unauthorized work breaks. It may also be caused by production delays resulting from materials shortages or inferior materials.

3. **Favorable labor variances** are more ambiguous.
   a. A **favorable rate variance** could be caused by the company securing a good contract with the union.
      1) Unfortunately, the shift supervisor could also engineer a favorable price variance for him/herself by scheduling employees of insufficient skill level. They have lower wages but may be unable to produce products of the proper level of quality.
   b. A **favorable efficiency variance** is also subject to varying interpretations.
      1) A favorable labor efficiency variance indicates that the workers either have been unusually efficient or are producing lower-quality products with less than sufficient attention.
         a) A favorable efficiency variance, therefore, may suggest that costs have been reduced at the expense of product quality.
   c. As with direct materials, labor variances cannot be interpreted in isolation. No variance by itself is either "good" or "bad" news.

20.4 OVERHEAD VARIANCES

1. As with direct materials and direct labor, the static budget variance for variable overhead can be subdivided into two component variances (the variances for fixed overhead are described in item 4. on page 12).
   a. The **variable overhead flexible budget variance** reports how much actual variable overhead costs deviated from what was expected given the actual level of production.
      1) In other words, the variable overhead flexible budget variance is the **amount of over- or underapplied variable overhead**.
      2) Obviously, actual overhead costs for the period can simply be totaled to prepare for variance calculation. If an "actual rate" is desired, this total can be divided by the actual number of allocation-base units expended.
   b. The **variable overhead sales volume variance** reports how much variable overhead costs that were expected given the actual level of production (i.e., the amount applied) deviated from what was planned for when the master budget was prepared.
2. Likewise, the flexible budget variance for variable overhead can be subdivided into two component variances. The spending and efficiency variances are analogous to the price/rate and quantity/efficiency variances for materials and labor, respectively.
   a. The **variable overhead spending variance** measures how much the "actual" overhead rate deviated from the standard (holding the driver level constant).

      Variable OH spending variance = AQ × (SP – AP)
      = (AQ × SP) – (AQ × AP)
      = (AQ × SP) – Actual costs incurred

      1) EXAMPLE: The variable OH spending variance for the month is calculated as follows:

         Variable OH spending variance = (AQ × SP) – Actual costs incurred
         = (198 machine hours spent × $48 per hour) – $9,702 actual costs
         = $9,504 – $9,702
         = **$198 U**

b. The **variable overhead efficiency variance** measures the "efficiency" with which the allocation base was used (holding the application rate constant).

Variable OH efficiency variance = (EQ – AQ) × SP

1) EXAMPLE: The variable OH efficiency variance for the month is calculated as follows:

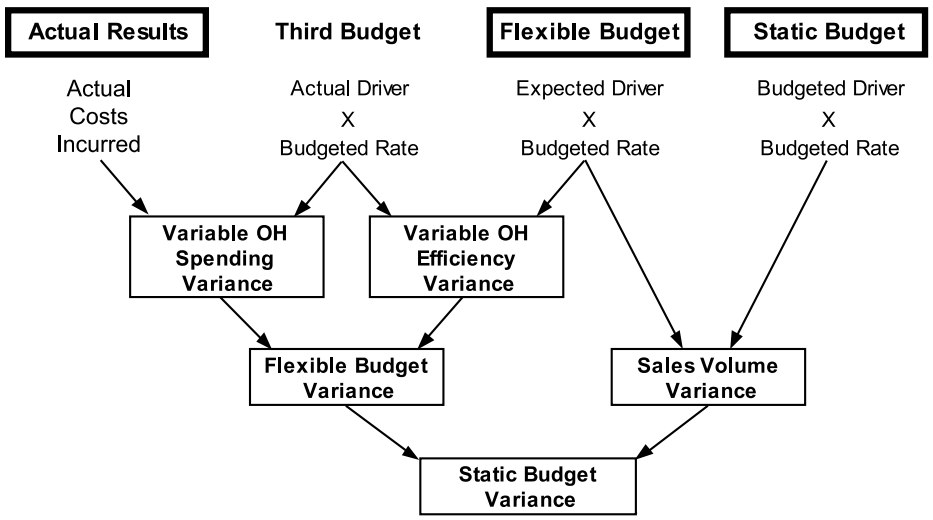
Variable OH efficiency variance = (EQ – AQ) × SP
= [(660 tons output × 0.28571) – 198 machine hours] × $48
= (188.5685 – 198) × $48
= **$453 U**

2) The calculations are confirmed by the fact that the net of the two equals the flexible budget variance.

Variable OH flexible budget variance = Spending variance + Efficiency variance
= $198 U + $453 U
= **$651 U**

c. The similarity of the variable overhead variances to the price/rate and quantity/ efficiency variances for materials and labor can be seen in the following diagram:

Variable Overhead Variances



3. **Variable overhead variances** do not directly measure production performance as materials and labor variances do.

a. A **variable overhead spending variance** measures the accuracy of the estimates used to derive the application rate.

1) Multiple indirect costs are pooled in variable overhead (indirect materials, indirect labor, utilities, etc.). Explaining this variance, **favorable or unfavorable**, would require detailed information about each of these costs.

b. A **variable overhead efficiency variance** indicates a deviation in the efficiency of the allocation base for variable overhead.

1) Machine hours are a commonly used driver for variable overhead. An **unfavorable** variance could be caused by:

a) Obsolete machinery
b) Improper machine maintenance
c) Lack of training in proper use of machines
d) Jobs poorly scheduled

4. The **fixed portion of the total overhead variance** also has two components, but they are not combined.
   a. Just as with variable overhead, the **fixed overhead spending variance** is derived by comparing the actual costs incurred with the flexible budget.
      1) This variance is caused by an unexpected change in the amount of fixed costs, such as a sudden increase in factory insurance or the penalty-free cancelation of an equipment lease.
      2) EXAMPLE: The fixed OH spending variance for the month is calculated as follows:

         Fixed OH spending variance = Flexible/Static budget – Actual costs incurred
         = $8,000 – $9,496
         = **$1,496 U**

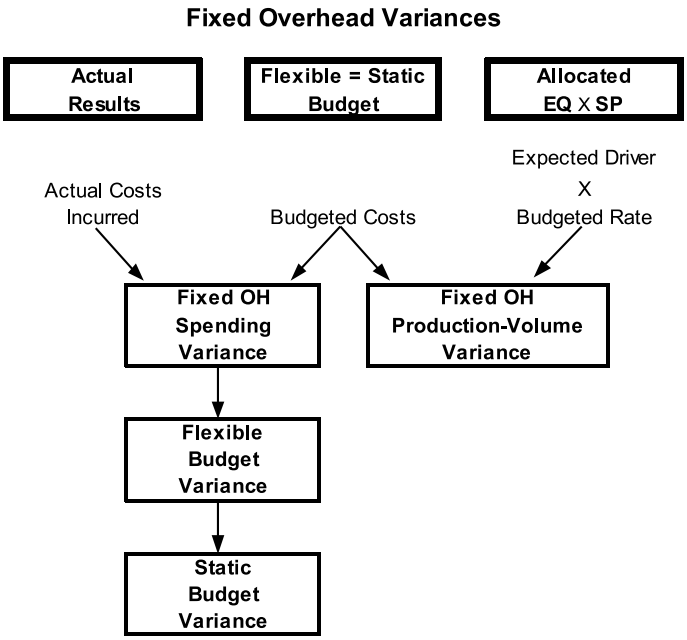
      3) Note that fixed overhead has **no efficiency variance**, due to the fact that the **flexible and static budget amounts** for fixed overhead are the **same**.
         a) This is because fixed costs are, by their nature, unchanging within the relevant range of the budgeting cycle. The same amount of fixed costs must be covered regardless of machine usage or output level.
   b. Instead, a **production-volume variance**, also known as a **denominator-level variance**, is calculated.
      1) The production volume variance equals the fixed overhead allocation minus the flexible/static budget. The allocation is calculated as follows:

         Fixed OH allocation = Actual number of outputs produced (AO)
         × Budgeted driver level per unit of output (SI/O)
         × Budgeted FOH application rate (SP)

      2) As noted above, the flexible/static budget amount is the amount of fixed overhead that must be covered regardless of the level of production.
         a) If the firm **produces fewer units than were budgeted**, fixed overhead will be **underallocated**. That is, if the plant's capacity is underutilized during the period, fixed costs will not be sufficiently covered.
         b) This **underallocation** will be indicated by an **unfavorable production-volume variance**.
         c) An **unfavorable** variance may therefore be the result of excess capacity. A **favorable** variance may result from overproduction.
      3) EXAMPLE: The fixed OH production-volume variance is calculated as follows:

         Fixed OH production-volume variance = Fixed OH allocated – Flexible/Static budget
         = (660 tons output × 0.28571 × $40 per hour) – $8,000
         = $7,543 – $8,000
         = **$457 U**

c. The fixed overhead variances can be depicted graphically as follows:



5. **Integrated overhead variance analysis** combines the variable and fixed portions of the overhead variance to allow simplified scrutiny.

   a. **Four-way** overhead variance analysis includes all four intermediate variances calculated on pages 10-12.

      1) EXAMPLE:

4-Way Analysis	Spending	Efficiency	Production-Volume
Variable	$198 U	$453 U	--
Fixed	$1,496 U	--	$457 U

   b. **Three-way** overhead variance analysis combines the variable and fixed spending variances into a single spending variance and reports the other two variances separately.

      1) EXAMPLE:

	VOH + FOH	VOH	FOH
	Spending	**Efficiency**	**Production-Volume**
3-Way Analysis	$1,694 U	$453 U	$457 U

   c. **Two-way** overhead variance analysis combines the spending and efficiency variances into a flexible budget variance and reports the production-volume variance separately.

      1) EXAMPLE:

	VOH + FOH	FOH
	Flexible Budget	**Production-Volume**
2-Way Analysis	$2,147 U	$457 U

      2) The flexible budget variance in 2-way analysis is also called the **controllable variance**. It is the portion of the total not attributable to the production-volume variance.

d. **One-way** overhead variance analysis combines all the overhead variances into a single amount.

1) EXAMPLE:

	VOH + FOH
	Total Overhead Variance
1-Way Analysis	$2,604 U

2) Since this amount includes the fixed overhead production-volume variance, it cannot be tied to the overall table of variances in item 10.e. in Subunit 1.

20.5 COMPREHENSIVE EXAMPLE OF VARIANCE ANALYSIS

1. Formula Recap

a. First level

Static budget variance = (Standard quantity × Standard price) – (Actual quantity × Actual price)

b. Second level

Sales volume variance = (Standard quantity – Expected quantity) × Standard price
Flexible budget variance = (Expected quantity × Standard price) – (Actual quantity × Actual price)

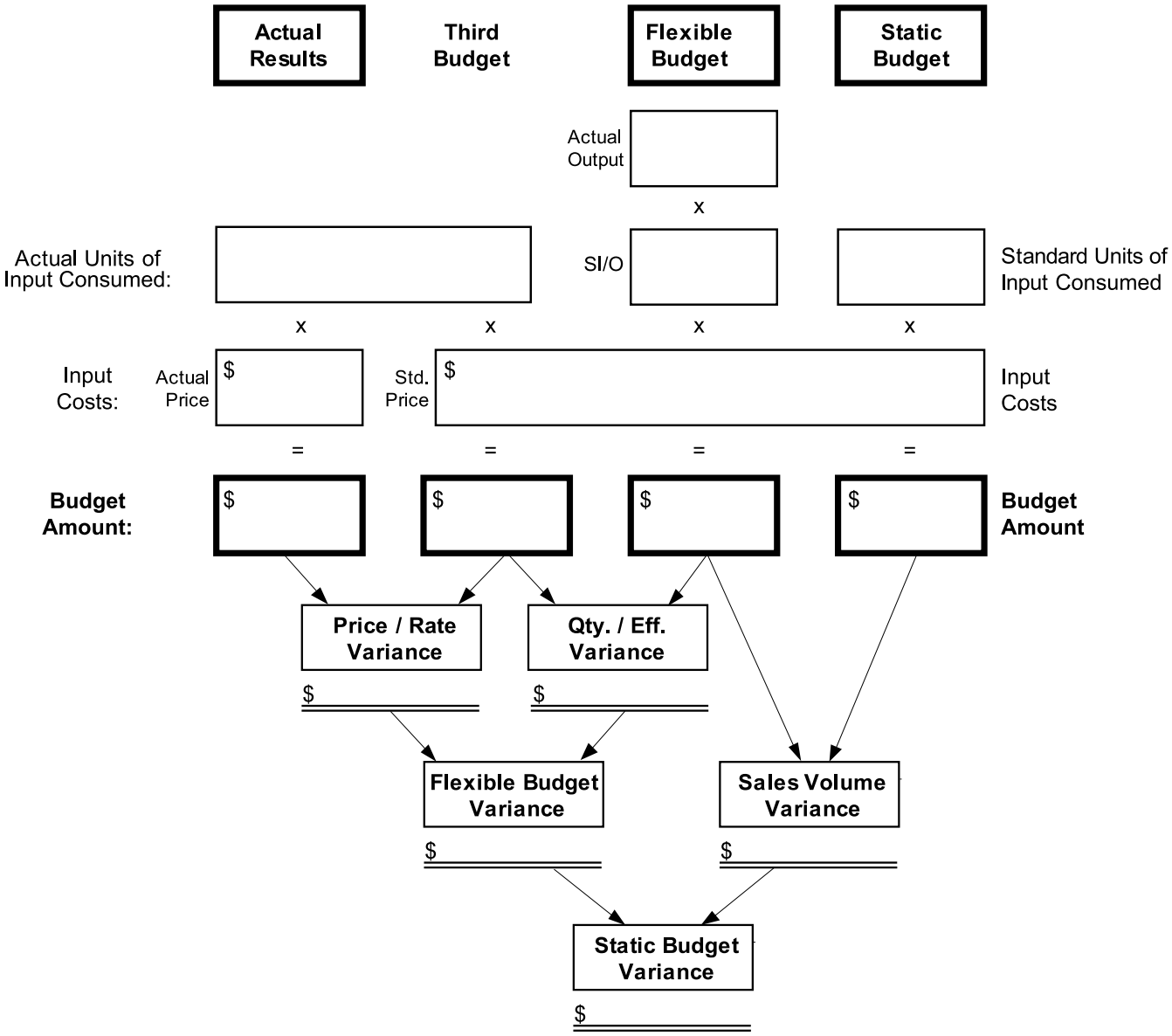
c. Third level

Price / rate variance = Actual quantity × (Standard price – Actual price)
Quantity / efficiency variance = (Expected quantity – Actual quantity) × Standard price

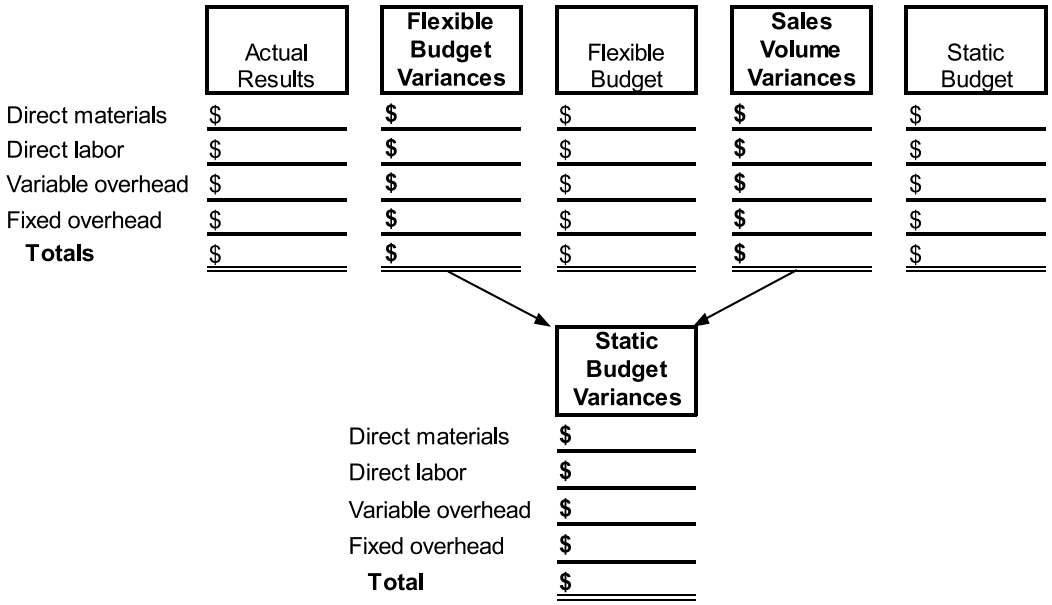
2. Situation

		BUDGET	ACTUAL
OUTPUT	1,000 units		1,020 units
DIRECT MATERIALS	Carbon	150,000 units @ $1.00	233,333.3 units @ $1.90
	Chromium	150,000 units @ $1.00	233,333.3 units @ $1.90
	Copper	300,000 units @ $3.00	233,333.3 units @ $1.90
DIRECT LABOR	68,000 hours @ $7.00 per hour		65,000 hours @ $7.20
OVERHEAD	Variable:	$6.00 per direct labor hour	$396,000
	Fixed:	$2.00 per direct labor hour	$130,000

3. Use this worksheet as an aid in deriving the variances.



Master Variances



4. Direct Materials Variances

a. Formulas

Calculation of weighted-average standard price

Carbon	150,000 units × $1.00 =	$ 150,000
Chromium	150,000 units × $1.00 =	$ 150,000
Copper	300,000 units × $3.00 =	$ 900,000
Totals	600,000 units	$1,200,000

SP = $1,200,000 ÷ 600,000 = $2.00

Calculation of weighted-average actual price

Carbon	233,333.3 units × $1.90 =	$ 443,333.3
Chromium	233,333.3 units × $1.90 =	$ 443,333.3
Copper	233,333.3 units × $1.90 =	$ 443,333.3
Totals	700,000 units	$1,330,000

AP = $1,330,000 ÷ 700,000 = $1.90

Static budget variance
(SQ × SP) – (AQ × AP)
(600,000 × $2.00) – (700,000 × $1.90)
$1,200,000 – $1,330,000
$130,000 U

Calculation of expected quantity

SI/O = Budgeted inputs ÷ Budgeted outputs
= 600,000 units ÷ 1,000 units
= 600
EQ = Actual outputs × SI/O
= 1,020 units × 600
= 612,000

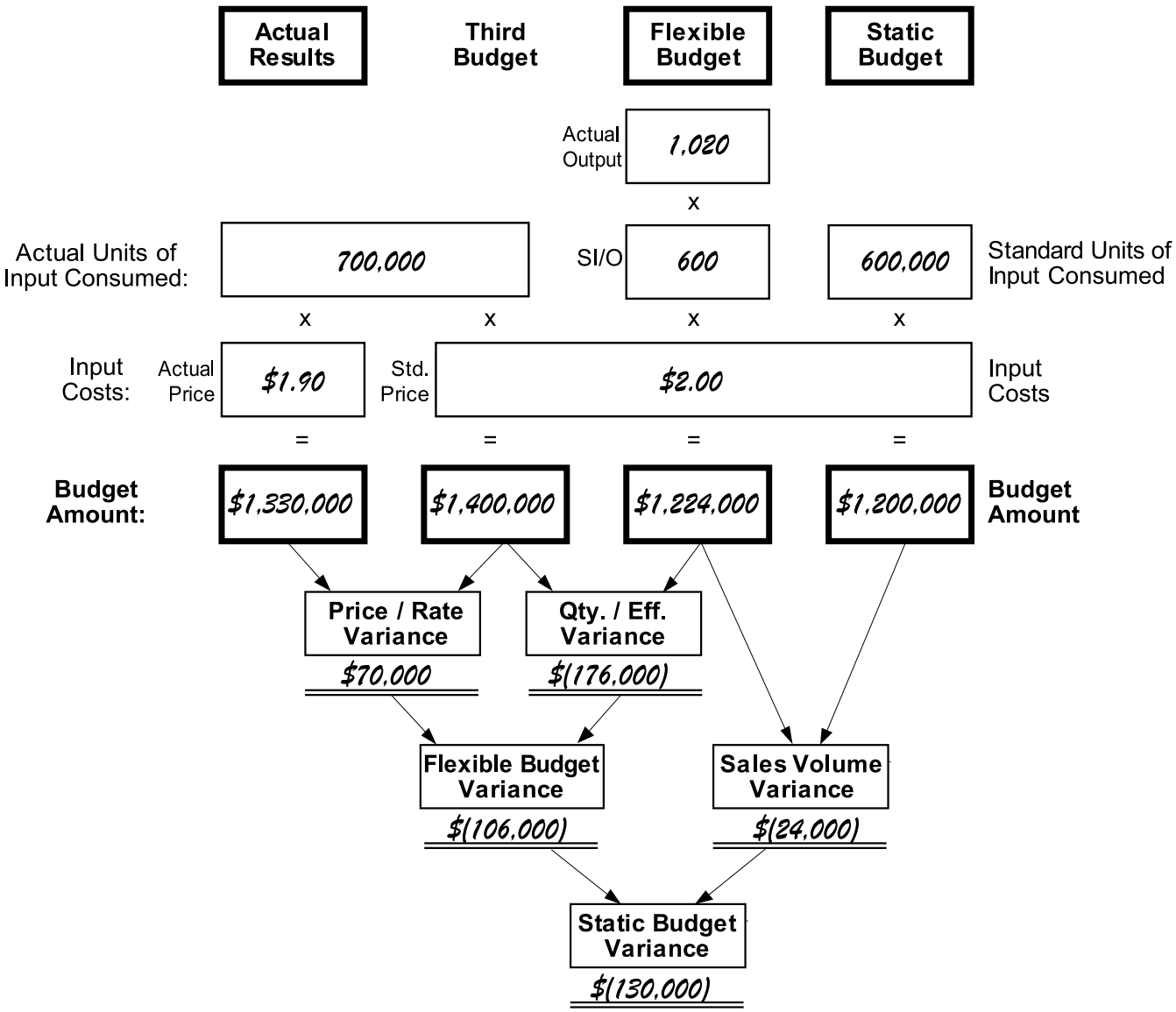
Flexible budget variance
(EQ × SP) – (AQ × AP)
(612,000 × $2.00) – (700,000 × $1.90)
$1,224,000 – $1,330,000
$106,000 U

Sales volume variance
(SQ – EQ) × SP
(600,000 – 612,000) × $2.00
–12,000 × $2.00
$24,000 U

Materials price variance
AQ × (SP – AP)
700,000 × ($2.00 – $1.90)
700,000 × $.10
$70,000 F

Materials quantity variance
(EQ – AQ) × SP
(612,000 – 700,000) × $2.00
– 88,000 × $2.00
$176,000 U

b. Diagram



5. Direct Labor Variances

a. Formulas

Static budget variance
(SQ × SP) – (AQ × AP)
(68,000 × $7.00) – (65,000 × $7.20)
$476,000 – $468,000
$8,000 F

Calculation of expected quantity
SI/O = Budgeted inputs ÷ Budgeted outputs
= 68,000 units ÷ 1,000 units
= 68
EQ = Actual outputs × SI/O
= 1,020 units × 68
= 8,160

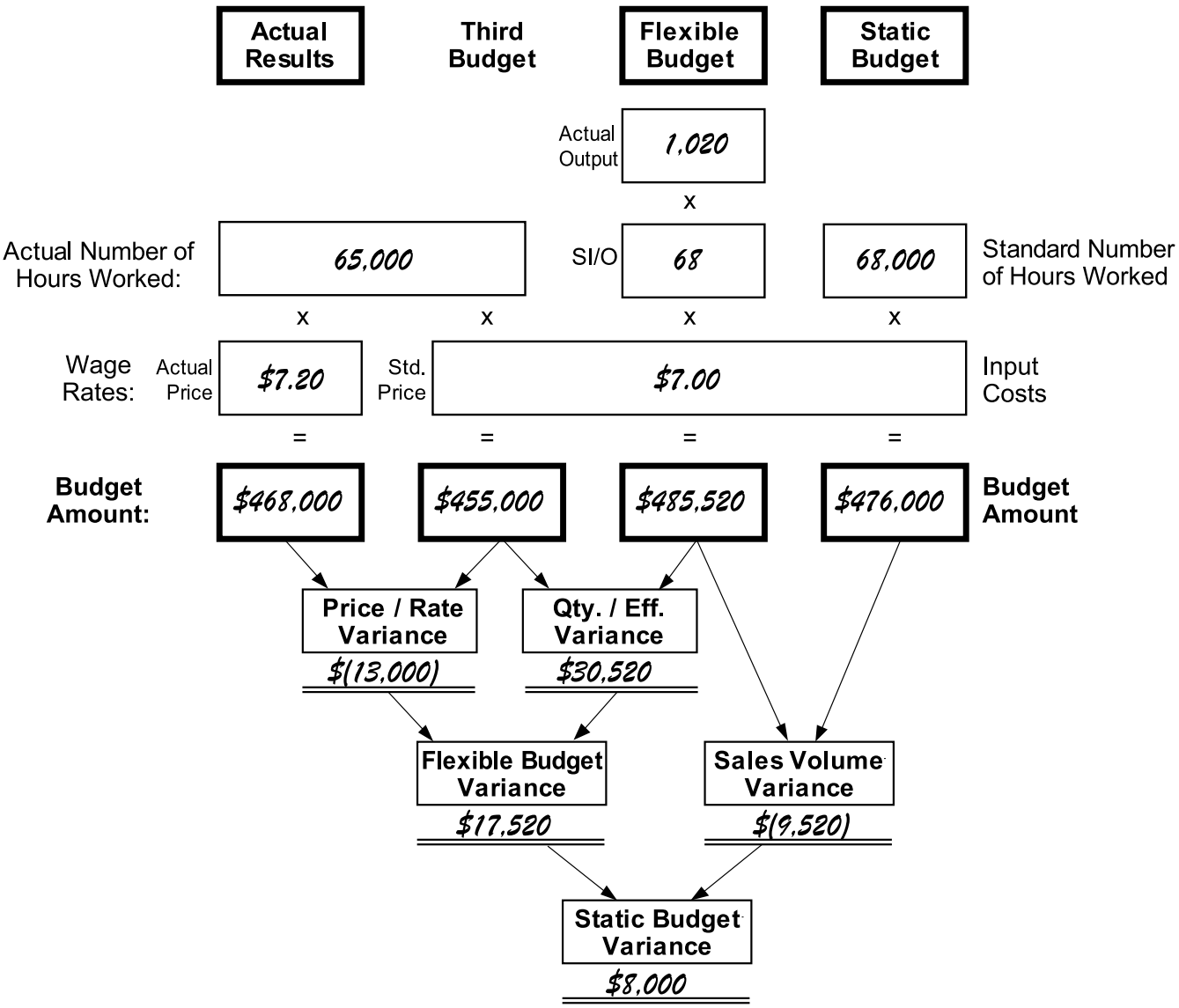
Flexible budget variance
(EQ × SP) – (AQ × AP)
(69,360 × $7.00) – (65,000 × $7.20)
$485,520 – $468,000
$17,520 F

Sales volume variance
(SQ – EQ) × SP
(68,000 – 69,360) × $7.00
–1,360 × $7.00
$9,520 U

Labor rate variance
AQ × (SP – AP)
65,000 × ($7.00 – $7.20)
65,000 × –$.20
$13,000 U

Labor efficiency variance
(EQ – AQ) × SP
(69,360 – 65,000) × $7.00
4,360 × $7.00
$30,520 F

b. Diagram



6. Variable Overhead Variances

a. Formulas

Static budget variance
(SQ × SP) – Actual costs incurred
(68,000 × $6.00) – $396,000
$408,000 – $396,000
$12,000 F

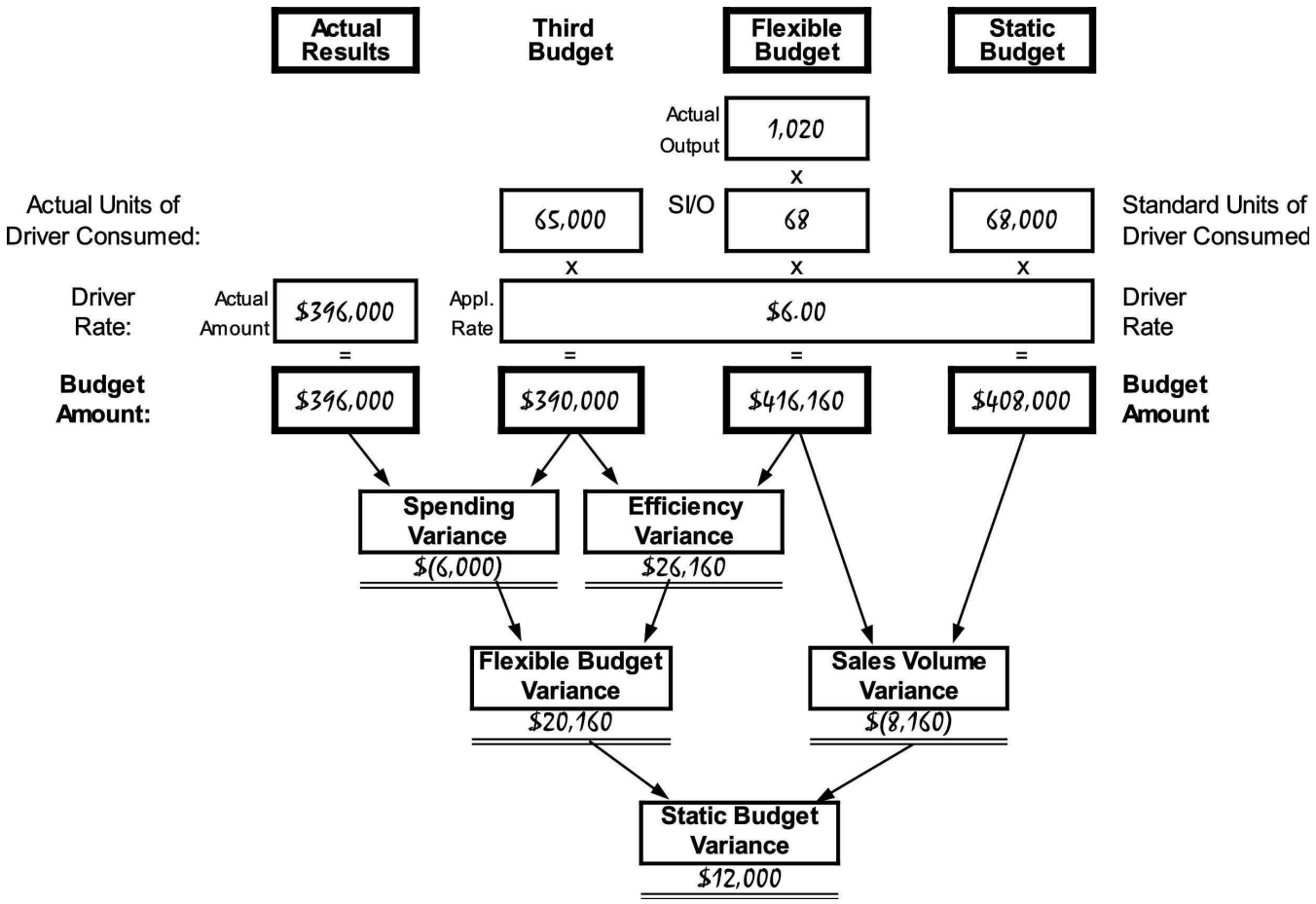
Flexible budget variance
(EQ × SP) – Actual costs incurred
(69,360 × $6.00) – $396,000
$416,160 – $396,000
$20,160 F

Sales volume variance
(SQ – EQ) × SP
(68,000 – 69,360) × $6.00
–1,360 × $6.00
$8,160 U

VOH spending variance
(AQ × SP) – Actual costs incurred
(65,000 × $6.00) – $396,000
$390,000 – $396,000
$6,000 U

VOH efficiency variance
(EQ × SP) – AQ × SP)
(69,360 × $6.00) – (65,000 × $6.00)
$416,160 – $390,000
$26,160 F

b. Diagram



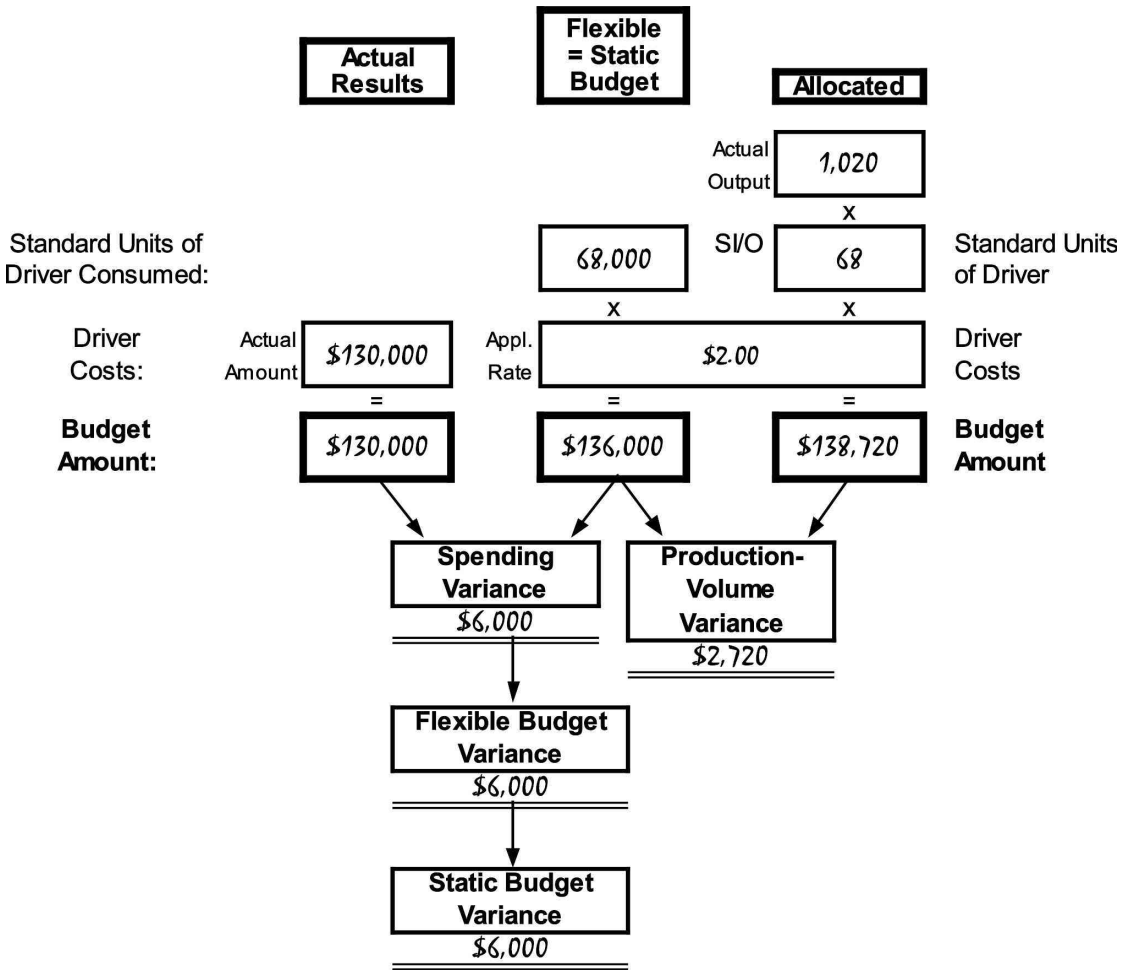
7. Fixed Overhead Variances

a. Formulas

Static budget variance
(SQ × SP) – Actual costs incurred
(68,000 × $2.00) – $130,000
$136,000 – $130,000
$6,000 F

Sales volume variance
(EQ – SQ) × SP
(69,360 – 68,000) × $2.00
1,360 × $2.00
$2,720 F

b. Diagram



8. The individual variances can be combined in a single schedule.

	Actual Results	Flexible Budget Variances		Flexible Budget	Sales Volume Variances		Static Budget
Direct materials	$1,330,000	$(106,000)	U	$1,224,000	$(24,000)	U	$1,200,000
Direct labor	468,000	17,520	F	485,520	(9,520)	U	476,000
Variable overhead	396,000	20,160	F	416,160	(8,160)	U	408,000
Fixed overhead	130,000	6,000	F	136,000	----		136,000
Total	$2,324,000	$ (62,320)	U	$2,261,680	$(41,680)	U	$2,220,000

	Static Budget Variances
Direct materials	$(130,000)
Direct labor	8,000
Variable overhead	12,000
Fixed overhead	6,000
Total	$(104,000)