WESTERN™ CPE

Innovative Education

Excel Budgeting and Forecasting Tools

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Course # 2164594, Version 1706, 4 CPE Credits

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Course CPE Information

Course Expiration Date

Per AICPA and NASBA Standards (S9-06), QAS Self-Study courses must include an expiration date that is ***no longer than one year from the date of purchase or enrollment***.

Field of Study

Computer Science. Some state boards may count credits under different categories—check with your state board for more information.

Course Level

Intermediate.

Prerequisites

Fundamental working knowledge of Microsoft Office Excel.

Advance Preparation

None.

Course Description

For most organizations, Excel remains the budgeting tool of choice. However, many who use Excel for budgeting and forecasting fail to take advantage of numerous features that can help produce better, more accurate results in less time. In this course, you'll learn what these features are and how to put them to use.

Specifically, we'll cover how features such as Solver and Scenario Manager, Excel's forecasting tools, and data consolidation tools that can streamline your budgeting processes. If you use Excel for budgeting and forecasting, you can't afford to miss this course!.

Publication/Revision Date

June 2017

Instructional Design

This Self-Study course is designed to lead you through a learning process using instructional methods that will help you achieve the stated learning objectives. You will be provided with course objectives and presented with comprehensive information and facts demonstrated in exhibits and/or case studies. Review questions will allow you to check your understanding of the material, and a qualified assessment will test your mastery of the course.

Please familiarize yourself with the following instructional features to ensure your success in achieving the learning objectives.

Course CPE Information

The preceding section, "Course CPE Information," details important information regarding CPE. If you skipped over that section, please go back and review the information now to ensure you are prepared to complete this course successfully.

Table of Contents

The table of contents allows you to quickly navigate to specific sections of the course.

Learning Objectives and Content

Learning objectives clearly define the knowledge, skills, or abilities you will gain by completing the course. Throughout the course content, you will find various instructional methods to help you achieve the learning objectives, such as examples, case studies, charts, diagrams, and explanations. Please pay special attention to these instructional methods, as they will help you achieve the stated learning objectives.

Review Questions

The review questions accompanying this course are designed to assist you in achieving the course learning objectives. The review section is not graded; do not submit it in place of your qualified assessment. While completing the review questions, it may be helpful to study any unfamiliar terms in the glossary in addition to course content. After completing the review questions, proceed to the review question answers and rationales.

Review Question Answers and Rationales

Review question answer choices are accompanied by unique, logical reasoning (rationales) as to why an answer is correct or incorrect. Evaluative feedback to incorrect responses and reinforcement feedback to correct responses are both provided.

Glossary

The glossary defines key terms. Please review the definition of any words you are not familiar with.

Index

The index allows you to quickly locate key terms or concepts as you progress through the instructional material.

Qualified Assessment

Qualified assessments measure (1) the extent to which the learning objectives have been met and (2) that you have gained the knowledge, skills, or abilities clearly defined by the learning objectives for each section of the course. Unless otherwise noted, you are required to earn a minimum score of 70% to pass a course. If you do not pass on your first attempt, please review the learning objectives, instructional materials, and review questions and answers before attempting to retake the qualified assessment to ensure all learning objectives have been successfully completed.

Answer Sheet

Feel free to fill the Answer Sheet out as you go over the course. To enter your answers online, follow these steps:

1. Go to www.westerncpe.com.
2. Log in with your username and password.
3. At the top right side of your screen, hover over "My Account" and click "My CPE."
4. Click on the big orange button that says "View All Courses."
5. Click on the appropriate course title.
6. Click on the blue wording that says "Qualified Assessment."
7. Click on "Attempt assessment now."

Evaluation

Upon successful completion of your online assessment, we ask that you complete an online course evaluation. Your feedback is a vital component in our future course development.

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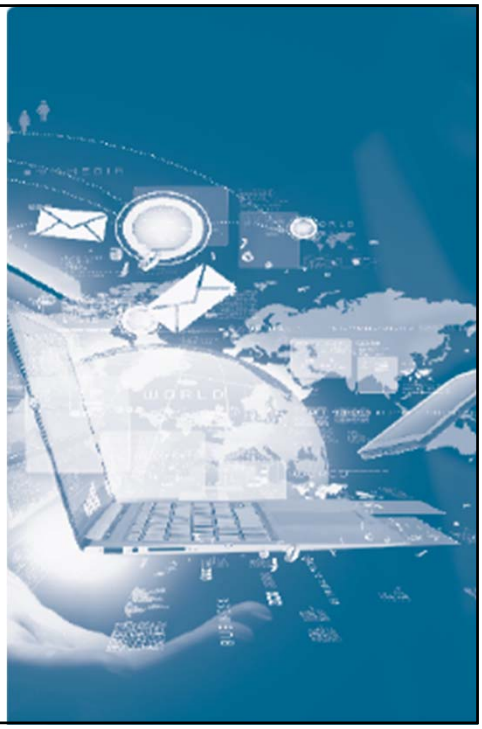
Table of Contents

Learning Objectives

Upon successful completion of this course, you will be able to:

- Identify appropriate tools and their functionality within Excel in order to solve problems and analyze data
- Identify the specific process and "clicks" for executing various functions within Excel
- Cite how to predict future outcomes using functions such as FORECAST, LINEST, and TREND and to test them with regression analysis
- Specify how to handle multiple versions of budgets and forecasts with Scenario Manager
- Identify optimal solutions of multi-variable problems using Solver
- Specify how to manage risk and uncertainty with Excel add-ins such as RiskAMP
- Identify efficient ways to handle capital budgeting issues
- Recognize how to prepare budget reports, including consolidating reports

Excel Budgeting and Forecasting



Presented by

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Learning Objectives

Upon completing this course, participants will be able to:

- Cite how to predict future outcomes using functions such as FORECAST, LINEST, and TREND
- Cite how to handle multiple versions of budgets and forecasts with Scenario Manager
- Identify optimal solutions of multi-variable problems using Solver
- Identify how to manage risk and uncertainty with Excel add-ins such as RiskAMP
- Cite how to handle capital budgeting issues more effectively
- Cite how to prepare budget reports—including consolidation of reports—more efficiently

Today's Agenda

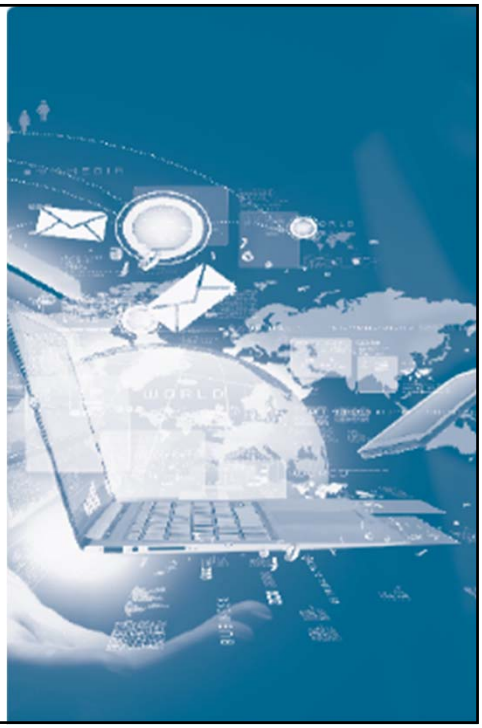
- Budgeting and Forecasting Features in Excel
- Capital Budgeting with Excel
- Miscellaneous Techniques Used in Creating Pro Forma Statements
- Budget Reporting Issues and Solutions

Let's Get Started!

Excel Budgeting and Forecasting

Thank You!

Tommy Stephens
K2 Enterprises



Excel Budgeting and Forecasting

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Budgeting and Forecasting Features in Excel

For most accounting and financial professionals, the single most challenging task in preparing a budget or forecast is to predict, with some degree of certainty, future revenues and expenses. Fortunately, Excel has a number of tools for creating accurate forecasts in minimal amounts of time.

Learning Objectives

Upon completing this section, you should be able to:

- Utilize the following tools in Excel budgeting and forecasting applications:
  - Data Tables,
  - Goal Seek,
  - Solver, and
  - Scenario Manager;

- Discuss the importance of Regression Analysis when preparing budgets and forecasts and describe Excel's regression features, including FORECAST, SLOPE, INTERCEPT, TREND, GROWTH, and LINEST; and

- Describe how to analyze and manage risk with Monte Carlo simulations.

> ⓘ To use **Solver** and many of the functions mentioned in this course, you must have the **Solver** and the **Analysis ToolPak Add-Ins** installed. Select **File** from the Ribbon, **Options**, and **Add-Ins** from the left navigation pane. At the bottom of the window, select **Excel Add-ins** from the **Manage** drop-down and select **Go**. In the Add-Ins window, check the boxes next to **Analysis ToolPak**, **Analysis ToolPak – VBA**, and **Solver Add-in** and click **OK**. This will enable both the **Solver** and **Analysis ToolPak**. Icons for **Data Analysis** and **Solver** are added on the **Data** tab of the Ribbon.

Using Data Tables for Sensitivity Analysis

One-variable and two-variable data tables have been a major spreadsheet analytical tool since Lotus 1-2-3, but, for many accountants, data tables have become a lost art. Data tables are an excellent method of conducting sensitivity or "what-if" analysis, which is an important aspect of forecasting data. In a simple one-variable data table, one variable is manipulated in calculating a result. In a two-variable data table, two variables are manipulated in calculating a result.

In our first example, Debbie Nelson, the CFO of a small manufacturing company, is trying to use a one-variable data table to forecast the impact of a change in unit sales price on the total sales revenue expected from a new product to be introduced in the coming year. In the table, the planned sales volume and unit

sales price are known. However, Nelson would like to calculate the sales revenue generated by unit prices ranging from $6.50 to $9.00 per unit.

To work with data tables, begin by creating a worksheet with a layout similar to the one displayed at the left in **Figure 1**. Put the alternative prices in a single column, in this case in cells **C11** through **C21**. Build a formula in cell **D10** to calculate the estimated sales revenue from the planned sales volume and unit price. *In a one-variable data table, the formula at the top of each column of the data table area is recalculated for each of the values in a single variable* – in this case, unit sales price. To create the data table, highlight the range **C10:D21** and select **What-If Analysis, Data Table** from the **Data** tab. In the **Data Table** dialog box, click in the box for the **Column input cell** and then click on cell **D7**. This process indicates to Excel where it is to substitute the values $6.50 through $9.00 in recalculating the total sales revenue. Click **OK** to produce the data table shown in the lower right of **Figure 1.** Note the formula in D11 is **{=TABLE(,D7)}.**

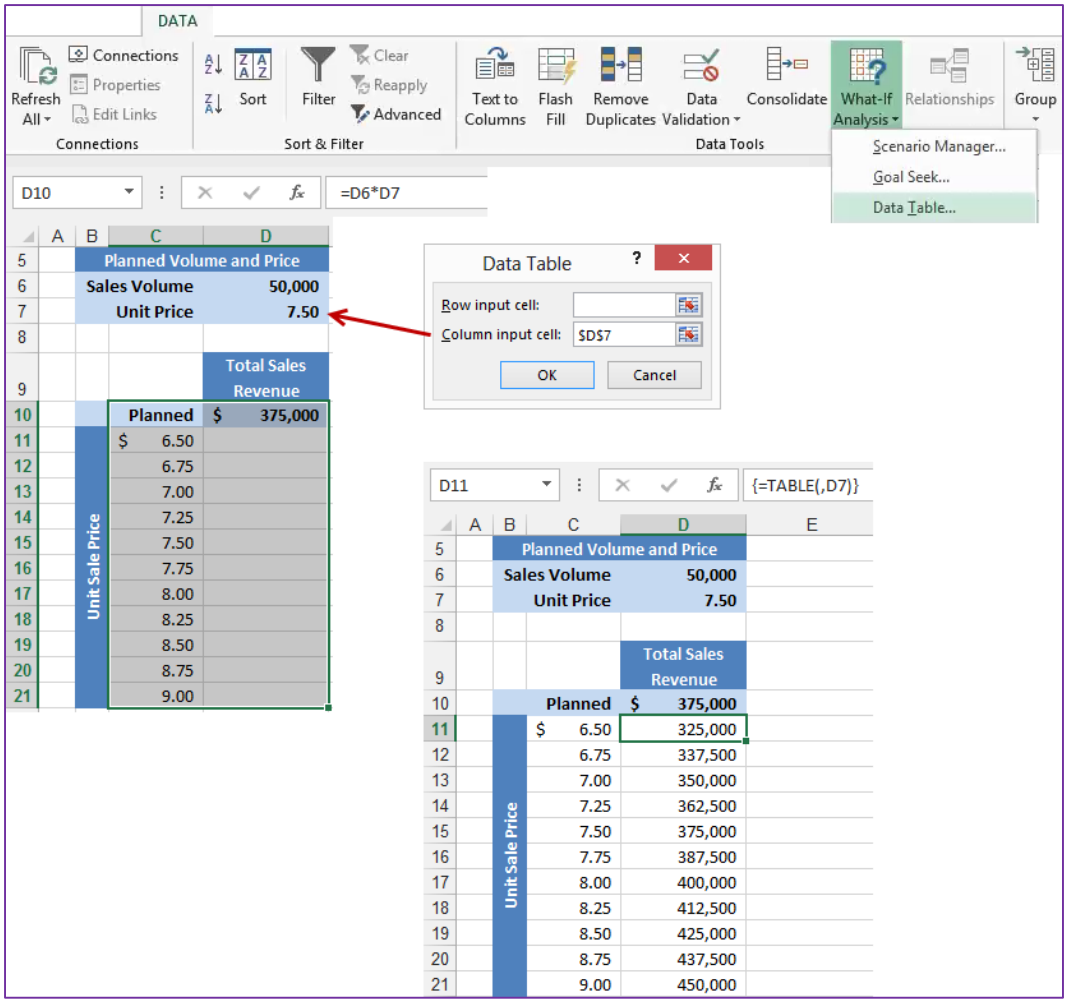
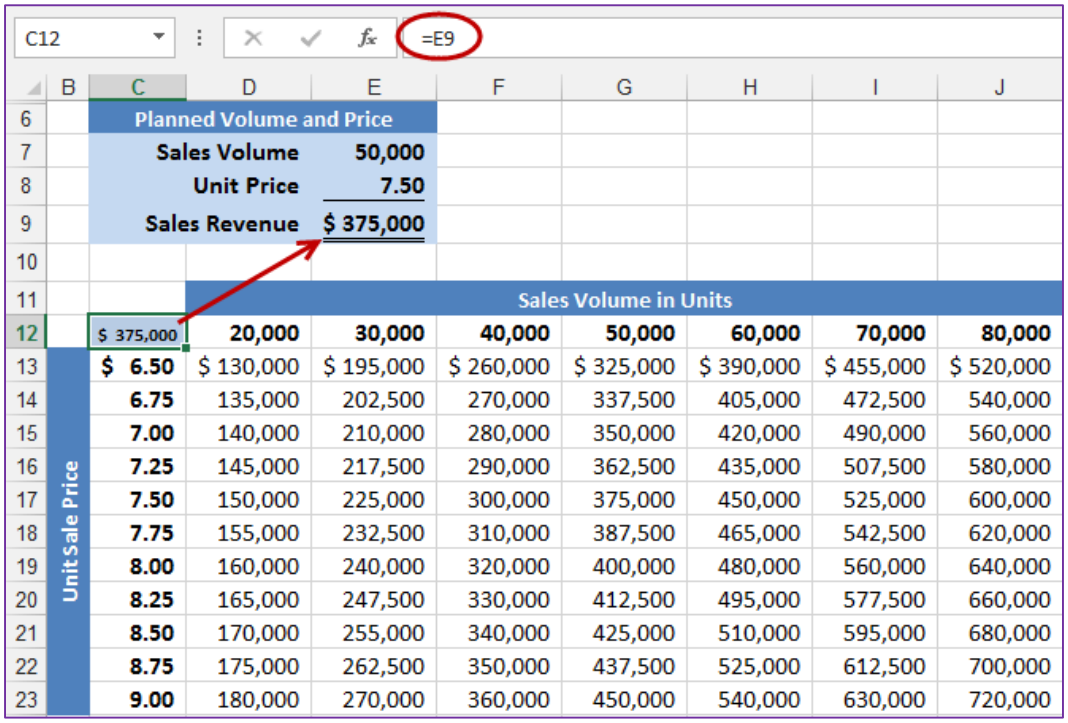


Figure 1 - Creating a One-Way Data Table to Calculate Sales Revenue from Multiple Prices

Nelson realizes that changing the unit sales price will affect the quantity sold. She would like to extend her analysis by stipulating various sales volumes as well as various sales prices in re-calculating the estimated

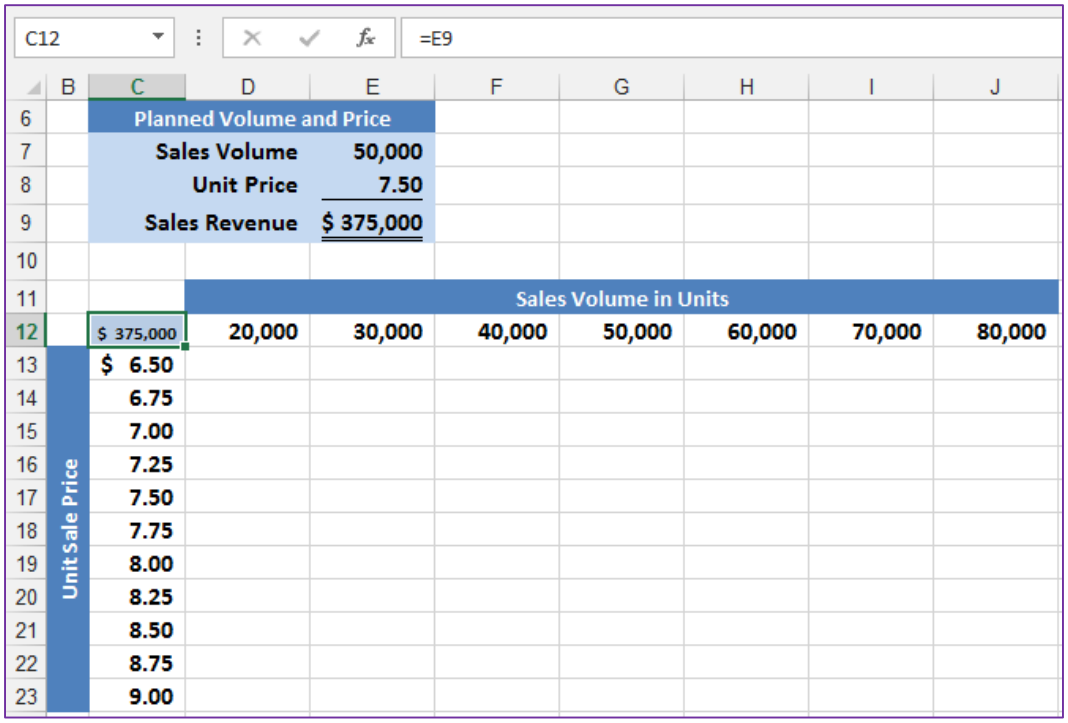
sales revenue from the introduction of the new product. Since two variables will be manipulated, this analysis will require a two-variable data table, shown in **Figure 2**.



	B	C	D	E	F	G	H	I	J
6		Planned Volume and Price							
7		Sales Volume		50,000					
8		Unit Price		7.50					
9		Sales Revenue		$ 375,000					
10									
11			Sales Volume in Units						
12		$ 375,000	20,000	30,000	40,000	50,000	60,000	70,000	80,000
13	Unit Sale Price	$ 6.50	$ 130,000	$ 195,000	$ 260,000	$ 325,000	$ 390,000	$ 455,000	$ 520,000
14		6.75	135,000	202,500	270,000	337,500	405,000	472,500	540,000
15		7.00	140,000	210,000	280,000	350,000	420,000	490,000	560,000
16		7.25	145,000	217,500	290,000	362,500	435,000	507,500	580,000
17		7.50	150,000	225,000	300,000	375,000	450,000	525,000	600,000
18		7.75	155,000	232,500	310,000	387,500	465,000	542,500	620,000
19		8.00	160,000	240,000	320,000	400,000	480,000	560,000	640,000
20		8.25	165,000	247,500	330,000	412,500	495,000	577,500	660,000
21		8.50	170,000	255,000	340,000	425,000	510,000	595,000	680,000
22		8.75	175,000	262,500	350,000	437,500	525,000	612,500	700,000
23		9.00	180,000	270,000	360,000	450,000	540,000	630,000	720,000

Figure 2 - Using a Two-Way Data Table to Compute Estimated Sales Revenue from Two Variables

To create the two-variable data table shown in Figure 2, begin by creating the outline of the data table as shown in **Figure 3**. Note that in the outline shown, cell E9 contains the formula **=E6*E7**. Note that cell C12 contains a cell reference back to cell E9, effectively replicating the formula in cell E9 into cell C12. Note, too, that the formula used to calculate total revenue is not limited to just the two variables in the data table and could contain references to other variables outside the data table.



	B	C	D	E	F	G	H	I	J
6		Planned Volume and Price							
7		Sales Volume		50,000					
8		Unit Price		7.50					
9		Sales Revenue		$ 375,000					
10									
11			Sales Volume in Units						
12		$ 375,000	20,000	30,000	40,000	50,000	60,000	70,000	80,000
13	Unit Sale Price	$ 6.50							
14		6.75							
15		7.00							
16		7.25							
17		7.50							
18		7.75							
19		8.00							
20		8.25							
21		8.50							
22		8.75							
23		9.00							

Figure 3 - Outline of Two-Variable Data Table

Once the outline of the two-variable data table is complete, select the range from cell C12 through cell J23. Then, from the **Data** tab, select **What-If Analysis** and **Data Table** to open the **Data Table** dialog box shown in **Figure 4**. In the Data Table dialog box, enter cell **E7** as the **Row input cell** and cell **E8** as the **Column input cell** and click **OK**. This instructs the data table to substitute the contents of the first row of the data table into cell E7 and the contents of the left-most column of the data table into cell E8 and to recalculate the formula in cell C12, placing the results in the "grid" of the data table. Upon completion, the two-variable data table resembles that shown in Figure 2.

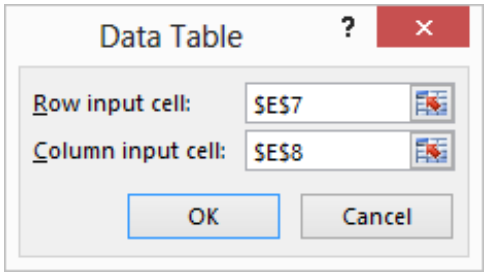


Figure 4 - Data Table Dialog Box

Referencing Data Tables in Budgeting and Forecasting Models

From a budgeting and forecasting perspective, once a data table has been constructed, users will likely need to reference data in the data table and use that data elsewhere in preparing budgeting and forecasting models.

One of the more effective means of doing so would be to use a double-lookup approach in which combining the power of **VLOOKUP** and **MATCH** functions is used to extract a specific element of a data table.

Using the completed two-variable data table from our previous example as the starting point of this example, suppose the designer of a forecasting spreadsheet wanted to enable users to quickly extract data from a data table for use elsewhere in the model. In cell D6 of the snippet of the spreadsheet shown in **Figure 5**, the following formula examines the contents of the two-variable data table and returns the value that meets the criteria specified in cells D3 and D4 of Figure 5.

```
=IFERROR(VLOOKUP(D4,'Two-Way Data Table COMPLETE'!C13:J23,
(MATCH(D3,'Two-Way Data Table COMPLETE'!D12:J12)+1),FALSE),
"Value Not Found")
```

In the formula shown above, the VLOOKUP function identifies the row that contains the Unit Price; the MATCH function identifies the column that contains the Sales Volume; and the IFERROR function traps any errors and replaces them with the phrase "Value Not Found." Of course, by definition, the VLOOKUP function also returns the value at the intersection of the identified row and column.

	A	B	C	D	E
1					
2		Planned Volume and Price			
3		Sales Volume		50,000	
4		Unit Price		7.50	
6		Planned Revenue		375,000.00	
7					

Figure 5 - Extracting Data from a Data Table

Remember that data tables depend on a formula entered in their upper, left-hand corner to calculate the values appearing in the data table. Further, remember that this formula can be a very complex formula and is not limited to just the variables in the data table. With these factors in mind, it becomes apparent that using a data table to calculate values based on a complex formula and then using the data extraction technique described above can prove to be a very effective technique when building complex budgeting and forecasting models.

Working with Excel's Goal Seek Function

Excel's **Goal Seek** function is a tool that allows users to "back-in" to the value needed in a variable to produce a specific result. In other words, use Goal Seek when you already know what the answer is – or should be – and just need identify the value in a specific variable that will produce the intended result.

In the following example, suppose Greg Adams, a budget analyst at GTM Manufacturing, has the responsibility of determining what level of sales revenue is needed to provide gross profit of $6 million for the upcoming fiscal year. Greg knows that GTM's gross profit percentage averages 29%, so he could simply

divide $6 million by 29% to arrive at the necessary sales revenue of $20,689,655. Greg could also use Goal Seek to solve this problem.

Using Goal Seek, Greg might construct a model similar to that shown in **Figure 6**.

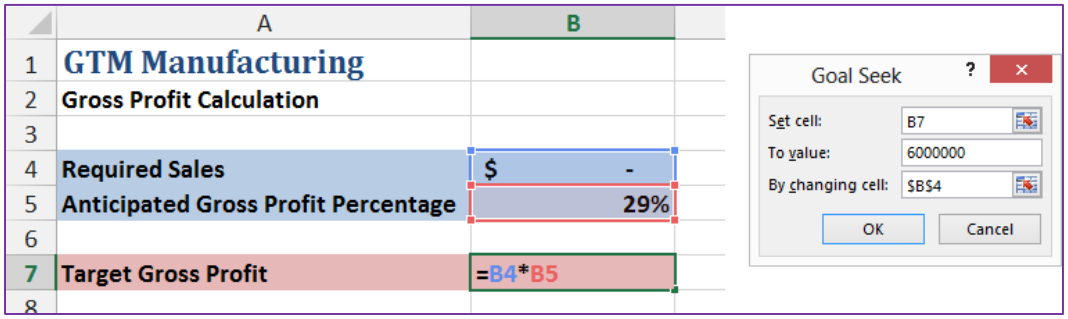


Figure 6 - Goal Seek Model

When Greg constructs this model, he would access the **Goal Seek** dialog box by choosing **What-If Analysis** from the **Data** tab and selecting **Goal Seek**. Upon entering the information shown in Figure 6, Greg clicks **OK** in Goal Seek dialog box. Upon doing so, Goal Seek calculates the result and displays it as shown in **Figure 7**.

	A	B
1	GTM Manufacturing	
2	Gross Profit Calculation	
3		
4	Required Sales	20,689,655.17
5	Anticipated Gross Profit Percentage	29%
6		
7	Target Gross Profit	$ 6,000,000

Figure 7 - Completed Goal Seek Calculation

Of course, rarely are the calculations required in preparing budgeting and forecasting models as simple as the one required by Greg in the previous example. Consequently, a more complex example is in order. In the next example, John Adams, the Chair of the School of Accountancy at State University, proposes to establish an endowed professorship at the school to teach Applied Technology to Accounting majors at the school. In considering the expected rate of return on the endowment, a professor's initial annual salary, and annual cost of living and merit raises, Adams is attempting to determine the level of fundraising required to endow the professorship for a term of thirty years.

After performing due diligence, Adams makes the following initial estimates regarding variables affecting the endowment.

Expected Annual Investment Earnings Rate *7.5%*

Expected Annual Cost of Living and Merit Raises	*4.5%*
Expected Initial Salary	*$160,000*

To begin the process, Adams creates a schedule, a portion of which is shown in **Figure 8**. As shown there, if the professorship were endowed at $1 million, it would run out of money by year 8.

State University
Endowed Professorship Calculation

Endowment Necessary	$ 1,000,000
Expected Annual Investment Earnings Rate	7.50%
Expected Annual Cost of Living and Merit Raises	4.50%
Expected Initial Salary	$ 160,000

Year	Beginning Balance	Annual Salary	Investment Earnings	Ending Balance
1	$ 1,000,000	$160,000	$ 75,000	$ 915,000
2	$ 915,000	$167,200	$ 68,625	$ 816,425
3	$ 816,425	$174,724	$ 61,232	$ 702,933
4	$ 702,933	$182,587	$ 52,720	$ 573,066
5	$ 573,066	$190,803	$ 42,980	$ 425,243
6	$ 425,243	$199,389	$ 31,893	$ 257,747
7	$ 257,747	$208,362	$ 19,331	$ 68,717
8	$ 68,717	$217,738	$ 5,154	$ (143,867)

Figure 8 - Proposed Endowment Schedule for State University

Adams returns to the model and opens the Goal Seek dialog box. There, he uses Goal Seek to solve the equation by setting cell H34 (the ending balance for year 30) to **0** by changing the value in cell B4 (the beginning balance in the endowment) as shown in **Figure 9**. Once Adams establishes these parameters and clicks OK, Goal Seek approximates the amount required in the endowment at $3,051,764[1]. Note that the answer is approximate because, by default, Excel only runs 100 iterations in an attempt to find the correct answer. If Adams required a greater degree of precision, he could adjust the number of iterations for the workbook in Excel's **Formula Options**. Additionally, rounding functions in the workbook also cause the calculation to be less accurate than is otherwise possible.

[1] Those familiar with Excel's financial functions could also solve this problem by using Excel's PV function.

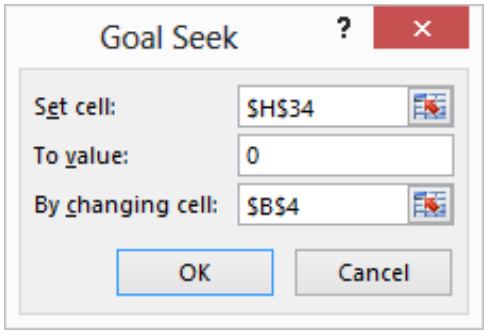


Figure 9 - Establishing Goal Seek Parameters for Calculating Required Initial Endowment

While some avoid using Goal Seek because it is capable of solving equations with one variable only, as demonstrated above, the usefulness of Goal Seek is not limited to only simple "what-if" problems. Nonetheless, when requiring functionality in Excel to assist in solving multivariable problems, Excel's **Solver** function is a better tool.

Using Solver to Maximize Resources

One of the key considerations for anyone involved in preparing revenue forecasts is to maximize profits, given available resources and operational and financial constraints. Constraints on profitability may take the form of distribution restrictions, production capacity limits, scarce inventory, or shortages of working capital caused by growth in accounts receivable or inventory. Whatever the nature of the constraints, it is the goal of every financial manager to find solutions that maximize the value of the organization. Excel's Solver add-in can assist in that process.

Solver is used to find optimal solutions to *linear programming models*. For example, Solver can be used to maximize gross profits by calculating the optimal mix of products sold, to minimize interest expense by finding an optimal capital structure for the company, or to maximize production output by calculating the most efficient production runs. Solver optimizes a value in one cell of a workbook by adjusting various input cells, subject to user-specified constraints placed on the input cells.

In this example, the CFO of a medical technology lab seeks to maximize the gross profit generated by a piece of testing equipment. The equipment can perform three different tasks, each with different billing rates, marginal costs, and gross profits. Further, the maximum number of units that can be sold of each procedure varies. **Table 1** displays the relevant data.

	Task A	Task B	Task C
Billing Rate	$350	$250	$200
Marginal Cost	$175	$50	$100
Gross Profit Per Unit Sold	$175	$200	$100
Max Number Of Sales Per Year	500 minus 1/2 of the instances of Tasks B and C sold for the year	500 minus 1/2 of the instances of Task C sold for the year	500

Table 1 - Relevant Data for a Solver Equation

In addition to the data presented in Table 1, no more than 750 procedures in total can be sold during the year, and a minimum of 50 units of each procedure must be sold. Given these constraints, the CFO must calculate the optimal mix of sales units of each task in order to maximize overall gross profit. Using Solver, a solution for this complex revenue maximization model can be calculated in short order.

First, build the basic structure of the worksheet as shown in **Figure 10**. The second panel in the figure displays the underlying formulas.

	A	B	C	D	E	F
1		Task A	Task B	Task C		
2	Maximum Number Available	450	475	500	Total Sold Cannot Exceed	750
3	Billing Rate	$350.00	$250.00	$200.00		
4	Marginal Cost	$175.00	$ 50.00	$100.00		
5	Gross Profit Per Unit	$175.00	$200.00	$100.00		
6	Number Sold	50	50	50	Total Sold	150
7	Total Gross Profit	$ 8,750	$10,000	$ 5,000	Total Gross Profit	$ 23,750

	A	B	C	D	E	F
1		Task A	Task B	Task C		
2	Maximum Number Available	=500-(0.5*(D6+C6))	=500-(0.5*D6)	500	Total Sold Cannot Exceed	750
3	Billing Rate	350	250	200		
4	Marginal Cost	175	50	100		
5	Gross Profit Per Unit	=B3-B4	=C3-C4	=D3-D4		
6	Number Sold	50	50	50	Total Sold	=SUM(B6:D6)
7	Total Gross Profit	=B5*B6	=C5*C6	=D5*D6	Total Gross Profit	=SUM(B7:D7)

Figure 10 - Constructing a Worksheet with the Appropriate Structure and Formulas

To begin the process of finding a solution, click **Solver** on the **Data** tab to open the **Solver Parameters** dialog box as shown in **Figure 11**. In the **Solver Parameters** dialog box, specify the target cell to be optimized, in this case cell F7. The variable cells to be adjusted include the range of cells B6:D6. The relevant constraints are described in the table above. Click the **Solve** button, and **Solver** will attempt to find a solution based on the input cells and constraints identified. When the results are calculated, select **Keep Solver Solution** in the **Solver Results** dialog box and click **OK**.

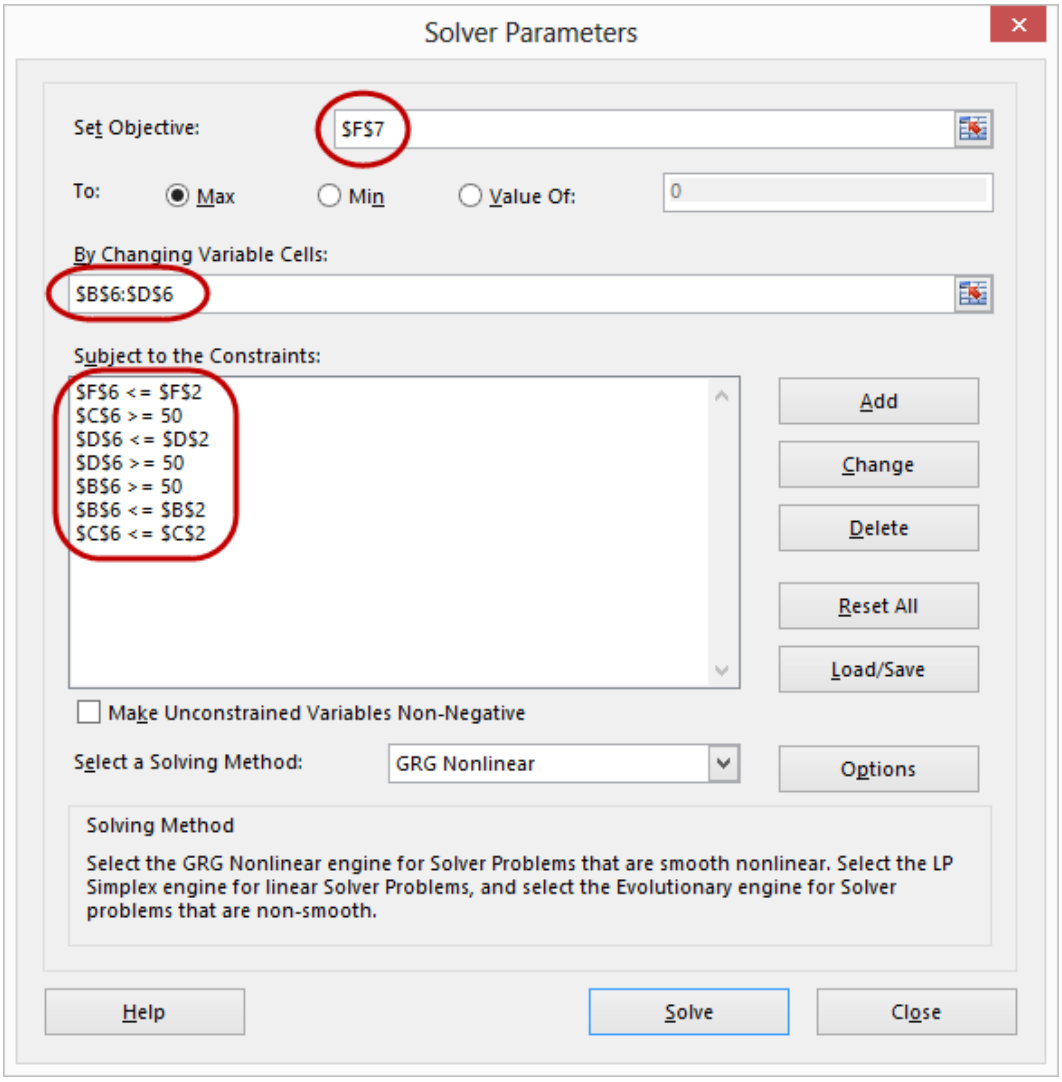


Figure 11 - Specifying the Parameters for a Solver Optimization

The solution suggested by Solver is presented in **Figure 12**. Maximum profits are generated when 225 units of Task A, 475 units of Task B, and 50 units of Task C are sold. Closer inspection reveals that at least 50 units of each task are sold, that the total number of all tasks being sold is less than or equal to 750 units, and that the number of units of each task sold is less than or equal to the maximum number available.

	A	B	C	D	E	F
1		Task A	Task B	Task C		
2	Maximum Number Available	238	475	500	Total Sold Cannot Exceed	750
3	Billing Rate	$350.00	$250.00	$200.00		
4	Marginal Cost	$175.00	$ 50.00	$100.00		
5	Gross Profit Per Unit	$175.00	$200.00	$100.00		
6	Number Sold	225	475	50	Total Sold	750
7	Total Gross Profit	$39,375	$95,000	$ 5,000	Total Gross Profit	$139,375

Figure 12 - Results of Solver Produced Profit Maximization

In addition to the computational efficiency of Solver, users can benefit from its documentation features in the form of several reports. The **Solver Answer Report** is shown in **Figure 13**.

Microsoft Excel 15.0 Answer Report
Worksheet: [Figure 074 Through Figure 077 - Solver.xlsx]GP Maximization
Report Created: 3/10/2013 5:43:57 PM
Result: Solver found a solution. All Constraints and optimality conditions are satisfied.
Solver Engine
Engine: GRG Nonlinear
Solution Time: 0.016 Seconds.
Iterations: 0 Subproblems: 0
Solver Options
Max Time 100 sec, Iterations 100, Precision 0.000001
Convergence 0.0001, Population Size 100, Random Seed 0, Derivatives Forward, Require Bounds
Max Subproblems Unlimited, Max Integer Sols Unlimited, Integer Tolerance 5%, Solve Without Integer Constraints

Objective Cell (Max)

Cell	Name	Original Value	Final Value
$F$7	Total Gross Profit	$ 139,375	$ 139,375

Variable Cells

Cell	Name	Original Value	Final Value	Integer
$B$6	Number Sold Task A	225	225	Contin
$C$6	Number Sold Task B	475	475	Contin
$D$6	Number Sold Task C	50	50	Contin

Constraints

Cell	Name	Cell Value	Formula	Status	Slack
$F$6	Total Sold	750	$F$6<=$F$2	Binding	0
$B$6	Number Sold Task A	225	$B$6<=$B$2	Not Binding	12.5
$C$6	Number Sold Task B	475	$C$6<=$C$2	Binding	0
$D$6	Number Sold Task C	50	$D$6>=50	Binding	-
$D$6	Number Sold Task C	50	$D$6<=$D$2	Not Binding	450
$C$6	Number Sold Task B	475	$C$6>=50	Not Binding	425
$B$6	Number Sold Task A	225	$B$6>=50	Not Binding	175

Figure 13 - Answer Report Generated with a Solver Solution

In addition to Answer reports, Solver can also generate **Sensitivity Analysis** and **Limits** reports. Further, users can save Solver solutions as **Scenarios** to be recalled later in **Scenario Manager**.

Scenario Manager

Managing Different Sets of Assumptions with Scenario Manager

Scenario Manager is a feature in Excel that provides users with the ability to see results under different sets of assumptions without needing to create multiple versions of worksheets or workbooks. In Scenario Manager, users specify the variable(s) to be changed and what the changes are. Then, whenever results are to be displayed based on a particular set of assumptions, Scenario Manager automatically recalls the assumptions and inserts them into the spreadsheet.

To illustrate how Scenario Manager works, consider the budget assumptions shown in **Table 2** for three different sets of circumstances.

	Best Case	Most Likely Case	Worst Case
A/R Collection Period	34	37	43
Days Sales In Inventory	18	24	36
Days Purchases In A/P	27	34	45
Gross Profit Percentage	49%	47%	43%
Interest Rate On Line Of Credit	5%	6%	8%
Total Sales	$900,000	$800,000	$700,000
Wages	$195,000	$200,000	$225,000

Table 2 - Scenario Manager Assumptions

Each of the assumptions associated with each set of circumstances can be loaded and saved under Scenario Manager by selecting **Data**, **What If Analysis,** and **Scenario Manager** from the Ribbon and clicking the **Add** button. In the **Add Scenario** dialog box shown in **Figure 14**, enter a name for the scenario, the cells to be changed, and any desired comments. Clicking the **OK** button advances users to the **Scenario Values** dialog box shown in **Figure 15**.

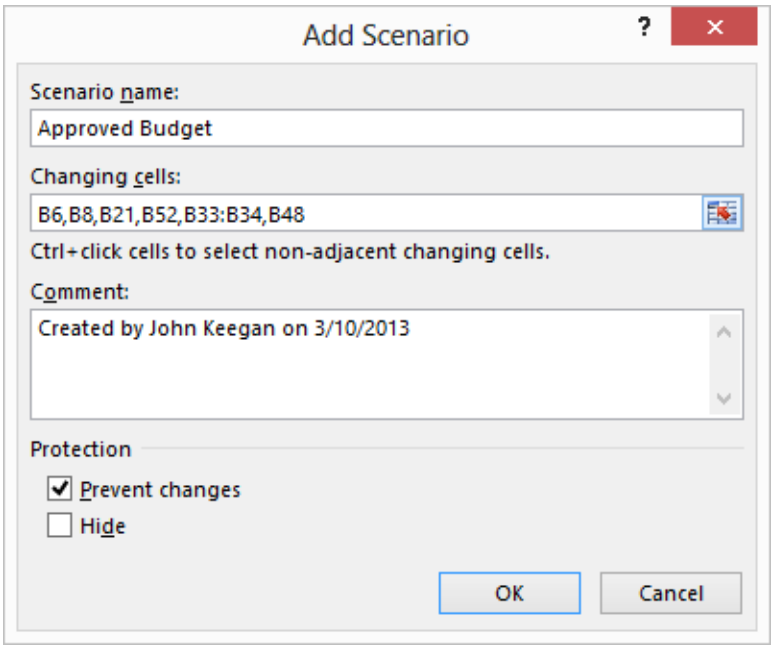


Figure 14 – Adding Scenario Dialog Box

In the **Scenario Values** dialog box, the values to be associated with each variable being changed under the scenario are entered. Once all values have been entered, click **OK** to save the data.

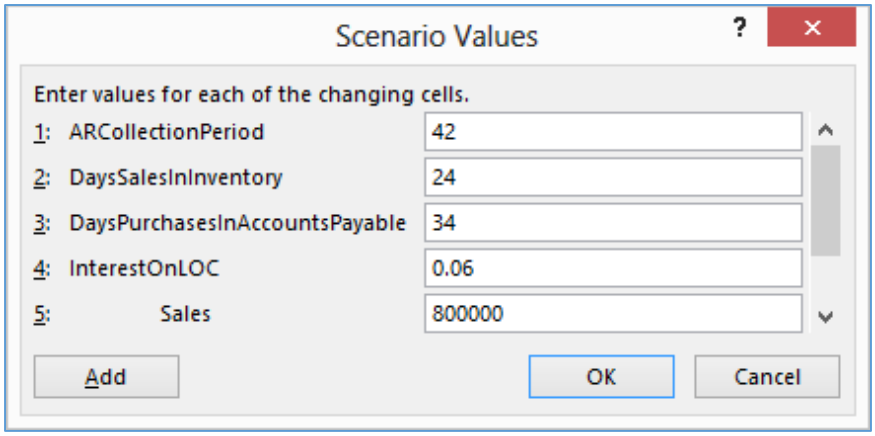
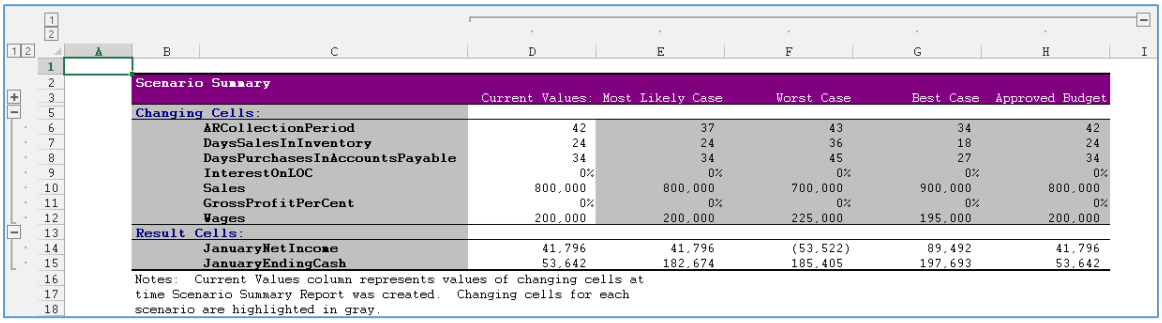


Figure 15 - Scenario Values Dialog Box

To see the results of a particular scenario, simply double-click the desired scenario in the Scenario Manger dialog box. At that point, the cell values associated with each variable identified in Scenario Manager are changed to reflect the values for that scenario. This effectively allows users to track multiple versions of the same budget. Further, Scenario Manager allows users to generate a Scenario Summary report showing the impact of changing the variables under each Scenario on selected "Result Cells." **Figure 16** displays an example of one such report.



Scenario Summary

	Current Values:	Most Likely Case	Worst Case	Best Case	Approved Budget
Changing Cells:					
ARCollectionPeriod	42	37	43	34	42
DaysSalesInInventory	24	24	36	18	24
DaysPurchasesInAccountsPayable	34	34	45	27	34
InterestOnLOC	0%	0%	0%	0%	0%
Sales	800,000	800,000	700,000	900,000	800,000
GrossProfitPerCent	0%	0%	0%	0%	0%
Wages	200,000	200,000	225,000	195,000	200,000
Result Cells:					
JanuaryNetIncome	41,796	41,796	(53,522)	89,492	41,796
JanuaryEndingCash	53,642	182,674	185,405	197,693	53,642

Notes: Current Values column represents values of changing cells at time Scenario Summary Report was created. Changing cells for each scenario are highlighted in gray.

Figure 16 - Scenario Summary Report

In addition, Scenario Manager can be used to consolidate different Scenarios from various worksheets and other workbooks. A budget analyst, for example, could distribute budget workbook templates to other users who create their own Scenarios. The analyst could then merge these Scenarios into a "master" workbook by using the **Merge Scenarios** feature shown in **Figure 17**. To merge Scenarios, navigate to **Data**, **What If Analysis,** and **Scenario Manager** and select the **Merge** button. In the **Merge Scenarios** dialog box, simply highlight the workbook and worksheet where they reside and click **OK**.

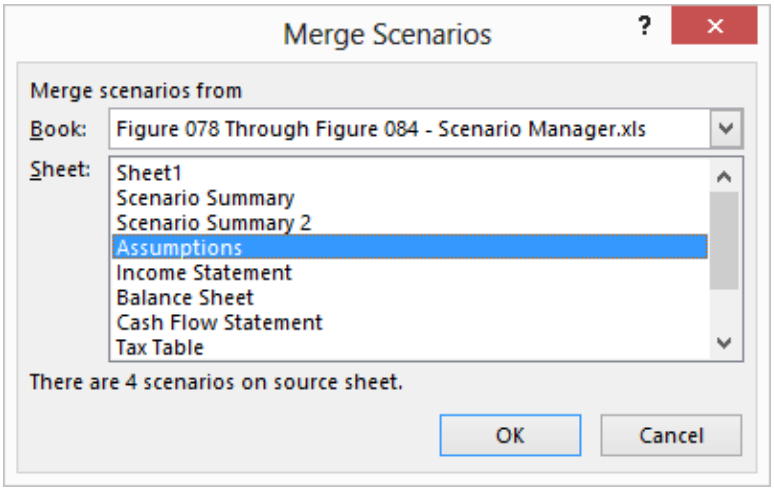


Figure 17 - Merging Scenarios

From the **Scenario Manager** dialog box, you can highlight a scenario name, click **Edit**, and edit the values within the scenario cells. You can also delete scenarios no longer needed. The Summary button is useful for generating a report comparing the input values of all the summaries created as shown in **Figure 18**.

Scenario Summary	Current Values:	Units Sold cannot Exceed 750	Units Sold cannot exceed 500	Units sold cannot exceed 300	Units sold cannot exceed 275
Changing Cells:					
$B$6	250	250	400	200	175
$C$6	50	50	50	50	50
$D$6	450	450	50	50	50
Result Cells:					
$F$6	750	750	500	300	275
$B$7	$ 43,750	$ 43,750	$ 70,000	$ 35,000	$ 30,625

Notes: Current Values column represents values of changing cells at time Scenario Summary Report was created. Changing cells for each scenario are highlighted in gray.

Figure 18 - Generating a Scenario Summary Report from the Scenario Dialog Box

The report would be even more useful if the **Changing Cells** and **Result Cells** were descriptive names rather than coordinates. To accomplish this, add **Defined Names** to those cells before generating the Scenario Summary. The summary reports are not interactive. Therefore, if you change the scenario values or add scenarios, delete the sheet tab with the old report and generate a new Summary report from the Scenario dialog box.

As shown in **Figure 19**, Scenario Manager is also represented by a tool that can be added to the Quick Access Toolbar. The tool provides a drop-down list of all the Scenario names for the active sheet and populates the changing values cells when a name is selected. Right-click the **Quick Access Toolbar** and select **Customize Quick Access Toolbar**. In the Choose commands from the drop-down, select **All Commands**. Scroll down, click the **Scenario** tool, and click the **Add** button to place it on the Quick Access Toolbar. Click **OK**.

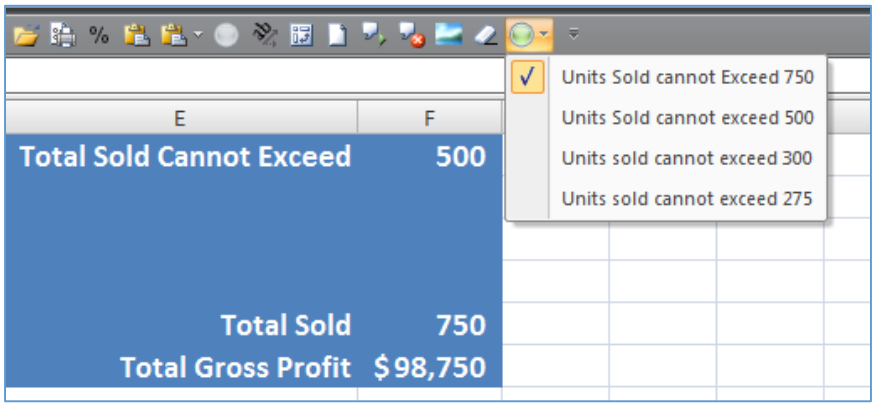


Figure 19 - Scenario Manager Tool on Quick Access Toolbar

Integrating Scenario Manager and Solver

Returning to the previous discussion of Solver, if you need to retain the input values for future use, select **Save Scenario** in the **Solver** dialog box as shown in **Figure 20**. You are prompted to enter a **Scenario Name**. The Scenario Manager uses the reference in the **By Changing Cells** box in the Solver Parameters dialog box to determine what values are stored.

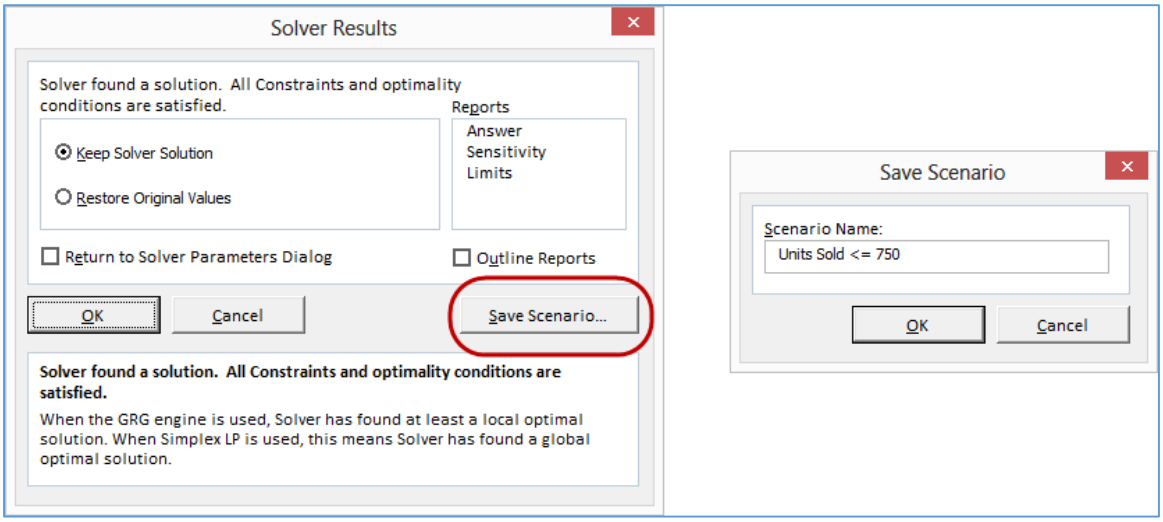


Figure 20 - Creating a Scenario from a Solver Solution

Scenario Manager features are useful with Solver because the scenarios are intended to capture changing input cells upon which formulas depend. The only limit of this feature is that a scenario can only hold up to 32 changing cells.

Forecasting with Regression Analysis

Regression analysis is a statistical method used to estimate and understand relationships between a dependent variable and one or more independent variables. Linear regression models the relationship between two or more variables by fitting a linear equation to observed data.

With regression analysis, one or more independent variables predict a single dependent variable. For example, a sales executive may want to investigate the effect of advertising expenditures on sales revenue. Relationships are explained by this linear regression equation.

$Y = \alpha + \beta x$

Y is the dependent variable (sales revenue).

α is the intercept (the value of **Y** when ***x*** = 0).

β is the slope of the line.

x is the independent variable (advertising expenses).

The correlation coefficient quantifies the strength of the association between the independent and dependent variables. The correlation coefficient always takes a value between minus one and plus one, with plus one or minus one indicating perfect correlation (with all points along a straight line). A positive correlation indicates a positive association between the variables. Increasing values in one variable correspond to increasing values in the other variable. A negative correlation indicates a negative association between the variables. Increasing values in one variable correspond to decreasing values in the other variable. A correlation value of zero indicates that there is no association between the variables.

R^2 is the square of the correlation coefficient. It shows the percentage of variation in the dependent variable explained by variation in the independent variable. When the correlation is 0.80 between the variables sales revenue and advertising expense, then the linear regression model calculates that 64% (0.80^2) of the variability in the data is predictable. The major conceptual limitation of regression analysis is that one can ascertain relationships but can never be sure about the underlying causal mechanism.

For example, a strong positive relationship may exist between the number of overtime hours worked by production personnel and the quantity of goods produced, but a regression analysis cannot support the conclusion that the quantity of goods produced actually caused the overtime. Other factors, such as machinery breakdowns or production line inefficiencies, may have caused it. While regression analysis can quantify the relationship between overtime hours worked and quantity of goods produced, it cannot explain the cause of the relationship.

Regression Analysis in Excel

Excel contains a number of tools that are useful in conducting regression analysis. The regression analysis tool in the Analysis ToolPak add-in allows estimation of a single dependent variable based on *up to sixteen* independent variables. Regression analysis is not the only tool available in the ToolPak. Tools are also available to compute descriptive statistics, calculate moving averages and ANOVAs, generate random numbers, determine ranks and percentiles, and more.

In our first example, a sales executive wants to determine if there is a relationship between monthly revenue and advertising expenditures incurred in the previous month. Used here, regression analysis will determine the strength of the relationship between these variables and will forecast future sales revenues.

Consider the data shown in **Figure 21**, which summarizes monthly revenue and advertising expenditures for the past thirty months. Note the general trend in the data. As advertising expenses for the prior month increase, sales revenues for the current month increase. As advertising expenses for the prior month decrease, sales revenues for the current month decrease. The scatter chart displayed in **Figure 22** shows this relationship. Visual scrutiny of the scatter chart suggests that a significant relationship exists between monthly sales revenue and advertising expenses incurred in the previous month.

	A	B	C
1	Monthly Sales	Ad Expense 1 Month Prior	Ad Expense 2 Months Prior
2	$ 1,700,000	$ 20,000	$ 20,000
3	1,650,000	19,000	20,000
4	1,725,000	20,000	19,000
5	1,750,000	21,000	20,000
6	1,725,000	20,000	21,000
7	1,750,000	21,000	20,000
8	1,750,000	20,500	21,000
9	1,775,000	21,000	20,500
10	1,775,000	21,000	21,000
11	1,800,000	21,000	21,000
12	1,800,000	21,500	21,000
13	1,775,000	20,500	21,500
14	1,800,000	21,000	20,500
15	1,825,000	21,000	21,000
16	1,825,000	21,500	21,000
17	1,900,000	22,000	21,500
18	1,900,000	22,000	22,000
19	1,875,000	21,500	22,000
20	1,875,000	21,750	21,500
21	1,850,000	21,750	21,750
22	1,850,000	21,500	21,750
23	1,900,000	22,000	21,500
24	1,875,000	21,750	22,000
25	1,775,000	20,500	21,750
26	1,850,000	21,500	20,500
27	1,900,000	22,000	21,500
28	1,925,000	22,500	22,000
29	1,925,000	22,500	22,500
30	1,850,000	21,750	22,500
31	1,900,000	22,000	21,750

Figure 21 - Regression Analysis Data Set

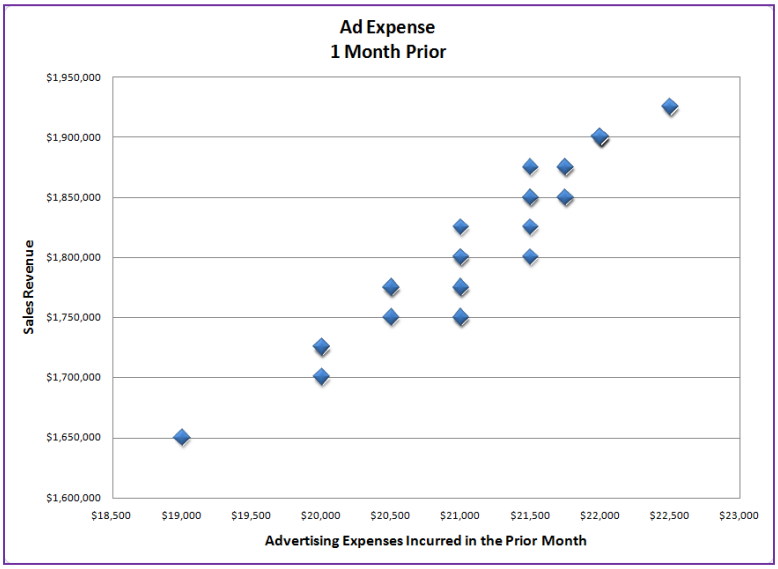


Figure 22 - Scatter Chart of the Regression Analysis Data Set

To begin the regression estimation process, click **Data Analysis** on the **Data** tab. Then, select **Regression** in the **Analysis Tools** list of the **Data Analysis** dialog box and click **OK** as shown in **Figure 23**.

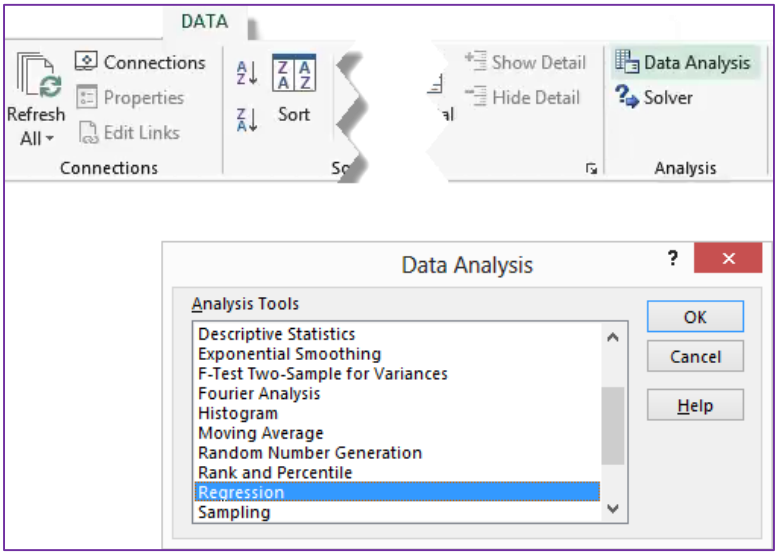


Figure 23 - Selecting Regression in the Data Analysis Dialog Box

In the **Regression** dialog box shown in **Figure 24**, click the **Collapse Dialog** button just to the right of the **Input Y Range** box and select the range of cells that contains the dependent variable. In this case, select the range A2:A31, Monthly Sales. Next, click the **Collapse Dialog** button just to the right of the **Input X Range** box and select the range of cells that contains the independent variable. In this case, select the range B2:B31, Ad Expense 1 Month Prior. Note that the number of observations in the X and Y ranges must be equal.

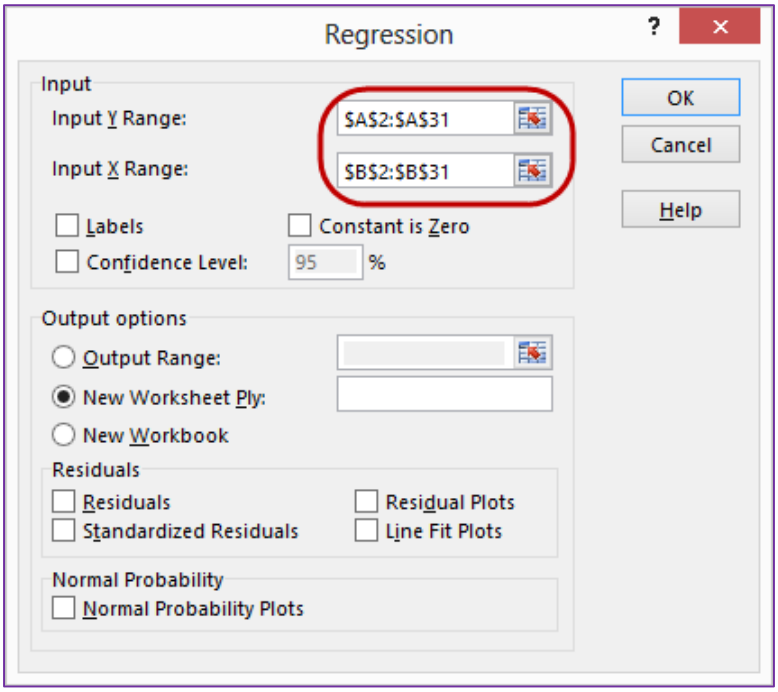


Figure 24 - Specifying the X and Y Ranges in a Simple Linear Regression

Click **OK** to calculate the regression and display the results on a new worksheet as shown in **Figure 25**.

	A	B	C	D	E	F	G	H	I
1	SUMMARY OUTPUT								
2									
3	*Regression Statistics*								
4	Multiple R	0.954919307							
5	R Square	0.911870882							
6	Adjusted R Square	0.908723414							
7	Standard Error	21880.19817							
8	Observations	30							
9									
10	ANOVA								
11		*df*	*SS*	*MS*	*F*	*Significance F*			
12	Regression	1	1.38699E+11	1.38699E+11	289.7156508	2.6595E-16			
13	Residual	28	13404806016	478743072					
14	Total	29	1.52104E+11						
15									
16		*Coefficients*	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
17	Intercept	10538.36094	106333.4823	0.099106704	0.921759697	-207275.9036	228352.6255	-207275.9036	228352.6255
18	X Variable 1	85.17872711	5.00432109	17.02103554	2.6595E-16	74.92784005	95.42961417	74.92784005	95.42961417

Figure 25 - Linear Regression Analysis Based on a Single Independent Variable

When interpreting the regression results, key components to consider are R Square, the Intercept Coefficient, and the X Variable 1 Coefficient. Recall that R Square is a measure of fit – it measures how well the computed linear equation fits the data. Generally, an R Square value of 0.80 or higher means that there is a strong relationship between the independent variable(s) and the dependent variable. In this example, the R Square is calculated to be 0.9118, which indicates a strong relationship between the variables and that the linear equation fits the data very well.

The Intercept Coefficient and the X Variable 1 Coefficient are used to specify the equation for estimating or predicting new values of the dependent variable based on specified values of the independent variable. In this case, the equation for estimating monthly sales as a function of the advertising expense incurred in the prior month is as follows.

Monthly Sales = $10,538 + (85.179 * Ad Expense 1 Month Prior)

To forecast the sales revenue for a future month based on anticipated advertising expenses of $25,000 in the prior month, simply substitute the anticipated advertising expenses into the equation and solve for monthly revenue.

Monthly Revenue = $10,538 + (85.179 * $25,000)

$2,140,013 = $10,538 + (85.179 * $25,000)

In this case, the regression equation yields estimated sales revenue of $2,140,013.

The regression analysis tool can regress up to sixteen independent (predictor) variables on a single dependent variable. To include more independent variables in the regression, simply expand the X Input Range to include the observations of the additional variables.

For example, many experienced marketing executives argue that advertising expenses have a lasting impact on sales. To include advertising expenses incurred two months prior to the measurement of sales revenue, simply expand the X Input Range to include the column that contains the additional observed advertising expenses. In this example, the **Input X Range** is expanded to include two months of advertising expenses – range B2:C31, as shown in **Figure 26**.

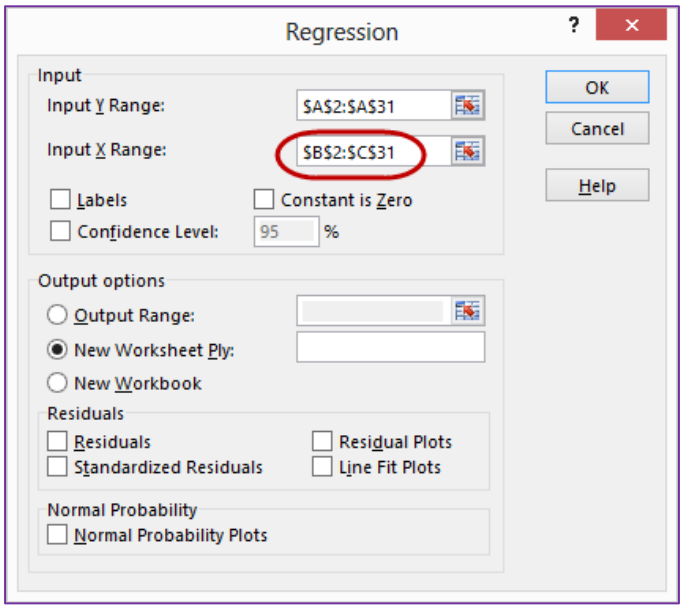


Figure 26 - Specifying the X and Y Ranges in a Multiple Linear Regression

The multiple linear regression performed in this example yields the calculations displayed in **Figure 27**.

	A	B	C	D	E	F	G	H	I
1	SUMMARY OUTPUT								
2									
3	*Regression Statistics*								
4	Multiple R	0.965000261							
5	R Square	0.931225503							
6	Adjusted R Square	0.926131096							
7	Standard Error	19683.5027							
8	Observations	30							
9									
10	ANOVA								
11		*df*	*SS*	*MS*	*F*	*Significance F*			
12	Regression	2	1.41643E+11	70821639574	182.7936937	2.01962E-16			
13	Residual	27	10460887519	387440278.5					
14	Total	29	1.52104E+11						
15									
16		*Coefficients*	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
17	Intercept	-91683.19386	102594.5494	-0.893645856	0.379408192	-302189.8187	118823.431	-302189.8187	118823.431
18	X Variable 1	73.03751936	6.298189624	11.59658945	5.40485E-12	60.11470184	85.96033688	60.11470184	85.96033688
19	X Variable 2	17.00881257	6.170402417	2.756515933	0.010342499	4.34819274	29.6694324	4.34819274	29.6694324

Figure 27 - Linear Regression Analysis Based on Multiple Independent Variables

The results of the multiple linear regression suggest a better fit of the data since R Square has increased from 0.9118 in the simple linear regression to 0.9312 in the current analysis. The results support the assertion that advertising expenditures – at least in this sample – have a lasting effect. In examining the summary output, a second X variable coefficient has been added to coincide with the inclusion of the second independent variable. The formula for predicting sales revenue based on advertising expenditures must be revised to include a second advertising estimate, shown below.

Monthly Sales = $-91,683 + (73.038 * Ad Expense 1 Month Prior) + (17.009 * Ad Expense 2 Months Prior)

Adding a Trendline to a Scatter Chart

An alternative to using the regression analysis tool for generating a regression equation from which to forecast future revenues or expenses would be to add a linear trendline with the equation and R Square displayed on a scatter chart of the data points as shown in **Figure 28**.

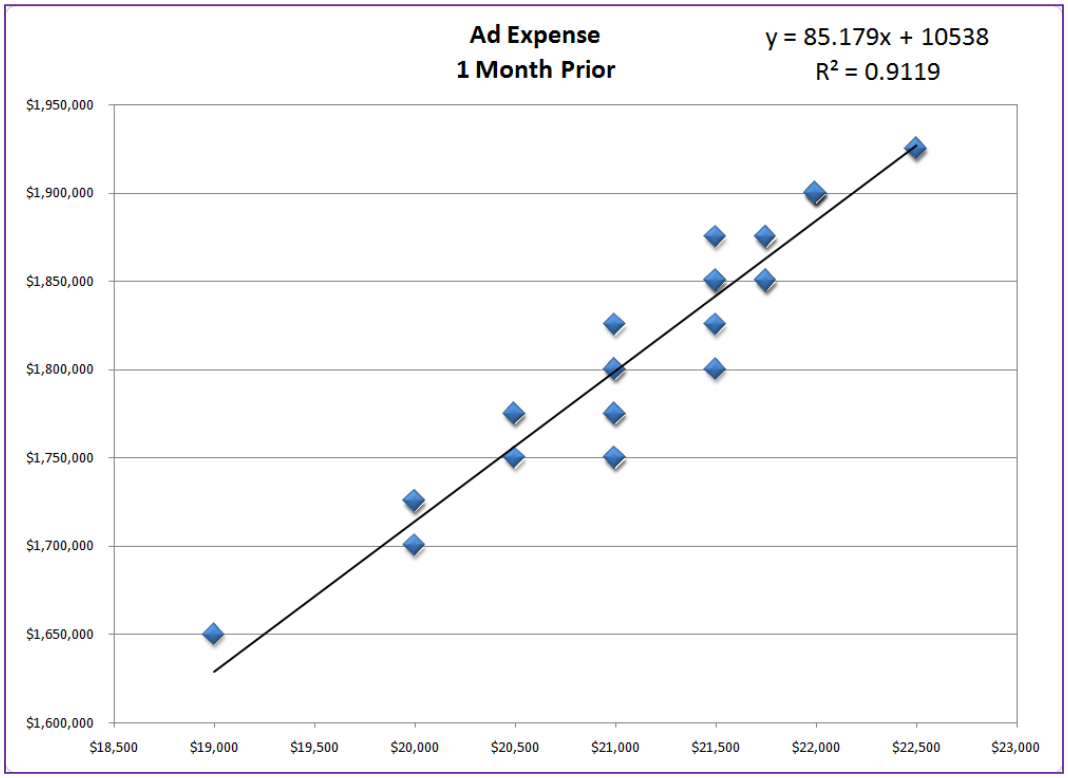


Figure 28 - Adding a Linear Trendline with R Square and Equation to a Scatter Chart

Adding a linear trendline uses the same least-squares process to calculate the results. Note that the R Square and regression equation are exactly the same as that produced using the regression tool in the Analysis ToolPak.

To add a trendline to a scatter chart, right-click on one of the data points in the chart and select **Add Trendline**. In the **Format Trendline** dialog box, click **Linear** as the **Trend/Regression Type** and check **Display Equation on Chart** and **Display R-squared value on chart** as shown in **Figure 29**.

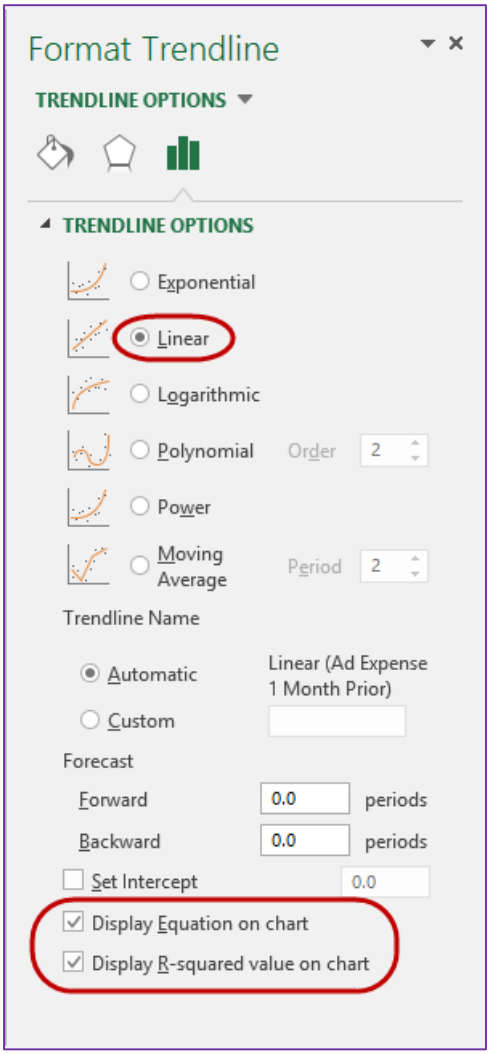


Figure 29 - Adding a Linear Trendline to a Scatter Chart

Using Regression Functions

In addition to adding trendlines to charts, Excel contains a number of statistical functions for calculating the components produced by a regression analysis. These functions allow a user to construct simple formulas on observed data for producing the regression equations useful in forecasting revenues or expenses.

- FORECAST
- SLOPE
- INTERCEPT
- TREND

- GROWTH
- LINEST

FORECAST is used to calculate or predict a value based on existing values. Using the sample data as an example, the formula **=FORECAST(25000,A2:A31,B2:B31**) would predict the monthly sales associated with advertising expenses of $25,000 one month prior, given the linear relationship between the independent variable in range B2:B31 and the dependent variable in range A2:A31.

In effect, the FORECAST function generates the linear regression equation to predict monthly sales from advertising revenue. However, this method does not calculate or display R Square, nor does it show the intercept or slope of the linear equation. Nevertheless, for estimating revenues and expenses when relationships are known to exist, and the data fit is good, FORECAST is an excellent alternative for predicting values using simple formulas.

SLOPE calculates the slope of the linear regression line, given the values of the independent variables and dependent variable. Using the sample data, the formula **=SLOPE(C2:C32, B2:B32)** will calculate a linear slope of 85.179, the same value computed using the simple linear regression analysis discussed earlier in this section.

INTERCEPT calculates the intercept of the regression line, given the values of the independent variables and dependent variable. Again, using the sample data, the formula **=INTERCEPT(C2:C32,B2:B32)** will calculate an intercept of $10,538, the same value computed using the simple linear regression analysis.

TREND generates values along a linear trendline and can be used to predict multiple future dependent values based on the relationship between existing dependent and independent variables. Note that TREND formulas are array formulas and must be entered using **CTRL+SHIFT+ENTER**.

GROWTH is very similar to TREND except that GROWTH provides an exponential calculation rather than a linear calculation as provided by the TREND function. Like TREND, the GROWTH function must be entered as an array formula.

LINEST can be used to produce an array formula to calculate the slope and intercept of a linear regression without using the Analysis ToolPak. It also can be used to generate descriptive statistics regarding the linear regression, including R Square. As shown in **Figure 30**, LINEST calculates the slope and intercept based on the input of the dependent and independent variables in an array formula. Prior to entering the formula, select two adjacent cells such as cells E2 and F2 to produce the output displayed. To modify the LINEST formula so that it returns descriptive statistics, first highlight a range that is two columns wide by five rows deep and then enter the following array formula.

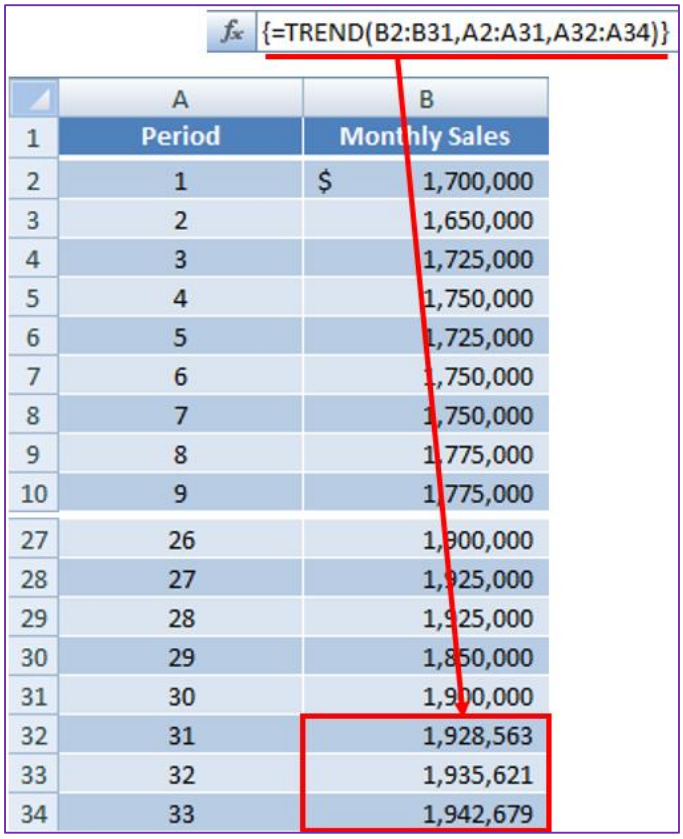


Figure 30 - Using LINEST to Calculate the Regression Intercept and Slope

Calculating and Charting Moving Averages

Moving averages can be useful in projecting revenues and expenses and in evaluating projections for reasonableness. Unlike traditional averages, moving averages are useful in identifying trends in the underlying data and in *smoothing* period-to-period fluctuations.

For example, the chart in **Figure 31** depicts a moving average calculation of operating expenses using the prior six months as the baseline for the calculation. The smoothed line represents the moving average, while the jagged line represents the actual values.

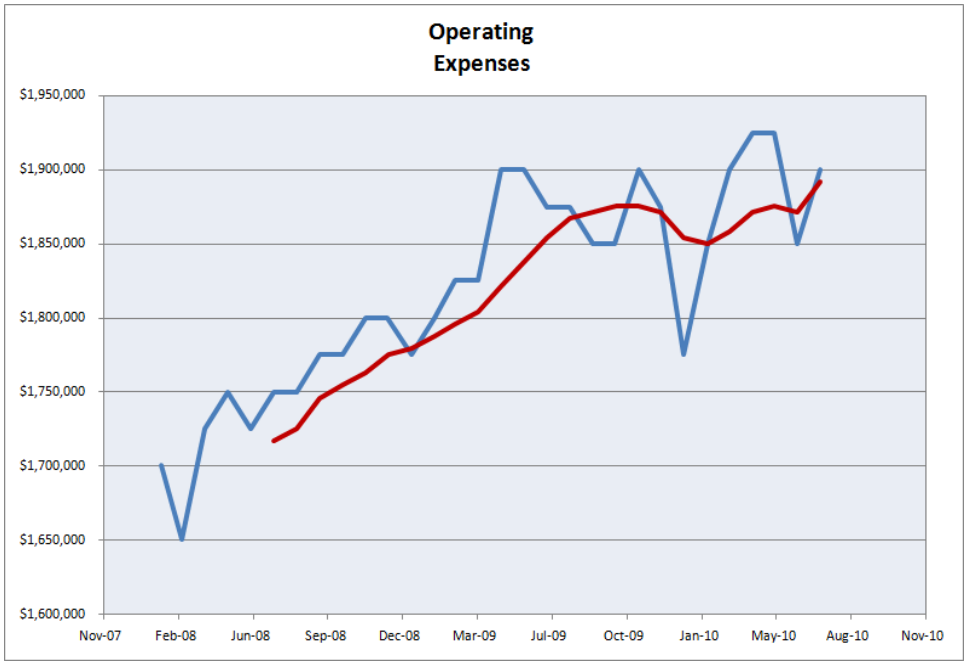


Figure 31 - Smoothed Moving Average of Actual Operating Expenses

Excel has two tools to assist users in calculating moving averages. The first is in the Analysis ToolPak, and the second is integrated within Excel's charting functionality. The moving average tool found in the Analysis ToolPak calculates moving averages and provides users with the option of plotting these values on a chart.

To use the tool, select **Data Analysis** on the **Data** tab and then choose **Moving Average** in the **Data Analysis** dialog box. Enter a single data **Input Range**, an **Interval** over which the average will be calculated, and an **Output Range**. Note that the Output Range must be on the same sheet as the data. Check **Chart Output** to create a chart of the original data and the calculated moving average. The process for using the moving average tool is displayed in **Figure 32**.

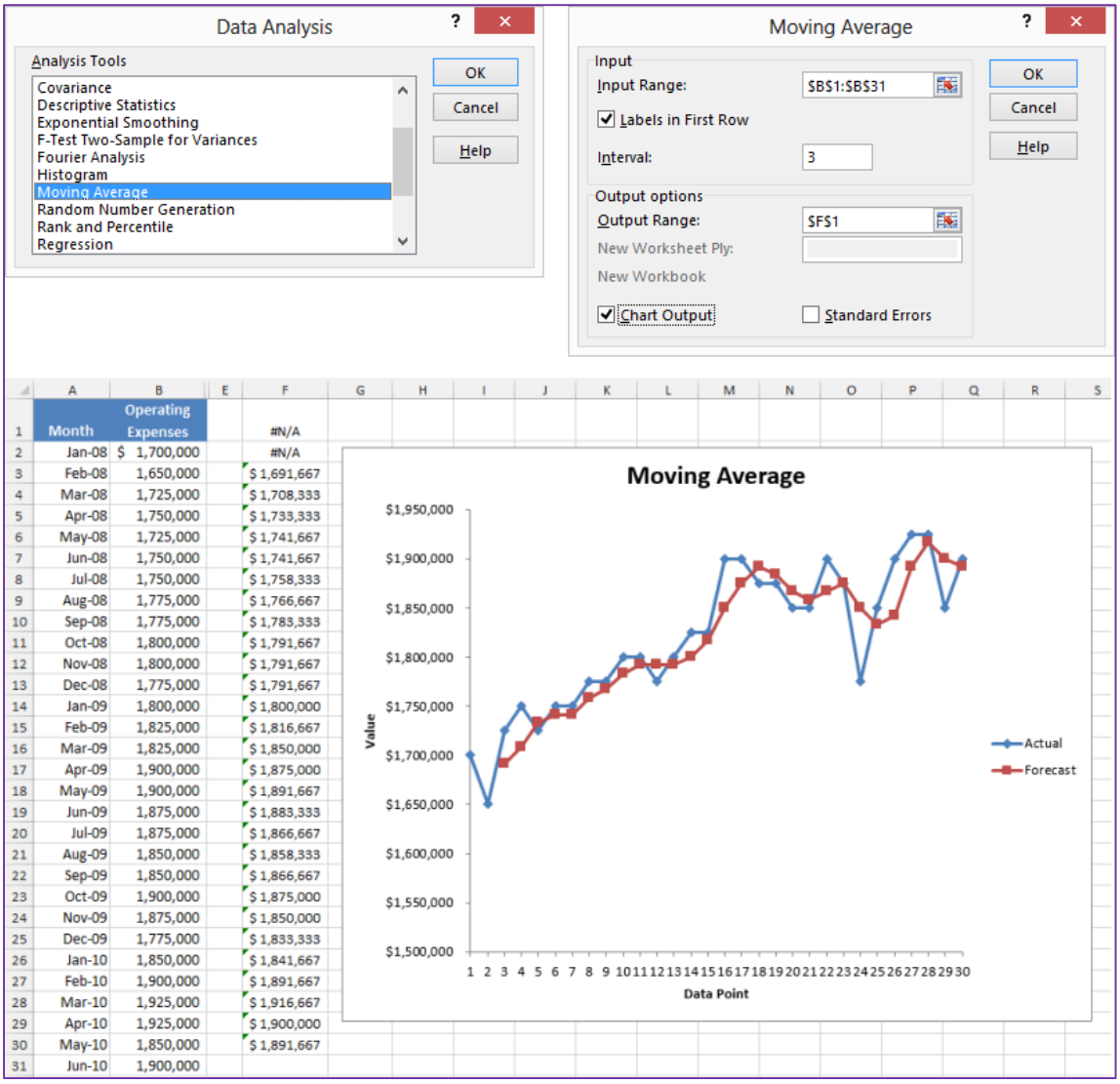


Figure 32 - Calculating and Charting Moving Averages with the Analysis ToolPak

Alternatively, moving averages can be plotted as trendlines on charts. To add a moving average trendline to an existing chart, right-click on any data element on the chart and select **Add Trendline**. Then, select **Moving Average** and enter the appropriate period over which to calculate the average in the **Format Trendline** dialog box. Format the **Line Color**, **Line Styles**, and **Shadow** as desired. The process and resulting moving average trendline are shown in **Figure 33**.

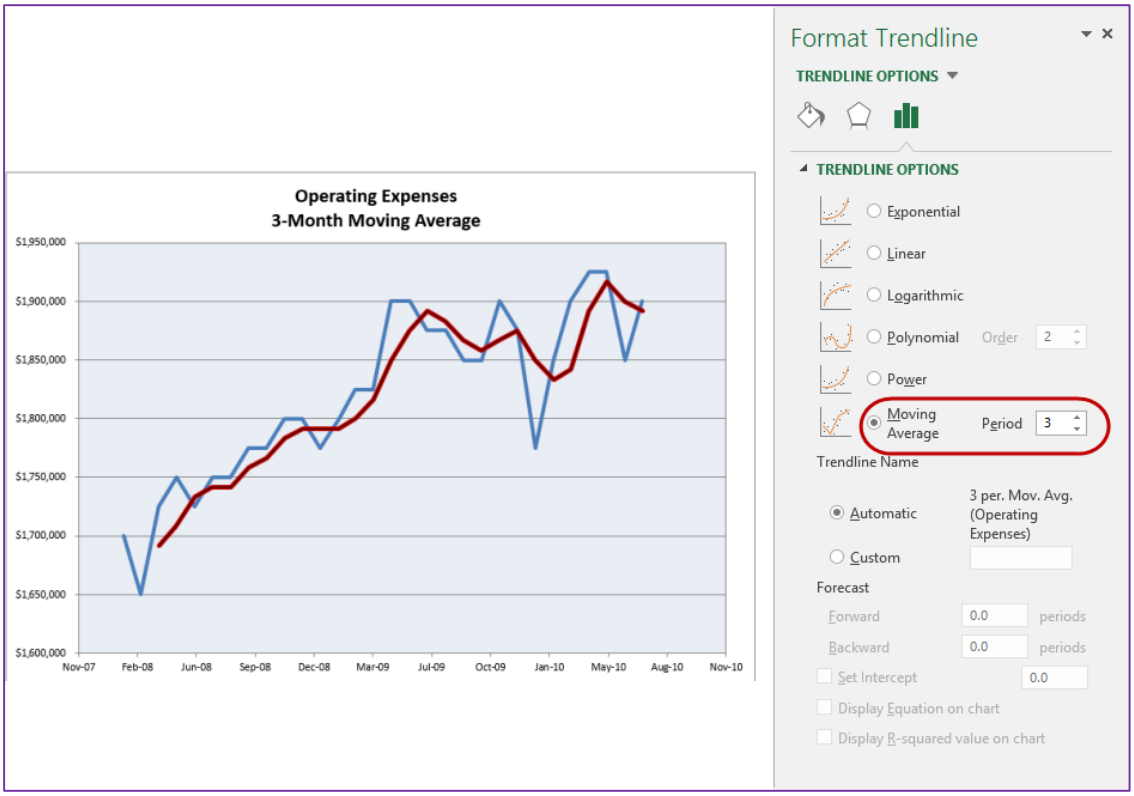


Figure 33 - Adding a Moving Average Trendline to a Scatter Chart

Analyzing Risk with Monte Carlo Simulations

What is Risk Analysis?

In a broad sense, risk analysis is any method, qualitative and/or quantitative, for assessing the impacts of risk on decision situations. The goal of any of these methods is to help the decision maker choose a course of action, given a better understanding of the possible outcomes that could occur.

The techniques of risk analysis have long been recognized as powerful tools to help decision makers successfully manage situations subject to uncertainty, such as forecasting revenues, expenses, and other inputs into budgets. Their use has been limited because they have been expensive, cumbersome to use, and have substantial computational requirements. However, the introduction of more powerful personal computers in business and in science has made it possible for these techniques to be commonly available to all decision makers.

Many of the risk analysis applications available are add-ins to Microsoft Excel. With these add-ins and Excel, risk can be effectively analyzed. Risk analysis is used to improve the picture of what the future could hold. Traditionally, analyses combine single point estimates of a spreadsheet model's variables to predict a single result. This is the standard Excel model – a spreadsheet with a single estimate of results. Estimates of critical variables must be used because the values that will actually occur are not known with certainty.

In reality, however, many things don't turn out as planned. Maybe some of the estimates are too conservative, and others are too optimistic. The combined errors in each estimate often lead to a real-life result that is significantly different from the anticipated result. A decision made based on the anticipated result may be the wrong decision, a decision that would never have been made if a more complete picture of all possible outcomes had been available. Business decisions, technical decisions, and scientific decisions use estimates and assumptions. Using risk analysis applications, uncertainty present in our estimates can be explicitly included in models to generate results that show all possible outcomes.

Simulation Sampling Techniques

Simulation refers to any analytical method used to imitate a real-life system. Monte Carlo simulation is a stratified sampling technique used for obtaining numerical solutions to problems that are too complicated to solve analytically. Monte Carlo is a stochastic process – it uses random numbers and statistics to investigate or solve a problem.

Excel models are deterministic. That means that the inputs are fixed: each cell has only one value. Without the aid of simulation, a spreadsheet model only produces a single outcome, generally the most likely or average result. Spreadsheet risk analysis uses both a spreadsheet model and simulation to automatically analyze the effect of varying inputs, such as interest rates, staffing needs, stock prices, inventory levels, phone calls per minute, or rainfall per year, on outputs of the modeled system.

A Monte Carlo simulation calculates multiple scenarios of a model by repeatedly sampling values from the probability distributions of the uncertain variables and using the calculated values for the variable input cells. During a single trial, Monte Carlo randomly selects a value for each variable, given the range and shape of the underlying distribution of the variable and then recalculates the spreadsheet. A true simulation consists of multiple trials – hundreds or thousands of trials – in which the outcomes of all combinations of all variables are calculated in just a few seconds. The calculated results identify a distribution of possible outcomes around which can be calculated the mean, standard deviation, and confidence interval.

What Risk Analysis Can and Cannot Do

Quantitative analysis techniques have gained a great deal of popularity with decision makers and analysts in recent years. Unfortunately, many people have mistakenly assumed that these techniques are magic "black boxes" that unequivocally arrive at the correct answer or decision. No technique, including those used by Excel add-ins, can make that claim.

These techniques are tools that can be used to help make decisions and to arrive at solutions. Like any tools, they can be used to good advantage by skilled practitioners, or they can be used to create havoc in the hands of the unskilled. In the context of risk analysis, quantitative tools should never be used as a replacement for personal judgment.

Finally, you should recognize that risk analysis cannot guarantee that the action you choose to follow, even if skillfully chosen to suit your personal preferences, is the best action viewed from the perspective of hindsight. Hindsight implies perfect information, which you never have at the time a decision is made. With risk analysis, you can guarantee, however, that you have chosen the best strategy given the information that is available to you at the time the decision is made – and that's not a bad guarantee!

Risk Analysis Applications

There are several competing risk analysis applications. Most are add-ins to Microsoft Excel. Some, such as **@Risk** from **Palisade Software** and **Crystal Ball** from **Decisioneering**, are very sophisticated. Others do simulation without the frills. With these simple applications, the number of built-in distributions may be limited, or the reporting or graphic presentation of the results may be limited. Here is a short list of risk analysis applications suitable for use in a business setting, including developer contact details and pricing.

@RISK

Application Fact Sheet

- Microsoft Excel add-in
- 37 built-in distributions
- Comprehensive group of add-on modules
- Multiple editions and pricing
  Standard Edition, $1,195
  Professional Edition, $1,495
  Industrial Edition, $1,995
- Best Fit, Goal Seek, Stress Analysis, and Advanced Sensitivity Analysis
- Risk Optimizer and Risk Accelerator
- Current Version: 5.0
- Company Contact Information
  Palisade Corporation
  798 Cascadilla Street
  Ithaca, NY 14850-3239
  1.800.432.7475
  www.palisade.com

Oracle Crystal Ball

Application Fact Sheet

- Microsoft Excel add-in
- 20 built-in distributions plus custom distributions
- Pricing Per User: $995
- Company Contact Information
  303.334.6835
  www.oracle.com/crystalball/

Risk Analyzer

Application Fact Sheet

- Microsoft Excel add-in
- 8 built-in distributions plus custom distributions
- Comprehensive group of add-on modules
- Single edition and pricing
  Standard Edition, $79.95
- Company Contact Information

Macro Systems
144 Dewberry Drive
Hockessin, DE 19707
1.302.234.9857
www.add-ins.com/analyzer

RiskAMP Monte Carlo Add-in for Excel

Application Fact Sheet

- Microsoft Excel add-in
- 20 built-in distributions
- Limited group of add-on modules
- Single edition and pricing
  Personal Edition: $129.95
  Professional Edition: $249.95
- Current Version: 2.97
- Company Contact Information
  Structured Data, LLC
  New York, NY
  1.800.573.6559
  www.riskamp.com

Case Study of Modeling Risk When Forecasting Revenues

Traditional analysis of proposed capital budgeting projects or new product introductions combine single point estimates of variables in a spreadsheet model to yield a single predictive result. Estimates of critical variables are used because the values that will actually occur are not known with certainty. In reality, however, many things don't turn out as planned. Some of the estimates are likely to be too conservative, while others will likely be too optimistic. The combined errors in each estimate often lead to a real life result that is significantly different from the one anticipated. A decision made based on the expected result from a simple Excel model may be the wrong decision – a decision that would never have been made if a more complete picture of all possible outcomes were available. That's where Monte Carlo simulation comes it. Monte Carlo is used to produce models that consider all possible outcomes, given the likelihood of each assumption, and identify the assumptions that most effect the outcome of a decision.

To setup a project cash flow model to use Monte Carlo simulation with RiskAMP, users must first specify all assumption input cells as distributions instead of point estimates. Select **Insert Distribution** from the **Monte Carlo** tab of the **Ribbon** to open the **Insert Random Distribution dialog box**. Select a common distribution and then fill in the requested ranges. **Figure 34** shows a user specifying the assumption input of expected unit sales as a **Triangular Distribution** with **Minimum**, **Most Likely**, and **Maximum** values of 3200, 3500, and 3800 units respectively. Once the model has been updated so that all of the point estimates have been replaced with an appropriate distribution, users are ready to setup a results sheet on which to output the results, and run a simulation.

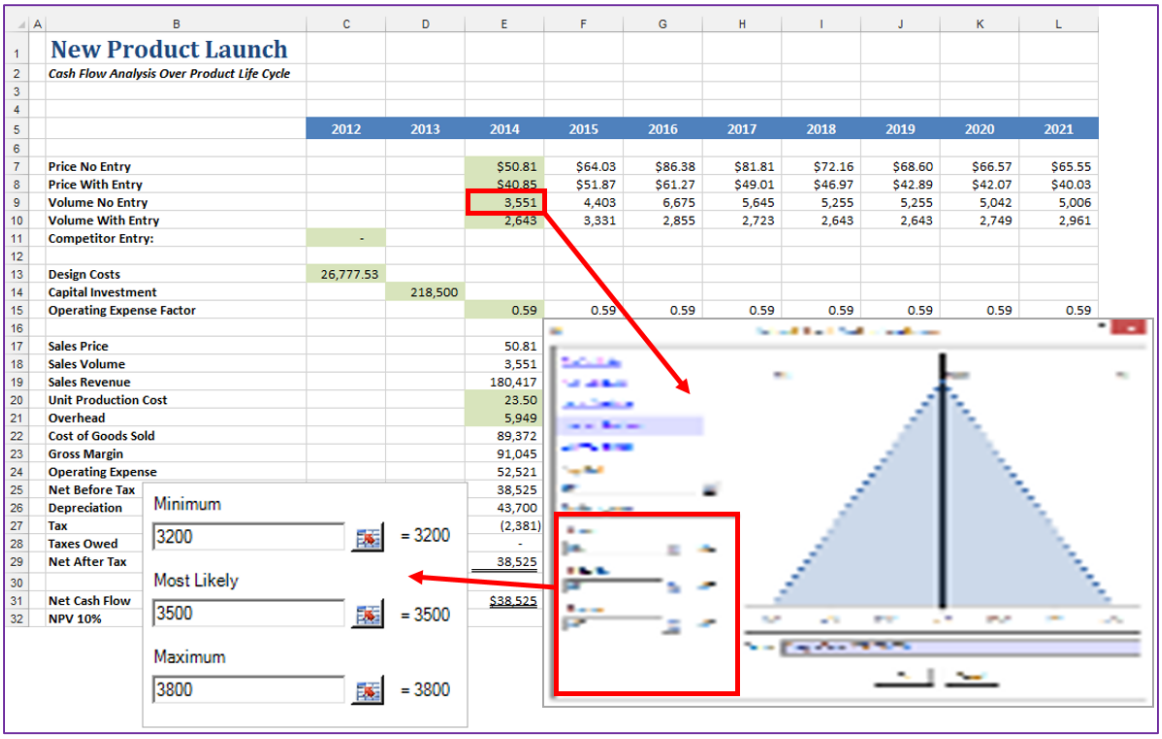
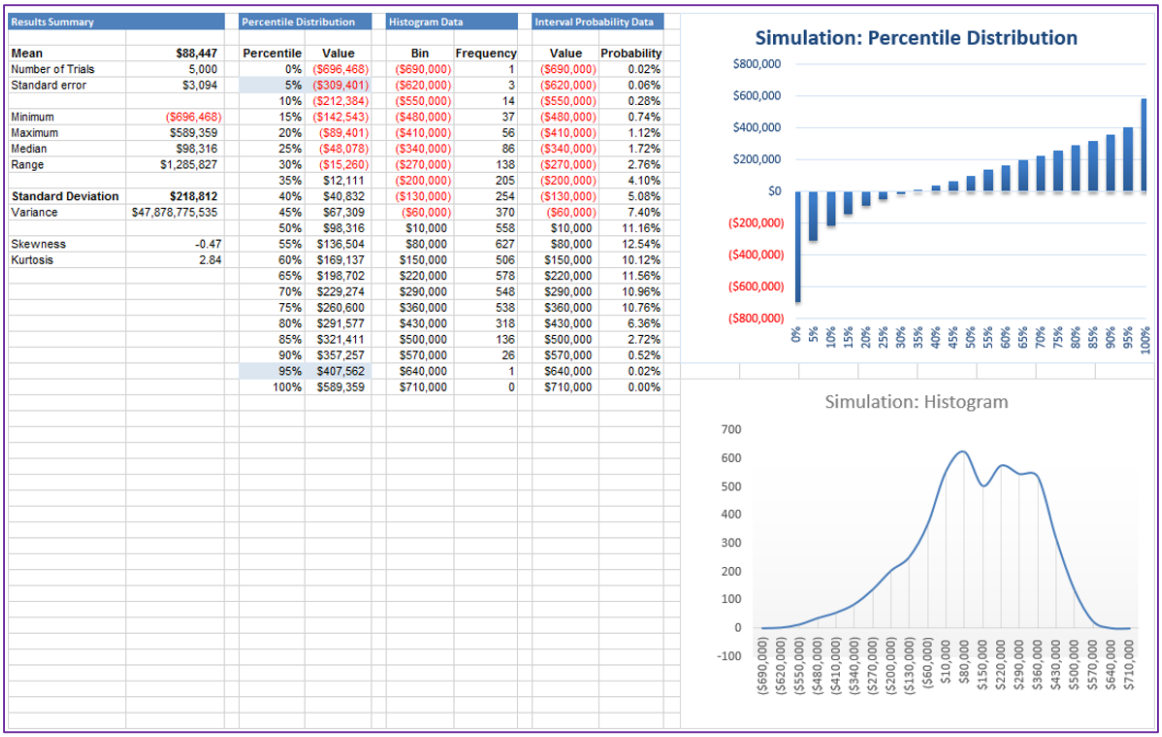


Figure 34 - Specifying an Assumption as a Distribution in RiskAMP

To setup a results sheet, select **Histogram & Chart Wizard** from the **Monte Carlo** tab of the Ribbon. Specify the results cell of your model, in this case the cell containing the estimated NPV for the new product introduction, and then choose to **Create a new Simulations Results Sheet**. Click **Run a Monte Carlo Simulation** and check **Chart the results table data** to produce the output displayed in **Figure 35**.



Results Summary	
Mean	**$88,447**
Number of Trials	5,000
Standard error	$3,094
Minimum	($696,468)
Maximum	$589,359
Median	$98,316
Range	$1,285,827
Standard Deviation	**$218,812**
Variance	$47,878,775,535
Skewness	-0.47
Kurtosis	2.84

Percentile Distribution	
Percentile	Value
0%	($696,468)
5%	($309,401)
10%	($212,384)
15%	($142,543)
20%	($89,401)
25%	($48,078)
30%	($15,260)
35%	$12,111
40%	$40,832
45%	$67,309
50%	$98,316
55%	$136,504
60%	$169,137
65%	$198,702
70%	$229,274
75%	$260,600
80%	$291,577
85%	$321,411
90%	$357,257
95%	$407,562
100%	$589,359

Histogram Data	
Bin	Frequency
($690,000)	1
($620,000)	3
($550,000)	14
($480,000)	37
($410,000)	56
($340,000)	86
($270,000)	138
($200,000)	205
($130,000)	254
($60,000)	370
$10,000	558
$80,000	627
$150,000	506
$220,000	578
$290,000	548
$360,000	538
$430,000	318
$500,000	136
$570,000	26
$640,000	1
$710,000	0

Interval Probability Data	
Value	Probability
($690,000)	0.02%
($620,000)	0.06%
($550,000)	0.28%
($480,000)	0.74%
($410,000)	1.12%
($340,000)	1.72%
($270,000)	2.76%
($200,000)	4.10%
($130,000)	5.08%
($60,000)	7.40%
$10,000	11.16%
$80,000	12.54%
$150,000	10.12%
$220,000	11.56%
$290,000	10.96%
$360,000	10.76%
$430,000	6.36%
$500,000	2.72%
$570,000	0.52%
$640,000	0.02%
$710,000	0.00%

Figure 35 - Simulation Results of 5,000 Iterations in RiskAMP

From the results, an analyst can easily determine that the NPV of the proposed new product introduction ranges from a minimum of -$696,468 to a maximum of $589,359, a range of $1,285,827, with a mean result of $88,447. Reading from the percentile distribution, a decision maker would be 90% confident that the NPV will range from -$309,401 to $407,562. Also, note that there is more than a 30% chance that the project will result in negative NPV. As you can see, the evaluative information provided by simulation results is far superior to simple point estimate models.

A formal risk assessment requires the correlation of the individual assumptions with the target output. Notwithstanding that a simulation produces superior information for decision making than point estimate models, the simulation results do not identify which of the assumptions has the greatest impact on NPV. RiskAMP calculates but does not automatically present this information, but analysts can examine these relationships with the custom functions provided with the RiskAMP add-in. The two functions that are most relevant to this analysis are **SimulationCorrelation** (SCorr) and **SimulationRSquare** (SRSq). SCorr returns the correlation coefficient for the relationship between the simulation output (in this case, NPV) and a specified simulation assumption input. It measures the strength of the relationship between the output and an individual input. SRSq is simply the square of the correlation coefficient. It measures the percentage variability in the output explained by the variability of an individual input. By building a few simple formulas, one for each assumption input, an analyst can determine which inputs have the greatest impact on the output. **Figure 36** presents just such an analysis along with an explanatory chart.

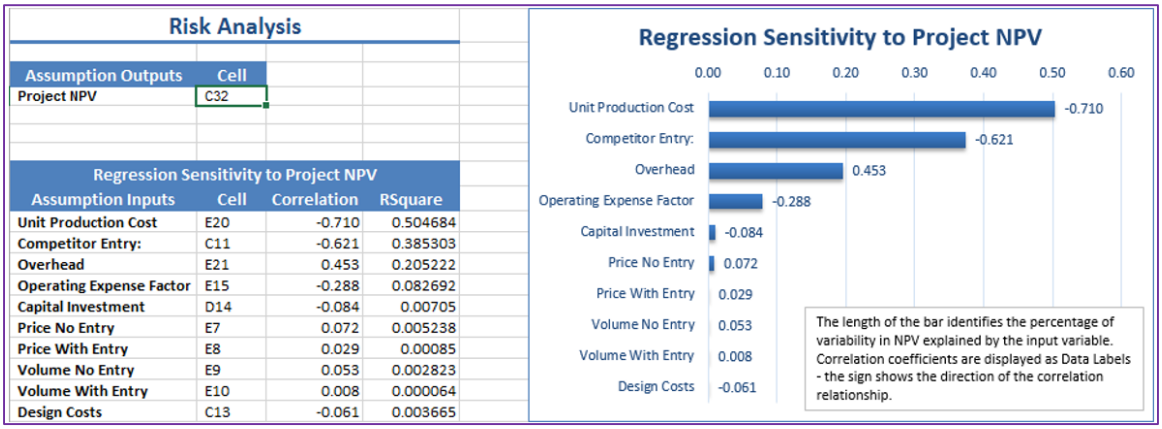


Figure 36 - Sensitivity of Project NPV to Assumption Inputs

As can be seen from the risk analysis, project NPV is most sensitive to unit production cost, competitor entry, overhead costs, and the operating expense factor, with over 50% of the variability in the project NPV explained by the variability in unit production cost. With this information in hand, managers should focus their attention on reducing project risk due to these factors. For example, unit production costs may be reduced and better controlled through outsourced manufacturing, especially if the company's manufacturing resources were old and required constant maintenance to keep them in tolerance.

Capital Budgeting with Excel

Capital budgeting is an important function in most organizations. Capital expenditures for equipment replacement, facility expansion or modernization, and other strategic purposes represent some of the largest expenditures made by businesses.

Learning Objectives

Upon completing this section, you should be able to:

- Distinguish between cash flows and accounting income and identify which should be used in capital budgeting decisions;
- Explain the difference between nominal and real cash flows and why consistency in their use is critical to capital budgeting equations;
- Describe, at a high level, how to compute weighted average cost of capital;
- Distinguish between net present value and internal rate of return and describe how to calculate both in Excel and how to overcome calculation issues associated with both;
- Discuss the issue of capital rationing and describe how to use the profitability index measure to rank projects; and
- List Excel's five depreciation calculation methods.

Introduction to Capital Budgeting

While capital assets comprise a smaller percentage of the total asset portfolio of many businesses, capital assets are long-lived. If an organization makes a mistake in acquiring a capital asset, it must live with the results of its decision for a number of years. Capital budgeting refers to the process of identifying, evaluating, and selecting capital assets or projects and the post acquisition evaluation of capital projects.

This section of the course focuses on properly evaluating and selecting suitable capital projects. It will briefly cover cash flow analysis versus accounting income evaluation methods, differentiate between real and nominal cash flows, and discuss how to compute an organization's cost of capital. Later in this section, the focus shifts to generally accepted techniques for evaluating capital projects followed by a discussion of how to deal with capital rationing.

Cash Flows versus Accounting Income

Using cash flows instead of accounting income in the evaluation of capital projects is a generally accepted practice in corporate budgeting. Incremental cash flows should be discounted at the cost of capital to determine the net present value of the project. Make sure to use incremental cash flows in the analysis and to recognize any investment in working capital resulting from the project. An incremental cash flow is one that would not exist if the project is not accepted.

Here is a simple example of the problem caused by discounting accounting income instead of incremental cash flows.

A project costs $10,000 and is expected to last for two years, producing cash income of $7,500 and $2,500. The cost of the project can be depreciated at $5,000 per year. The cost of capital is 10%. Compare the NPV calculated using cash flows versus the NPV calculated using accounting income. Ignore all tax effects.

Note from this

	Accounting Income	
	Year 1	Year 2
Cash Income	$ 7,500	$ 2,500
Depreciation	5,000	5,000
Accounting Income	$ 2,500	$ (2,500)
NPV	$ 207	

	Cash Flow		
	Time 0	Year 1	Year2
Cash Income		$ 7,500	$ 2,500
Project Cost	$ (10,000)	$ -	$ -
Cash Flow	$ (10,000)	$ 7,500	$ 2,500
NPV	$ (1,116)		

analysis that using accounting income rather than incremental cash flows distorts the selection decision. While using accounting income returns a positive NPV, using incremental cash flows returns a negative NPV, indicating that the project is unacceptable given the cost of capital. Accounting income results in a higher NPV because the cash outflows associated with the acquisition of the project are recaptured as depreciation over the useful life of the asset. In other words, the cost of acquisition is postponed into the future.

Nominal Versus Real Cash Flows

The most common mistake made by most accountants and business professionals in evaluating and selecting capital projects is inconsistency in handling the effects of inflation on the incremental cash flows and choice of discount rate. Real dollars are constant dollars: the effect of inflation is not explicitly accounted for in the cash flows. Nominal dollars include the effects of inflation.

Here is a simple example to help make the point.

A project is expected to generate real cash flows of $5000 in years one and two. What nominal cash flows are generated by the project if the expected inflation rate is 3%?

	Cash Flow		
	Time 0	Year 1	Year2
Real		$ 5,000	$ 5,000
Nominal		$ 5,150	$ 5,305

Note from the analysis above that the nominal cash flows have been inflated at a rate of 3% per year. The nominal cash flows in Year 1 amount to $5,000 x 1.03, totaling $5,150. The nominal cash flows in Year 2 amount to $5,000 x 1.032, totaling $5,305.

To maintain consistency in your project evaluations, just follow these simple rules.

- Use real discount rates with real cash flows.
- Use nominal discount rates with nominal cash flows.

If inflation is handled consistently in evaluating capital projects, it doesn't matter whether real dollars or nominal dollars are used. The calculated NPVs and IRRs will be the same. At low rates of inflation, a real rate can be approximated by subtracting the inflation rate from the nominal rate. In other words, if the nominal rate is 9%, and the expected inflation rate is 2%, then the real rate would be approximately 7% (9% – 2%). As the inflation rate goes up, a formal calculation should be used to compute the appropriate rate, whether real or nominal.

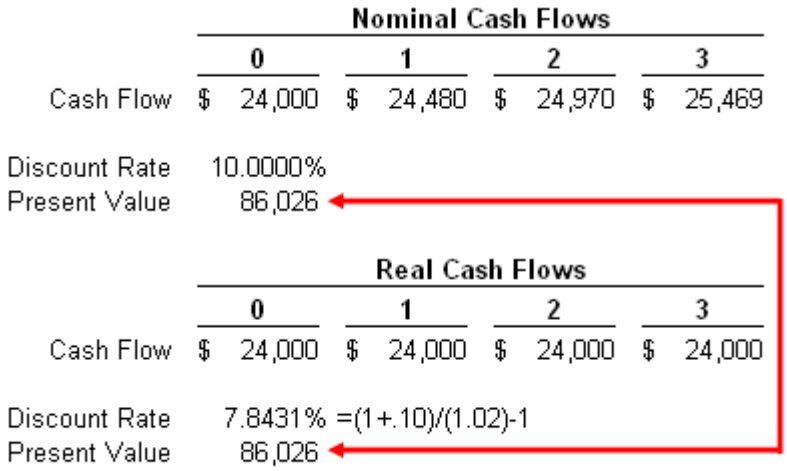
The formulas to use in converting real rates to nominal rates and vice versa are shown here.

Nominal Rate = (1+ Real Rate) x (1+ Inflation Rate) – 1

Real Rate = (1+ Nominal Rate) / (1+ Inflation Rate) – 1

Following is an example to prove the similar result of NPVs computed using nominal rates with nominal cash flows and real rates with real cash flows.

A company owns a lease that will cost $24,000 per year, increasing at 2% per year over the next four years. The lease payment is due in advance at the beginning of each year. The increased lease cost is equal to the expected inflation rate over the four year period. If current discount rates are 10%, what is the present value of the lease?



One of the most common errors when accounting for inflation in capital budgeting is using real cash flows with a nominal discount rate. This inconsistency in the treatment of inflation creates a bias against the selection of worthwhile projects because the discounted cash flows will be understated and result in a lower NPV.

Cost of Capital

Now that we have investigated the impact of inflation on cash flow, let's turn our discussion to the choice of discount rate. The rate at which cash flows are discounted should equal the company's cost of capital. What, however, is the cost of capital? Is it the short-term or long-term borrowing rate? Is it the average return on the stock market or the return expected by the shareholders at the time they invested in the company?

Actually, the appropriate rate of return is a combination of all of these and other factors. The company's cost of capital is often referred to as the weighted average cost of capital (WACC). The WACC is the discount rate used for discounting cash flows in calculating NPV; it also represents the required rate of return when using IRR.

The weighted average cost of capital represents the long-term, after-tax average cost of using funds, whether borrowed or invested by shareholders in the company. In its simplest form, WACC is the combined cost of debt and equity used by the business.

The cost of debt capital is represented by the average interest rate on long-term borrowings. The cost of long-term borrowings is used because the assets being acquired are capital assets; they will have a useful life greater than one year. Debt capital also has tax benefits. Because interest paid on debt is tax deductible, the true cost of debt capital will be ***net*** of any tax benefits. The tax benefit is equal to the marginal tax rate of a company times the amount of interest paid on debt. If the tax rate of a company is 30%, and the average cost of long-term debt is 6%, then the after-tax cost of debt capital is 4.2% (6% x (1-30%)).

The cost of equity capital, including retained earnings, is more difficult to estimate. To begin with, there is no tax advantage because dividends paid are not tax deductible by a company.

To estimate the cost of equity capital, most companies attempt to apply the principles of the capital asset pricing model (CAPM). The CAPM holds that interest is a function of risk. Risk is defined as variability or fluctuation in earnings. More variability means greater risk. The risk of an individual company can be measured by the variability of its returns over time relative to the variability of the returns of the entire stock market. That relationship is often referred to as beta (ß), which is a measure of market or systematic risk.

- A beta of 1 means that a company has risk equal to the stock market as a whole.
- A beta that is greater than 1 means that a company has greater risk than the market as a whole.
- A beta of less than 1 means that a company has less risk relative to the market.

Beta can be seen as the tendency of a company's returns to respond to changes in the market. A beta of 1.3 means that a company's earnings are 30% more volatile than the market. In other words, if the stock market went up $1, then the company's stock price would increase by $1.30. Likewise, if the market went down by $1, the company's stock price would decrease by $1.30.

What does this have to do with the cost of equity? CAPM states that the cost of equity is equal to the risk-free rate of return plus the risk premium associated with an individual company. The risk-free rate of return is generally accepted to be the average return on 10-year Treasury Inflation Protected Securities (TIPS) bonds.

The risk premium for an individual company is equal to the risk premium for the stock market as a whole times the beta for the company. The risk premium for the stock market represents the extra return that the stock market must provide over the risk-free rate to compensate investors for market risk. In other words, if the risk-free rate and the average return on the stock market are known, and a company's beta can be estimated, then the cost of equity capital for a specific company can be estimated. That is the rate that would be used in calculating WACC.

The cost of equity capital can be estimated using the following formula.

$k_e = ß(R_p) + R_f$

$\boldsymbol{k_e}$ = *cost of equity capital*

$\boldsymbol{ß}$ = *company beta*

$\boldsymbol{R_p}$ = *risk premium*

$\boldsymbol{R_f}$ = *risk-free rate*

The next step is to get estimates of the variables included in the formula. The risk-free rate is accepted to be the 10-year TIPS rate. The real return on TIPS bonds is currently estimated to be 2%. The long-term real return on equities is estimated to be between 4% and 5%. (Some economists estimate the average long-term return to be as high as 7%.) That means the risk premium ranges from 2% (4% - 2%) to 3% (5% - 2%). Publicly traded companies can get their beta from a number of readily accessible sources. If a company is not publicly traded, then beta must be estimated. Below is an example to illustrate how to calculate the real cost of equity.

The average real return on the stock market is 5%, and the average real return on 10-year TIPS is 2%. The company is traded on NASDAQ and has a computed beta of 1.5. Compute the risk premium for all equity securities and the real cost of equity capital for the company.

Average Real Return on Stock Market	R_{me}		5.0%
Average Real 10-Year TIPS Rate	R_f		2.0%
Risk Premium	R_p	$R_{me} - R_f$	3.0%
Risk Index or Beta	ß		1.5
Real Cost of Equity Capital	k_e	$ß(R_p) + R_f$	6.5%

Once the cost of long-term debt and the cost of equity are estimated, only one more piece of information is required to compute WACC: the capital structure of the company. Capital structure refers to the percentage of long-term debt and equity used to finance the company. In this case, the planned capital structure is more important than the actual capital structure. To calculate WACC, simply add 1) the after-tax cost of long-term debt times the percentage of debt in the capital structure to 2) the cost of equity times the percentage of equity in the capital structure.

Following is a simple example of calculating the weighted average cost of capital.

A company estimates its average real cost of long-term debt to be 6.5%, and its real cost of equity to be 7%. The company maintains a debt-to-equity ratio of .67. In other words, its capital structure is 40% debt and 60% equity, made up of 50% retained earnings and 50% common stock. The marginal tax rate of the company is 30%. Calculate the weighted average cost of capital.

Real Cost of Capital			
Equity	k_e		7.00%
Long-Term Debt	R_d		6.50%
Tax Rate	t		30%
Real After-Tax Cost of Capital			
Equity	k_e		7.00%
Long-Term Debt	k_d	$R_d(1 - t)$	4.55%
Capital Structure			
Equity	w_e		60%
Long-Term Debt	w_d		40%
WACC	k	$w_d(k_d) + w_e(k_e)$	6.02%

In this case, the cost of all equity capital, including common stock and retained earnings, was assumed to be the same. Quite often, common stock has a slightly higher cost of capital than retained earnings because of the issuance costs of common stock. If that were the circumstance in this example, retained earnings would occupy a separate layer in the calculation with their own unique cost of capital as would common stock and preferred stock if the company issued preferred shares. For every capital source with a different cost of capital, simply include a separate layer for each one in calculating the weighted average.

Remember, one of the more common mistakes in capital project evaluation is using a nominal discount rate with real, constant dollar cash flows. If real cash flows are used, make sure to adjust your nominal discount rate for inflation.

The formula for converting nominal rates to real rates was presented earlier in this section. In addition, don't overlook the propensity to mix nominal and real rates in calculating the cost of capital. The simple rule is to be consistent!

Evaluating Capital Projects

John Graham and Campbell Harvey of Duke University conducted a comprehensive investigation of the capital budgeting practices of American companies in 2001. Their findings were published in the *Journal of Financial Economics* (Vol. 60, 2001) and summarized in the *Journal of Applied Corporate Finance* (Vol. 15, Spring 2002). The following findings are summarized from their research.

- Nearly 75% of respondent CFOs reported using Net Present Value (NPV) to evaluate projects. Slightly more than 75% reported using Internal Rate of Return (IRR).
- Larger companies were more likely to use NPV.
- Highly leveraged companies were more likely to use NPV and IRR than companies with low debt ratios.
- Highly leveraged companies were more likely to use simulation and sensitivity analysis in evaluating capital projects.
- Companies used hurdle rates and the payback method most frequently after NPV and IRR.
- Over 73% of respondents used the capital asset pricing model (CAPM) for estimating the cost of capital.
- Larger companies and highly leveraged companies were more likely to use CAPM for estimating the cost of capital.
- Nearly 60% of respondents used a single corporate-wide discount rate, even when some projects were identified as projects with greater risk.

As indicated above, there are numerous methods that accountants and business professionals can use to evaluate the suitability of proposed capital projects. Among the most popular are NPV, IRR, Payback,

Discounted Payback, and simulation. The research indicates that nearly 60% of CFOs still use the payback method, although it is largely discredited in contemporary business literature.

The payback method does not take into account the *time value of money*, and it does not include the impact of cash flows beyond the cutoff date. The discounted payback method overcomes one of these problems by accounting for the time value of money. Payback's popularity can be partly attributed to its simplicity of application. However, Graham and Harvey point out that the payback method provides useful information to companies with severe capital constraints. In those companies, projects must return a positive cash flow early. If not, a company may not have funds available to take advantage of more promising investments as they arise in the near-term future, or worse, it may fail. This section will cover the widely used methods for project evaluation, NPV and IRR. Both are discounted cash flow methods, but they are different in application.

Net Present Value

Net present value (NPV) is the second most widely used method for evaluating capital projects. It is a discounted cash flow technique. If the weighted average cost of capital is used as the discount rate, NPV represents the potential increase in the value of the company produced by accepting the project.

NPV, as with all discounted cash flow methods, is sensitive to the discount rate used. If the perceived risk of proposed capital projects is about average for the company, the discount rate used should be the cost of capital, WACC. If the project has more risk associated with it than the average project, a risk adjusted discount rate should be used. In other words, as perceived risk increases, the required rate of return should increase. The cash flows for a project with above average risk should be discounted at a higher rate. As the discount rate increases, NPV decreases, and the likelihood of acceptance decreases.

Some organizations use three or four general-risk categories, such as very high, high, average, and low, each with its own preassigned risk premium. Each project is ranked as to risk, and the rate assigned to that category is used as the required rate of return for computing NPV or is used as the hurdle rate when using IRR.

All cash flows, direct and indirect, should be included in a capital budgeting analysis. Quite often, working capital required by the project is left out of the calculations. Another item that is often incorrectly accounted for is the tax effects of depreciation. The problem only occurs when real dollar analysis is used. Since depreciation is based on the nominal cost of an asset at acquisition, depreciation is always stated in nominal dollars. If you are using a real dollar analysis, make sure to reduce the tax savings by the compounded inflation rate over the useful life of the asset.

This example uses NPV for evaluating the suitability of a capital project. The inflation rate is assumed to be 2%, and the real WACC is 6%. All amounts are stated in real dollars, except depreciation, which is stated in nominal dollars. Note the inclusion in the analysis of the project's working capital requirements and the reduction of the tax benefit over the life of the asset. Since the NPV is positive, the proposal is an acceptable project.

	0	1	2	3	4	5	6
Inflation Rate	2%						
Investment	$ 20,000						
Working Capital							
Beginning	$ -	$ 3,000	$ 8,000	$ 8,500	$ 9,000	$ 9,500	$ 6,000
End	3,000	8,000	8,500	9,000	9,500	6,000	-
Change	3,000	5,000	500	500	500	(3,500)	(6,000)
Revenues		30,000	30,000	30,000	30,000	30,000	
Expenses		20,000	20,000	20,000	20,000	20,000	
Depreciation		4,000	4,000	4,000	4,000	4,000	
EBT		6,000	6,000	6,000	6,000	6,000	
Tax (30%)		1,800	1,800	1,800	1,800	1,800	
Net Income		$ 4,200	$ 4,200	$ 4,200	$ 4,200	$ 4,200	
Add:							
Depreciation	-	4,000	4,000	4,000	4,000	4,000	-
Change in WC	(3,000)	(5,000)	(500)	(500)	(500)	3,500	6,000
Reduction in Tax Savings due to Nominal Depreciation	-	(35)	(70)	(104)	(137)	(170)	-
Cash Flow from Operations	(3,000)	3,165	7,630	7,596	7,563	11,530	6,000
Investment Cash Flows							
Original Investment	(20,000)						
Salvage	-	-	-	-	-	-	-
Net Cash Flows	$ (23,000)	$ 3,165	$ 7,630	$ 7,596	$ 7,563	$ 11,530	$ 6,000
Real After-Tax WACC	6%						
NPV	$ 11,991						

Internal Rate of Return

Internal rate of return (IRR) is the most widely used method for evaluating capital projects. It is a discounted cash flow technique. If the weighted average cost of capital is used as the hurdle rate, then IRR should lead to the same decision as NPV under most conditions. If greater risk is associated with a project, most companies will adjust the hurdle rate upward. IRR also requires consistency in the use of real hurdle rates with real cash flows and nominal hurdle rates with nominal cash flows. The use of a nominal hurdle rate with real cash flows will bias the decision against the project being evaluated.

IRR is the rate of interest at which the present value of the expected cash inflows from a capital project equals the present value of the expected cash outflows of the project. It is sometimes referred to as the time-adjusted rate of return. Projects with higher IRRs are preferable to those with lower IRRs.

The IRR represents the rate at which the NPV for a project is equal to zero or the interest rate at which the project breaks even. If the IRR is greater than the cost of capital, the project is profitable.

Several problems are associated with using the IRR as a capital project evaluation technique.

1. First, all free cash flows are ***assumed to be reinvested*** in the project at the computed IRR. If a project yields an unusually high IRR, it is unlikely that a company will be able to reinvest at that high rate. The modified internal rate of return (MIRR) overcomes this problem. MIRR assumes

that free cash flows generated by a project are reinvested at the company's cost of capital, just like NPV. Of course, reinvestment at the company's cost of capital is a much more likely scenario.

2. Second, the calculated IRR may not be unique. In a conventional analysis, where all cash outflows occur at the beginning of a project, the calculated IRR is unique. In projects where cash outflows occur throughout the project, multiple IRRs can be calculated, depending on the seed rate used to make the calculation. No one has devised a way to determine which IRR calculated under these conditions is the correct one to use in the evaluation.

3. Third, IRR cannot handle a situation where the cost of capital is expected to change over the life of a long project. If NPV is being used, cash flows can be discounted at different rates to deal with this problem.

4. Fourth, since the IRR is a percentage interest rate rather than dollars, a group of individual projects cannot be easily evaluated as a group. In other words, the IRRs of the individual projects cannot be added together to get a composite IRR for the group. A composite NPV can be easily computed by adding the NPVs of the individual projects together.

Here is a simple example of using IRR and MIRR to evaluate a project using the same data as the previous NPV example. Again, all cash flows are in real dollars. The tax benefit is reduced at the compounded rate of inflation over the project's useful life, and the effect of the working capital requirements is included. Since the project is of average risk, the hurdle rate is the WACC. A self-checking formula tests whether the NPV is equal to zero at the IRR. If that test fails, then there is an error in the analysis. In this case, both the IRR and MIRR are greater than WACC; hence, the proposal is an acceptable project.

	0	1	2	3	4	5	6
Net Cash Flows	$ (23,000)	$ 3,165	$ 7,630	$ 7,596	$ 7,563	$ 11,530	$ 6,000
Real After-Tax WACC	6%						
NPV	$ 11,991						
IRR	19.41%						
MIRR	13.68%						
NPV at IRR == 0	=0=	OK					

Note that the analyses in both of the project evaluations using NPV and IRR did not explicitly include the impact of financing on the cash flows. In conventional capital project evaluation, investing and financing are treated as separate issues. In these examples, the evaluations were to determine whether to invest in the projects. Financing was implicitly taken into account by using the cost of capital to discount the cash flows.

Only after a company has accepted a project does financing play a role. If a company manages its capital structure consistent with its long-term intentions which were used in calculating WACC, it doesn't matter how an individual project is financed. Including the effect of financing on cash flows in the calculation of NPV or IRR is a common mistake. This practice results in a form of double-counting that invalidates the analysis.

Using Excel in Capital Budgeting

Excel has a full range of financial functions for determining the suitability of capital projects and other investment opportunities. Among them are NPV, XNPV IRR, MIRR, and XIRR.

Excel's Present Value Functions

NPV calculates the net present value of a series of future periodic cash flows discounted using a specified discount rate. *By default, all cash flows take place at the end of the period.* The syntax for NPV follows.

NPV(discount rate, value1, value2, …value254)

The **discount rate** is the rate of discount over the length of one period.

The arguments **value1, value2, ...value254** represent the future cash flows. The values must be equally spaced in time and occur at the end of each period.

In those cases where cash flows occur at uneven intervals, use Excel's XNPV function instead of NPV. XNPV calculates the net present value of a stream of cash flows that does not necessarily occur at the end of each period. The syntax for XNPV follows.

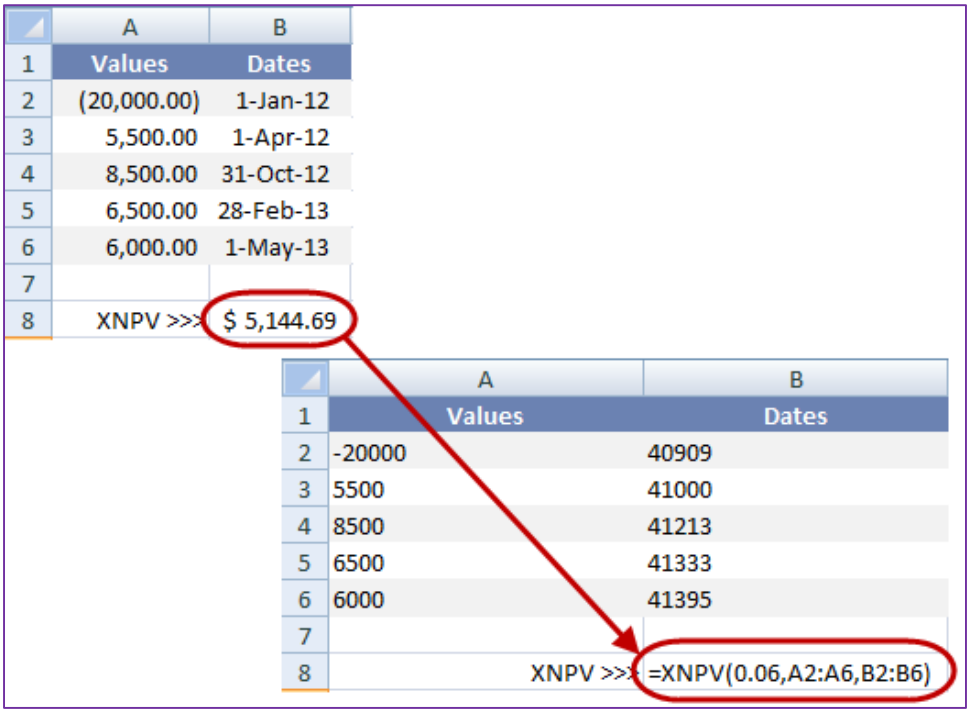
XNPV(rate, values, dates)

The **rate** is the rate by which Excel will discount all cash flows.

The **values** are the cash flows that correspond to a payment schedule. The first value is optional and corresponds to a cost or payment that occurs at the beginning of the investment. Excel discounts all succeeding payments based on a 365-day year. The series of values must contain at least one positive value and one negative value.

The **dates** are the dates that correspond to each of the cash flow values evaluated by the XNPV function. The first payment date indicates the beginning of the schedule of payments. All other dates must be later than this date, but they may occur in any order.

Many Excel users are familiar with the NPV function, but few have used the XNPV function, so an example of XNPV is provided in **Figure 37**.



	A	B
1	Values	Dates
2	(20,000.00)	1-Jan-12
3	5,500.00	1-Apr-12
4	8,500.00	31-Oct-12
5	6,500.00	28-Feb-13
6	6,000.00	1-May-13
7		
8	XNPV >>>	$ 5,144.69

	A	B
1	Values	Dates
2	-20000	40909
3	5500	41000
4	8500	41213
5	6500	41333
6	6000	41395
7		
8	XNPV >>>	=XNPV(0.06,A2:A6,B2:B6)

Figure 37 - XNPV Example

Excel's Internal Rate of Return Calculations

IRR returns the internal rate of return for a series of periodic cash flows. The internal rate of return is the rate of interest at which the present value of the expected cash inflows from a capital project equals the present value of the expected cash outflows of the project. The syntax of the IRR function is below.

IRR(values, [irr guess])

The **values** argument is an array or a reference to cells containing the periodic cash flows.

The **irr guess** argument is 10%. You can enter another guess if IRR returns the #NUM! error value. IRR cycles through the calculations until the result is accurate within 0.00001 percent of the guess.

MIRR returns the modified internal rate of return for a series of periodic cash flows. The MIRR overcomes one of the identified weaknesses of the internal rate of return. This weakness is the assumption that any free cash flow generated by a project reinvests in the project at the calculated rate of return. MIRR alters this assumption by allowing users to specify a reinvestment rate for cash flows generated by the project.

MIRR(values, finance rate, reinvestment rate)

The **values** argument represents an array or a reference to cells that contain the periodic cash flows. Values must contain at least one positive and one negative value to calculate.

Finance rate is the rate that you pay on the money used.

Reinvestment rate is the rate earned on reinvested cash flows.

Like XNPV, XIRR calculates the internal rate of return for a series of cash flows that occur at irregular intervals. The syntax for XIRR follows.

XIRR(values, dates, guess)

The **values** argument represents the cash flows that correspond to a payment schedule. The first value is optional and corresponds to a cost or payment that occurs at the beginning of the investment. Excel discounts all succeeding payments based on a 365-day year. The series of values must contain at least one positive value and one negative value

The **dates** argument represents the dates that correspond to each of the cash flow values evaluated by the XNPV function. The first payment date indicates the beginning of the schedule of payments. All other dates must be later than this date, but they may occur in any order.

The **guess** argument is optional. By default, Excel uses a rate of 10%, but users can enter their own guess if desired.

Figure 38 presents an example of XIRR.

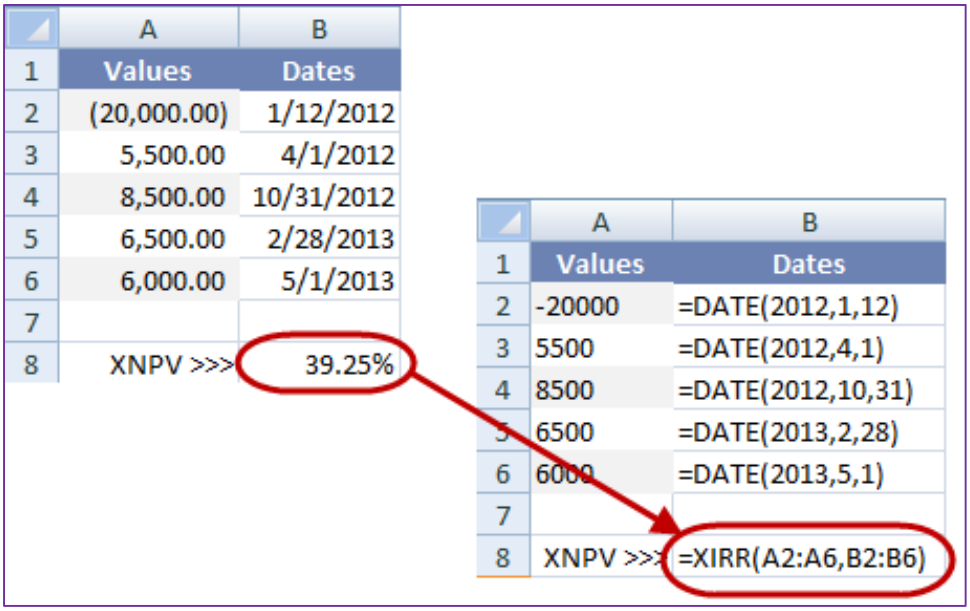


Figure 38 - XIRR Example

Using Excel to Evaluate Capital Projects

Now that we understand the basic syntax of the NPV, XNPV, IRR, MIRR, and XIRR functions, let us examine how to evaluate a capital project. In this example, a CFO is evaluating the installation of new equipment.

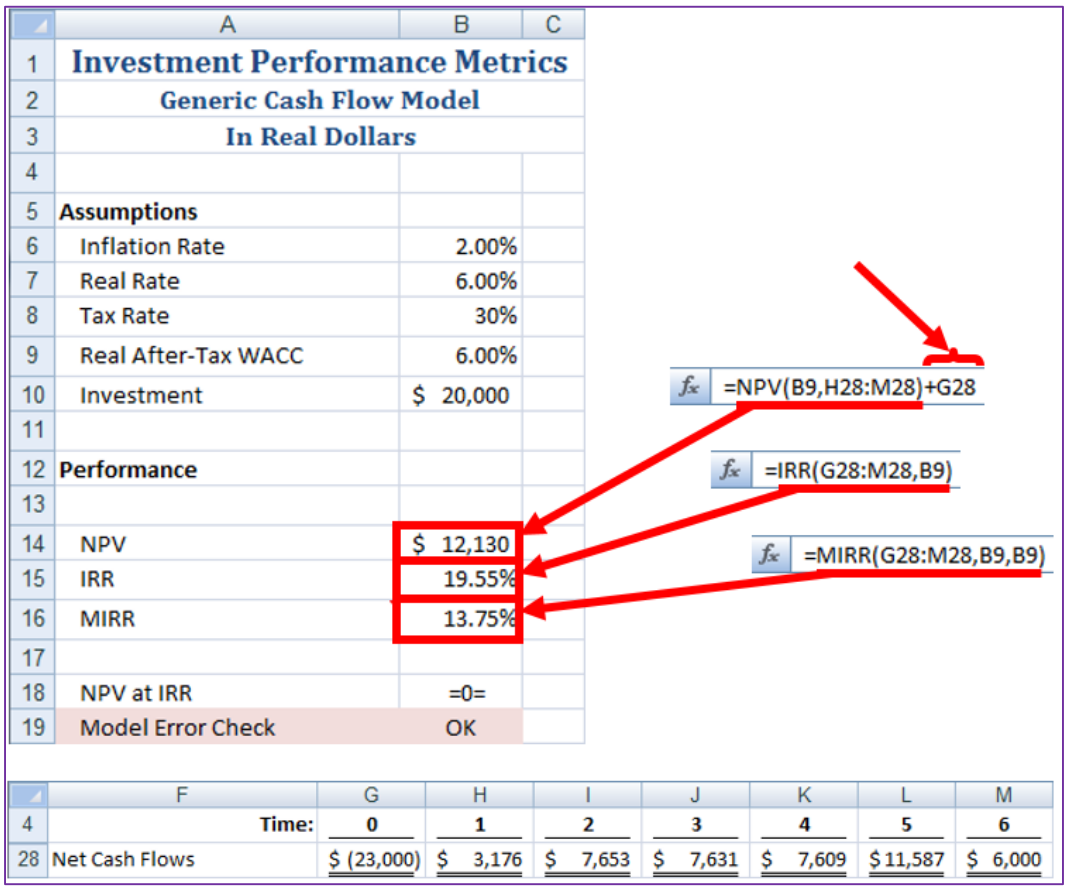


Figure 39 - Evaluating Investment Opportunities with NPV, IRR, and MIRR

The equipment costs $20 million and has a useful life of six years. The company's real weighted average after-tax cost of capital (WACC) is an estimated six percent. Over the life of the project, real inflation is an estimated two percent. The company uses straight-line depreciation and estimates its tax rate over the life of the investment to be thirty percent. The CFO has prepared a preliminary cash flow analysis and has used Excel to calculate the project's estimated net present value, internal rate of return, and modified internal rate of return as shown in **Figure 39**. We will briefly examine the full analysis. In the example, all amounts represent real dollars, except depreciation, which represents nominal dollars.

All cash flows, direct and indirect, should be included in a capital budgeting analysis. Quite often, working capital required by a project is not part of the calculations. Another item often incorrectly accounted for is the tax effect of depreciation. Since depreciation is a nominal cost of an asset at acquisition, *depreciation represents nominal dollars*. If a real dollar analysis is used, the calculation of tax savings resulting from the depreciation of the asset adjusts down by the compounded estimated inflation rate over the useful life of

the asset. The example used here incorporates the project's working capital requirements and the reduction of the tax benefit over the life of the asset.

Net present value (NPV) is the preferred method for evaluating capital projects. If the discount rate is the weighted average after-tax cost of capital, NPV represents the potential increase or decrease in the value of a company produced by accepting a project. NPV, as with all discounted cash flow methods, is sensitive to the discount rate used. If the perceived risk of a proposed capital project is about average for the company, the discount rate used should be the cost of capital, WACC. If the project has more risk associated with it than the average project, a risk-adjusted discount rate is used. In this case, positive NPV indicates that a project is acceptable.

Internal rate of return (IRR) is the most widely used method for evaluating capital projects. If the weighted average after-tax cost of capital is the hurdle rate, then IRR should lead to the same decision as NPV under most conditions. IRR is the rate of interest at which the present value of the expected cash inflows from a capital project equals the present value of the expected cash outflows of the project. The IRR represents the rate at which the NPV for a project is equal to zero or the interest rate at which the project breaks even. In this case, the project is acceptable because the IRR is greater than the cost of capital.

Several problems are associated with using the IRR as a capital project evaluation technique. One is the assumption that all free cash flows reinvest in the project at the calculated internal rate of return. If a project yields an unusually high IRR, it is unlikely that a company will be able to reinvest at such a high rate. The modified internal rate of return (MIRR) overcomes this problem by allowing a user to specify the reinvestment rate, usually WACC. In this case, the project is acceptable because the MIRR is greater than the cost of capital.

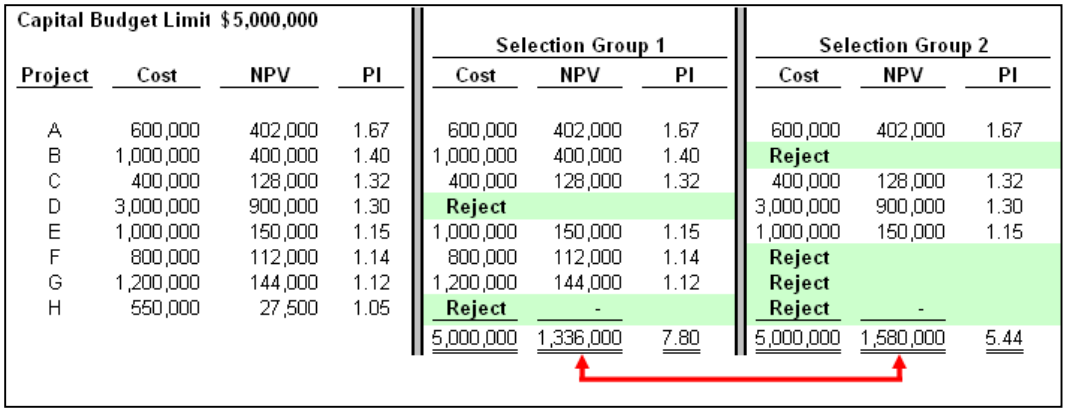
Capital Rationing

Quite often, a company is faced with multiple capital project proposals, all of which yield positive NPVs or suitable IRRs. Generally speaking, any project with a positive NPV is an acceptable project. If capital funding is freely available, rejection of an acceptable project is an irrational decision. Unfortunately, many companies artificially limit or cap their capital investment spending. This creates an environment of *capital rationing* where some acceptable projects are rejected in favor of others. Some accounting professionals use the profitability index to rank acceptable projects. The profitability index of a project is calculated with the following formula.

Profitability Index = 1+ (NPV / Cost)

A project with a higher profitability index, *ceteris paribus*, is better than a project with a lower index. Use caution when using the profitability index to rank projects in an environment of capital rationing because the index masks the magnitude of each investment. Mechanically choosing projects with the highest indices may result in a reduction of value to the company.

Here is an example to illustrate the problem. In this example, Project B and Project D are mutually exclusive. In other words, choosing Project B precludes a choice of Project D and vice versa. Capital projects are limited to a total of $5,000,000. Choose the group of projects that maximizes value to the company without going over the spending limit.



Capital Budget Limit $5,000,000				Selection Group 1			Selection Group 2		
Project	Cost	NPV	PI	Cost	NPV	PI	Cost	NPV	PI
A	600,000	402,000	1.67	600,000	402,000	1.67	600,000	402,000	1.67
B	1,000,000	400,000	1.40	1,000,000	400,000	1.40	Reject		
C	400,000	128,000	1.32	400,000	128,000	1.32	400,000	128,000	1.32
D	3,000,000	900,000	1.30	Reject			3,000,000	900,000	1.30
E	1,000,000	150,000	1.15	1,000,000	150,000	1.15	1,000,000	150,000	1.15
F	800,000	112,000	1.14	800,000	112,000	1.14	Reject		
G	1,200,000	144,000	1.12	1,200,000	144,000	1.12	Reject		
H	550,000	27,500	1.05	Reject	-		Reject	-	
				5,000,000	1,336,000	7.80	5,000,000	1,580,000	5.44

As this example illustrates, to maximize value to the company, one must maximize NPV within spending constraints. Between the mutually exclusive projects, Project B is a better investment than Project D. However, the selection of Project B forces the selection of several projects that are inferior to Project D, to the detriment of the company. While the total profitability index is larger for Selection Group 1, the total NPV of the group is less than Selection Group 2. By choosing Selection Group 1, the company forgoes an additional $244,000 of NPV for the same investment. That's because the *profitability index masks the magnitude of the costs and NPV of each individual project*. Simply maximizing NPV within the limits of the spending constraint always results in the best decision.

Depreciation Functions in Excel

Excel provides several depreciation calculation functions designed to assist in calculating depreciation in budgeting and other financial reporting models. Each of Excel's depreciation functions and related syntax is outlined below.

VDB – Variable Declining Balance Method

This function returns the depreciation of an asset for any period you specify, including partial periods, using the double-declining balance method or some other method you specify. VDB stands for variable declining balance.

= VDB (cost, salvage, life, start period, end period, factor, no switch)

DB - The Fixed-declining Balance Method

This function returns the depreciation of an asset for a specified period using the fixed-declining balance method.

= DB (cost, salvage, life, period, month)

DDB - The Double-declining Balance Method

This function returns the depreciation of an asset for a specified period using the double-declining balance method or some other method you specify.

= DDB (cost, salvage, life, period, factor)

SLN – Straight Line Method

This function returns the straight line depreciation of an asset for one period.

= SLN (cost, salvage, life)

SYD – Sum-of-the-Years Digits Method

This function returns the sum-of-the-year's digits depreciation of an asset for a specified period.

= SYD (cost, salvage, life, period)

Miscellaneous Techniques Used in Creating Pro Forma Statements

Ultimately, after all of the input has been collected and processed, after all of the forecasts and regressions have been made, after all of the value of the resources has been maximized, a set of pro forma financial statements is usually produced as an output of the budgeting process. These typically contain a balance sheet, an income statement, and a statement of cash flows. Because these pro forma financial statements are subject to revision many times over during the budget cycle, it is imperative that they are built and maintained to accommodate seemingly countless iterations and revisions.

Learning Objectives

Upon completing this section, you should be able to:

- List four best practices for addressing spreadsheet design issues;
- Describe how to adjust budgets for seasonal fluctuations and how to allocate and back-fill budget estimates by days;
- Utilize Excel's Watch Window feature to monitor budget results;
- Describe how to create VLOOKUP formulas;
- Describe how to link workbooks, including using defined names to establish links and why that is important; and
- Explain how to accommodate circular reference formulas in Excel.

Defining Budget Assumptions and Other Spreadsheet Design Issues

While the overall format of these statements will vary from company to company based on such factors as industry, number of periods, and individual preferences, there are fundamental issues that are central to virtually all projected financial statements. When assimilating all of the relevant inputs and building the projected financial statements, users should be cognizant of issues such as:

- Documenting and labeling assumptions,
- Clearly labeling assumptions for input,
- Not embedding assumptions into formulas, and
- Building error-checking routines into formulas.

Though clearly not meant to be an all-inclusive listing, the items presented above represent four of the key issues associated with sound spreadsheet design; each of these items is discussed in detail in the following sections.

Documenting and Labeling Assumptions

Virtually all spreadsheets contain assumptions, and budgeting spreadsheets generally contain a significant number of assumptions. Examples include projected accounts receivable collection periods, projected amounts of inventory on hand, and projected interest rates. In order to simplify the budgeting process to the extent possible and to enhance the overall accuracy of the pro forma financial statements, it is imperative that assumptions be clearly documented and labeled. Two techniques to assist with this process include placing all assumptions on a separate worksheet and using comments to document assumptions.

In the example presented in **Figure 40**, a separate worksheet has been created on which all assumptions feeding into the pro forma financial statements are placed. In this case, the assumptions are separate for each month, thereby accommodating any seasonal trends in the business and/or projected growth or contraction.

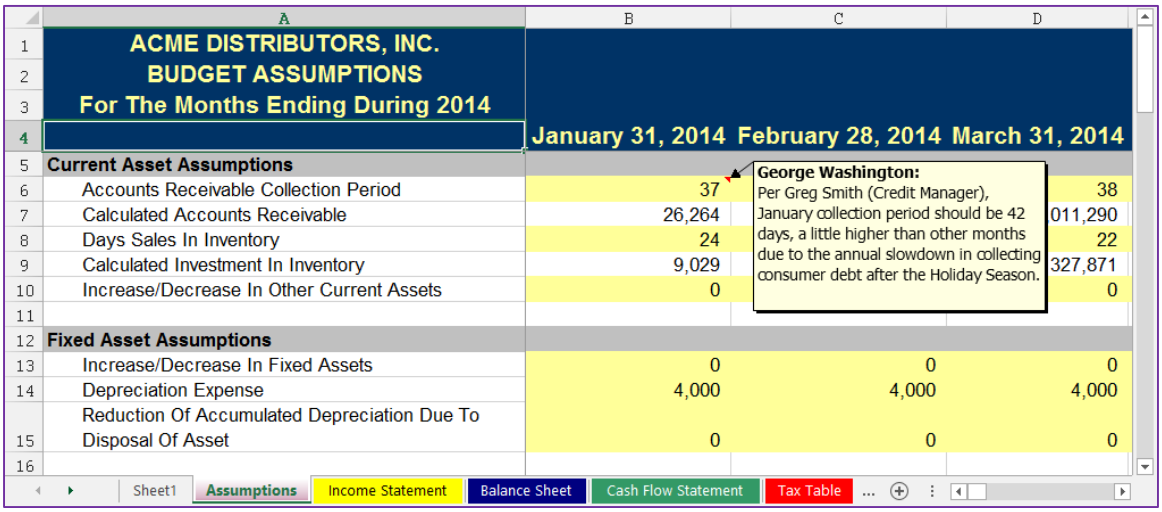


Figure 40 - The Assumptions Worksheet in a Budgeting Workbook

Notice also in the previous example, a comment has been included to assist in documenting the worksheet. In this case, George Washington inserted a comment to document why the January collection period is 42 days. Comments can be inserted in a number of ways, including simply by right-clicking on the desired cell and selecting **Insert Comment** from the resulting menu.

A key point to consider when using comments to document budget assumptions include not just the simple ability to insert comments into worksheets, but also how the comments appear in the worksheets. As shown in **Figure 41**, in the **Advanced** group of Excel's **Options**, users can control whether comments are always visible on the worksheet, visible only when the mouse hovers over the cell in which the comment resides, or are never visible.

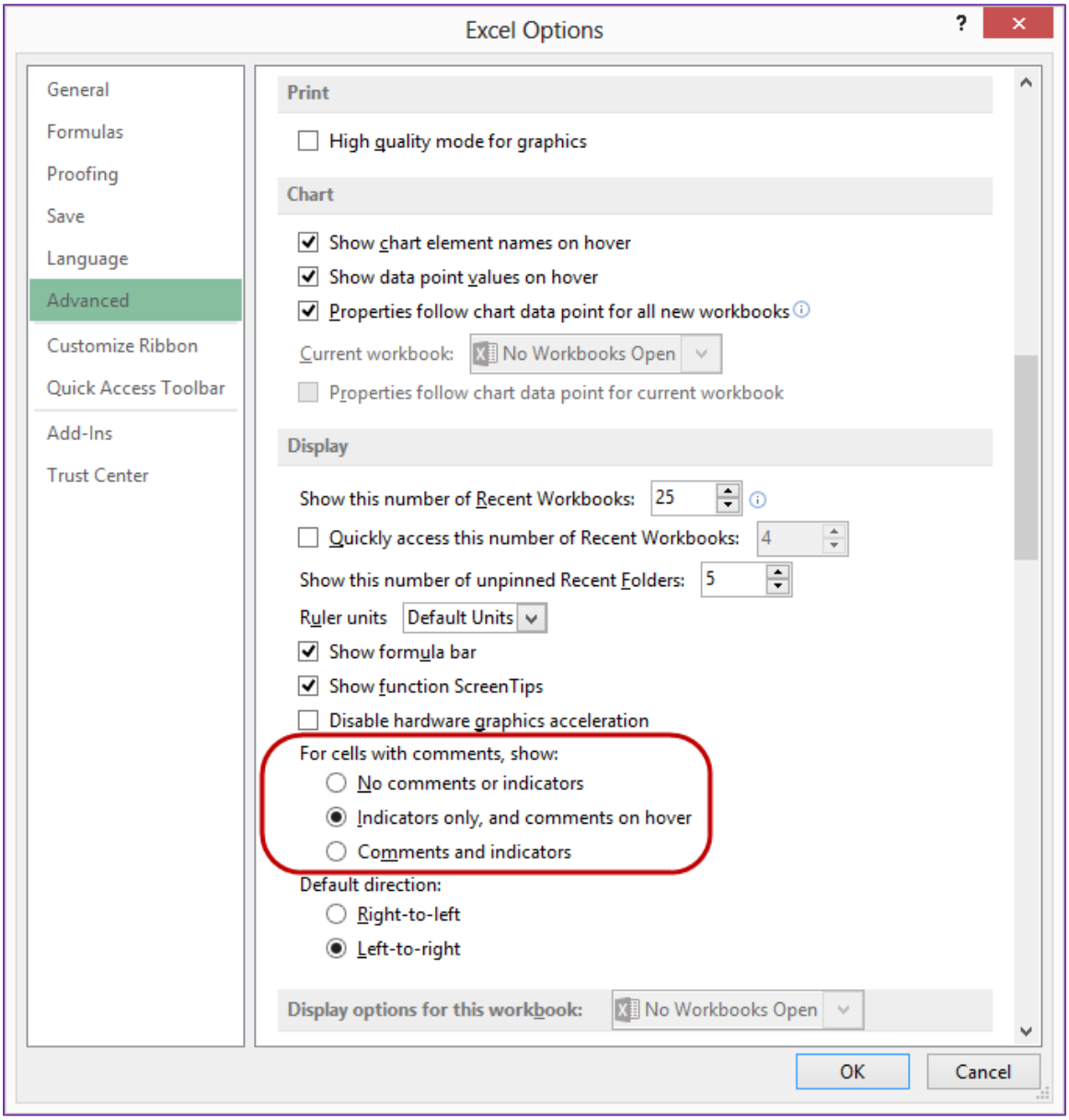


Figure 41 - Controlling How Comments Appear in an Excel Worksheet

In addition, users should address how Comments appear when worksheets are printed. As shown in **Figure 42**, by clicking the **Page Setup dialog launcher** on the **Page Layout** tab of the Ribbon and then clicking on the **Sheet** tab of the **Page Setup dialog box,** users can control whether comments print at all, print on a separate page apart from the worksheet, or print as displayed on the worksheet. As a practical matter, most users find printing on a separate page at the end of the worksheet to be the best choice in most circumstances.

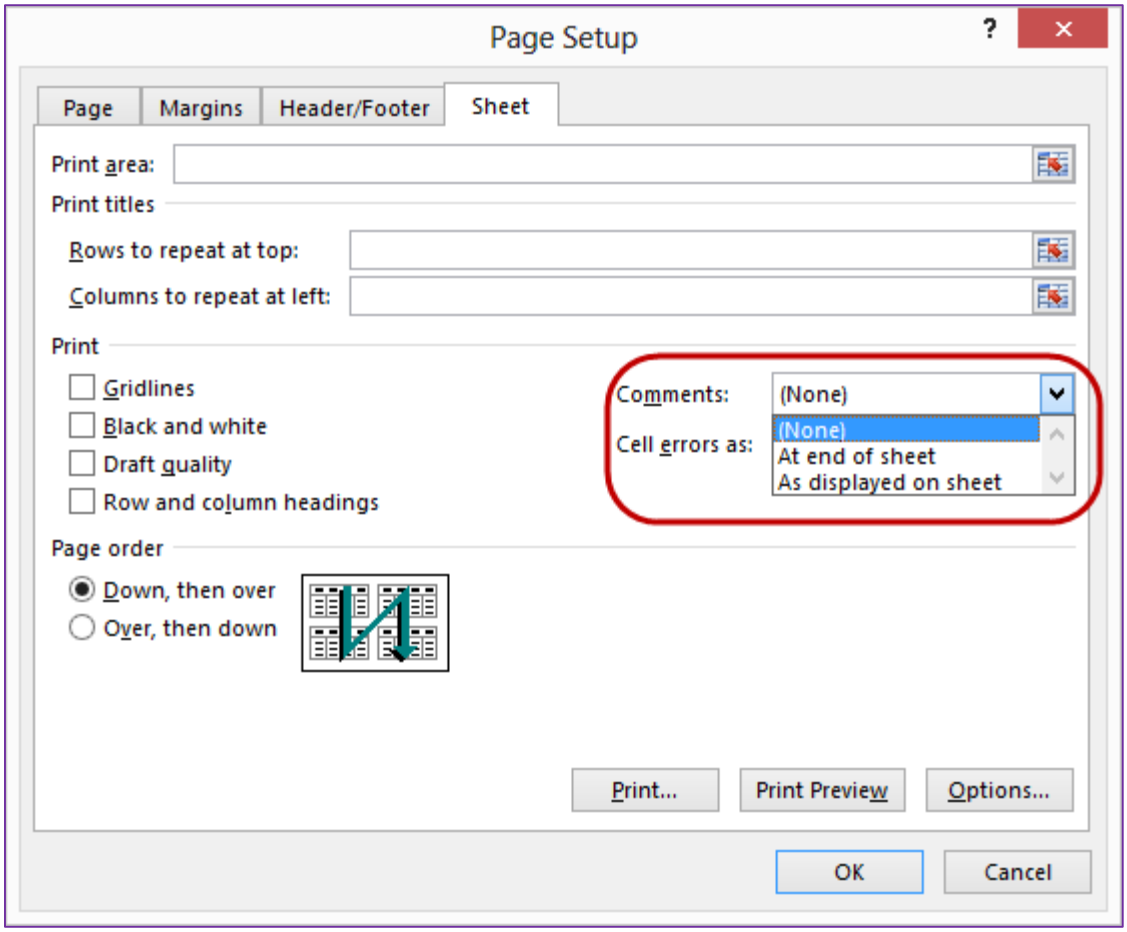
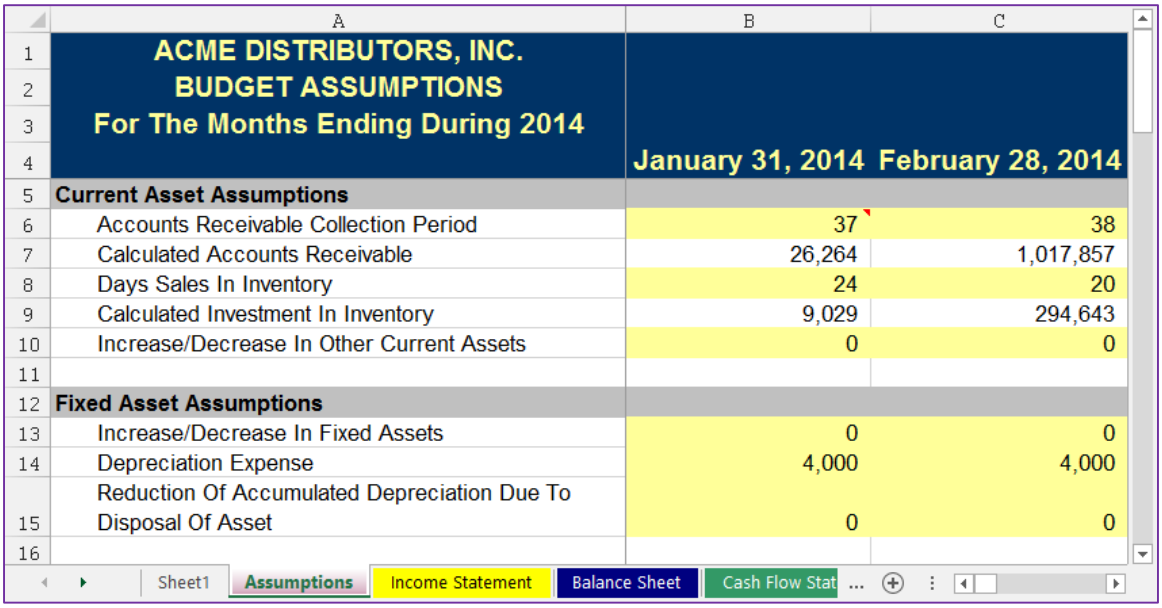


Figure 42 - Controlling How Comments Print

Clearly Labeling Assumptions for Input

To assist in ensuring the accuracy of the pro forma financial statements, clearly label assumptions for input. You can use visual indicators and input aids such as shading cells and creating Data Validation rules to accomplish this objective. The use of visual aids such as shading cells can be very effective at alerting users to cells requiring input as shown in **Figure 43**. Here, the shaded cells are those requiring input; those not shaded are protected, and input is not allowed.

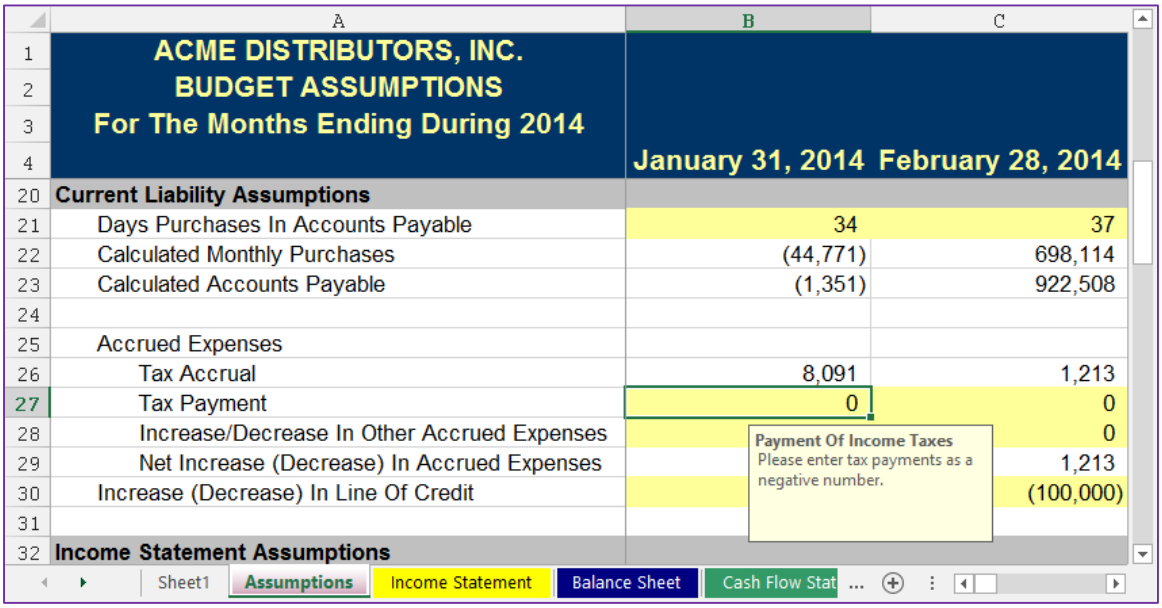


	A	B	C
1	ACME DISTRIBUTORS, INC.		
2	BUDGET ASSUMPTIONS		
3	For The Months Ending During 2014		
4		January 31, 2014	February 28, 2014
5	**Current Asset Assumptions**		
6	Accounts Receivable Collection Period	37	38
7	Calculated Accounts Receivable	26,264	1,017,857
8	Days Sales In Inventory	24	20
9	Calculated Investment In Inventory	9,029	294,643
10	Increase/Decrease In Other Current Assets	0	0
11			
12	**Fixed Asset Assumptions**		
13	Increase/Decrease In Fixed Assets	0	0
14	Depreciation Expense	4,000	4,000
15	Reduction Of Accumulated Depreciation Due To Disposal Of Asset	0	0
16			

Sheet1 | Assumptions | Income Statement | Balance Sheet | Cash Flow Stat ...

Figure 43 - Using Cell Shading to Indicate Input Cells

In addition, to ensure the entry of correct and valid data, spreadsheet designers may establish Data Validation rules and prompts. As shown in **Figure 44**, Data Validation allows users to create rules and prompts regarding the data entered into a cell. In the example presented, Data Validation prompts users to enter income tax payments and to enter these amounts as negative numbers. Of course, if a user enters an amount that does not meet the criteria established in the Data Validation rule, an error message appears prompting the user to enter a value in the correct range.



	A	B	C
1	ACME DISTRIBUTORS, INC.		
2	BUDGET ASSUMPTIONS		
3	For The Months Ending During 2014		
4		January 31, 2014	February 28, 2014
20	**Current Liability Assumptions**		
21	Days Purchases In Accounts Payable	34	37
22	Calculated Monthly Purchases	(44,771)	698,114
23	Calculated Accounts Payable	(1,351)	922,508
24			
25	Accrued Expenses		
26	Tax Accrual	8,091	1,213
27	Tax Payment	0	0
28	Increase/Decrease In Other Accrued Expenses		0
29	Net Increase (Decrease) In Accrued Expenses		1,213
30	Increase (Decrease) In Line Of Credit		(100,000)
31			
32	**Income Statement Assumptions**		

Payment Of Income Taxes
Please enter tax payments as a negative number.

Sheet1 | Assumptions | Income Statement | Balance Sheet | Cash Flow Stat ...

Figure 44 - Using a Data Validation Rule to Prompt User Input

Never Embed Assumptions in Formulas

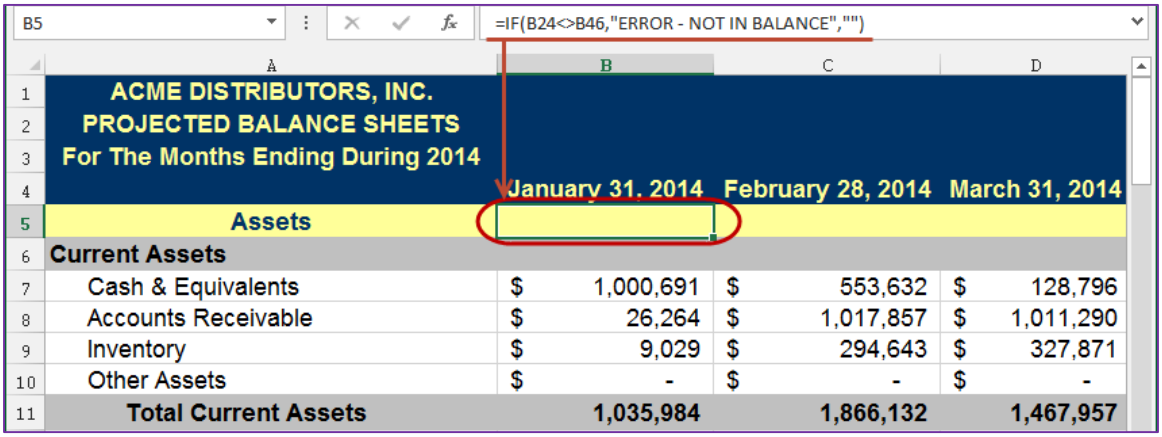
There are at least two potential problems associated with embedding assumptions into formulas. First, if an assumption is embedded into a formula, the assumption will not appear explicitly on any report. For instance, when printing a projected balance sheet, if the relevant assumptions are embedded into the formula calculating accounts receivable, then, when the report is printed, it will not be apparent what the accounts receivable collection period is. On the other hand, if the assumptions are discretely entered and displayed elsewhere and only referenced in the formulas, then it is possible to print the assumptions so that they can be reviewed and verified.

Second, when assumptions are embedded into formulas, changing them becomes more difficult and susceptible to error, as the formulas themselves must be modified. However, if the assumptions are listed separately on the worksheet and only referenced in the formulas, then when the assumptions need to be modified, doing so only requires editing the cells containing the assumptions and not the cells containing the formulas. In this case, the cells containing formulas can remain protected, thereby minimizing the likelihood that a user will corrupt the formulas.

Building Error-Checking Routines into Formulas

It is an unfortunate but indisputable fact – spreadsheets are prone to error, and we must take steps to reduce the number of errors that might appear in our budgeting spreadsheets. Tools such as Data Validation are beneficial in this effort, but they alone are not enough. Sometimes, we should also modify formulas to ensure that they assist us in identifying errors.

One common technique for doing so is to alert users when financial statements contained in the budget model do not balance. For instance, if total assets on the balance sheet do not equal total liabilities and equity, an **IF** statement similar to that pictured in **Figure 45** would call a user's attention to the fact that the statements do not balance.



	A	B	C	D
1	ACME DISTRIBUTORS, INC.			
2	PROJECTED BALANCE SHEETS			
3	For The Months Ending During 2014			
4		January 31, 2014	February 28, 2014	March 31, 2014
5	Assets			
6	Current Assets			
7	Cash & Equivalents	$ 1,000,691	$ 553,632	$ 128,796
8	Accounts Receivable	$ 26,264	$ 1,017,857	$ 1,011,290
9	Inventory	$ 9,029	$ 294,643	$ 327,871
10	Other Assets	$ -	$ -	$ -
11	Total Current Assets	1,035,984	1,866,132	1,467,957

Figure 45 - Using an IF Function to Identify Out-of-Balance Condition

Conditional formatting could also be useful in testing for the condition identified above by the IF statement. For instance, the conditional formatting rule shown in **Figure 46** examines the content of cell B5 from

Figure 45. If the content of the cell is “ERROR – NOT IN BALANCE” – the phrase inserted by the formula shown in Figure 45 – then the conditional formatting rule causes cell B5 to format with a red background and white text, calling even more attention to the out-of-balance condition.

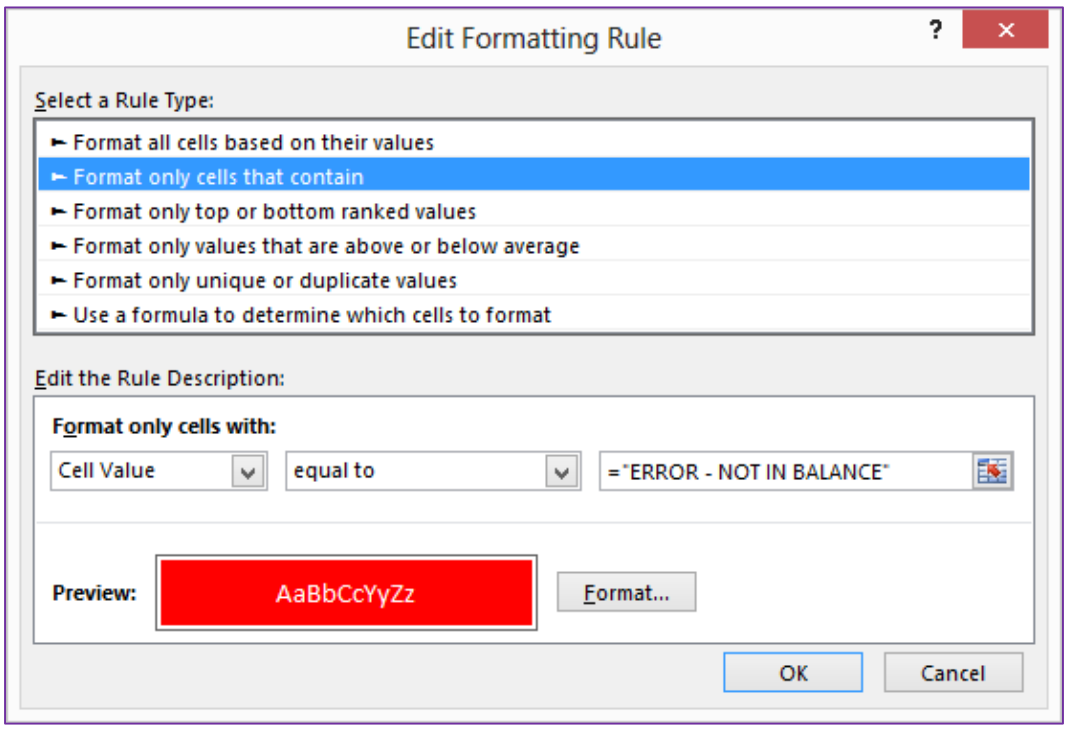
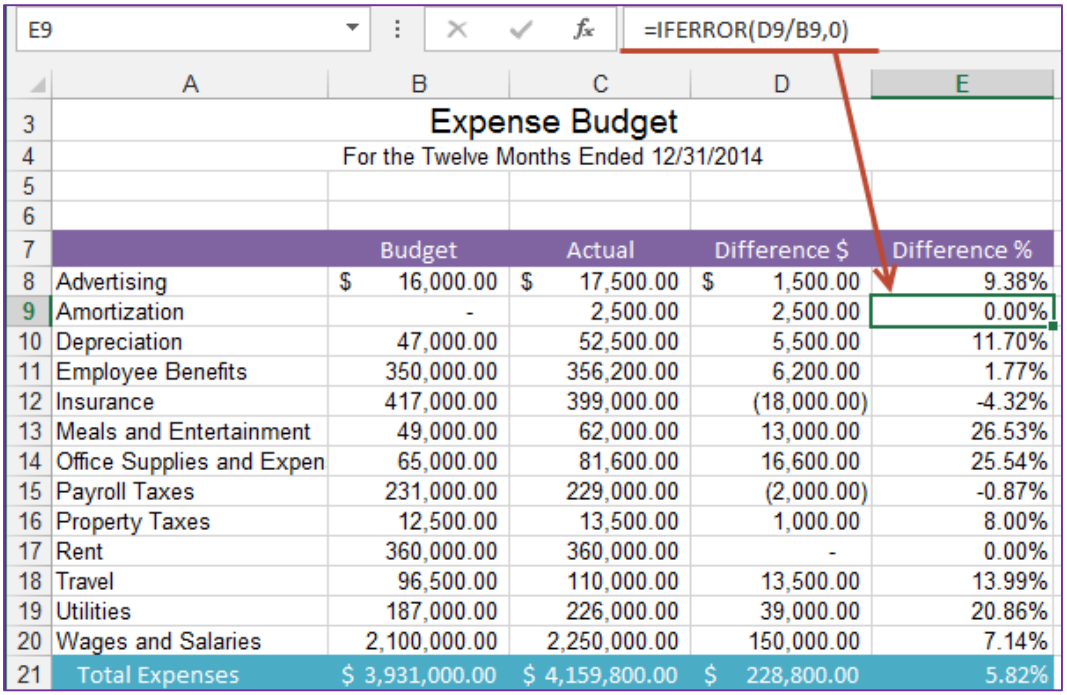


Figure 46 - Conditional Formatting Used to Identify Out-of-Balance Condition

Excel 2007, 2010, and 2013 contain an **IFERROR** function that can be useful in trapping errors in formulas. For instance, such a report can be useful at trapping “division by zero” errors that appear in budget versus actual financial statements when a zero appears in the “budget” column of the statement and a non-zero value appears in the “actual” column of the same statement. As shown in **Figure 47**, IFERROR tests to determine if the formula immediately following the IFERROR command will return an error. If so, Excel substitutes the value immediately following the formula for testing for the formula result; if not, then the result of the formula is recorded into the cell. In the specific example presented in Figure 47, because the budget amount for Amortization was zero, in the absence of an IFERROR formula, the percentage variance calculation would normally have returned a **#DIV/0!** error message. With the presence of the IFERROR formula, Excel recognized that an error would have been returned by the D7/B7 operation within the formula and, therefore, Excel substituted zero in lieu of the #DIV/0! Error message.



	A	B	C	D	E
3	Expense Budget				
4	For the Twelve Months Ended 12/31/2014				
5					
6					
7		Budget	Actual	Difference $	Difference %
8	Advertising	$ 16,000.00	$ 17,500.00	$ 1,500.00	9.38%
9	Amortization	-	2,500.00	2,500.00	0.00%
10	Depreciation	47,000.00	52,500.00	5,500.00	11.70%
11	Employee Benefits	350,000.00	356,200.00	6,200.00	1.77%
12	Insurance	417,000.00	399,000.00	(18,000.00)	-4.32%
13	Meals and Entertainment	49,000.00	62,000.00	13,000.00	26.53%
14	Office Supplies and Expen	65,000.00	81,600.00	16,600.00	25.54%
15	Payroll Taxes	231,000.00	229,000.00	(2,000.00)	-0.87%
16	Property Taxes	12,500.00	13,500.00	1,000.00	8.00%
17	Rent	360,000.00	360,000.00	-	0.00%
18	Travel	96,500.00	110,000.00	13,500.00	13.99%
19	Utilities	187,000.00	226,000.00	39,000.00	20.86%
20	Wages and Salaries	2,100,000.00	2,250,000.00	150,000.00	7.14%
21	Total Expenses	$ 3,931,000.00	$ 4,159,800.00	$ 228,800.00	5.82%

Figure 47 - Using IFERROR to Trap Potential Errors in Worksheets

Adjusting for Seasonal Fluctuations

Seasonal fluctuations in revenues and expenses are the norm for a number of businesses. Retailers, for instance, recognize approximately 40% of their annual revenues during the Christmas shopping season. Wholesalers supplying these retailers accumulate a substantial portion of their annual revenues during the late summer and early fall, selling products in anticipation of the Christmas shopping season. Likewise, ski resorts earn a substantial portion of all revenues and profits from the middle of December through the end of March. Cruise lines, on the other hand, realize most of their revenues during the summer vacation season.

Clearly, seasonal fluctuations in revenues and expenses are common in many businesses. Failing to account for these fluctuations in the budgeting and forecasting process can lead to errors in projecting cash flows and planning for resource requirements and allocations.

Businesses that experience significant seasonal fluctuations tend to experience the same seasonality pattern year-after-year. This fact makes incorporating seasonality into the budgeting and forecasting cycle much easier than if the fluctuations occurred randomly. By relying on historical patterns, it is relatively easy to account for seasonal fluctuations in both revenues and expenses.

When preexisting patterns exist, users can apply weighting factors calculated from prior years to projected totals for the current year to account for seasonality. In this example, historical information is used to compute relative percentages of sales for each month as shown in **Figure 48**. These percentages are then applied to projected total sales for the following year to generate projected revenue by month.

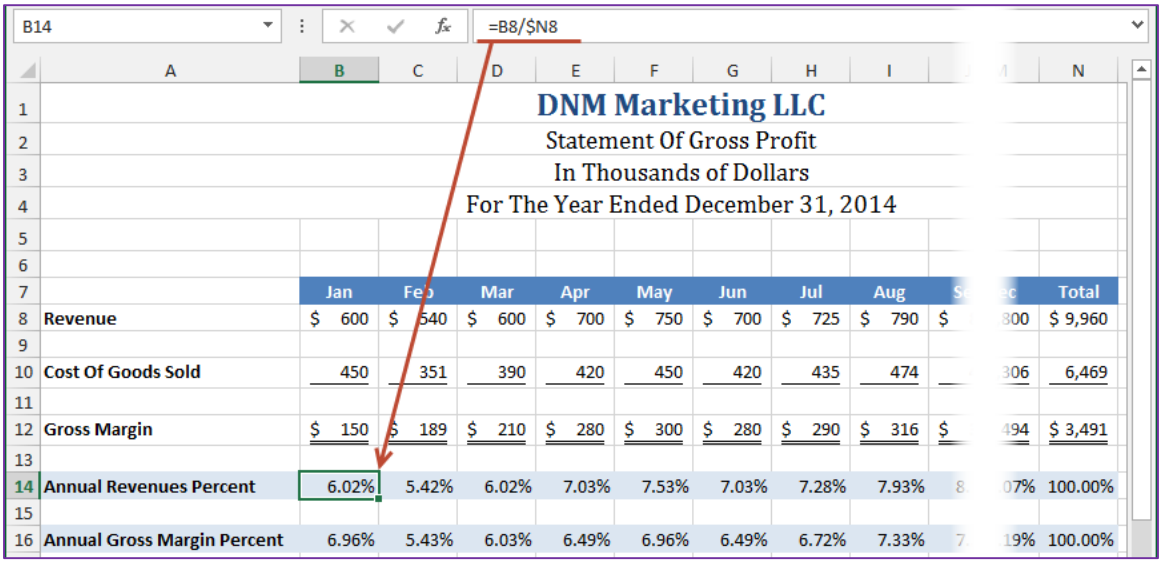


Figure 48 - Calculating Monthly Percentage Weights Applied to an Annual Revenue Projection

In the previous example, seasonal fluctuations were incorporated into the monthly revenue forecasts by multiplying the projected annual sales for the coming year by monthly weighting percentages developed from the prior year. In this example, the annual fixed expenses (taxes and maintenance fees) are allocated to the individual months based on the average annual occupancy rate of the vacation condos for the proceeding three years, as shown in **Figure 49**.

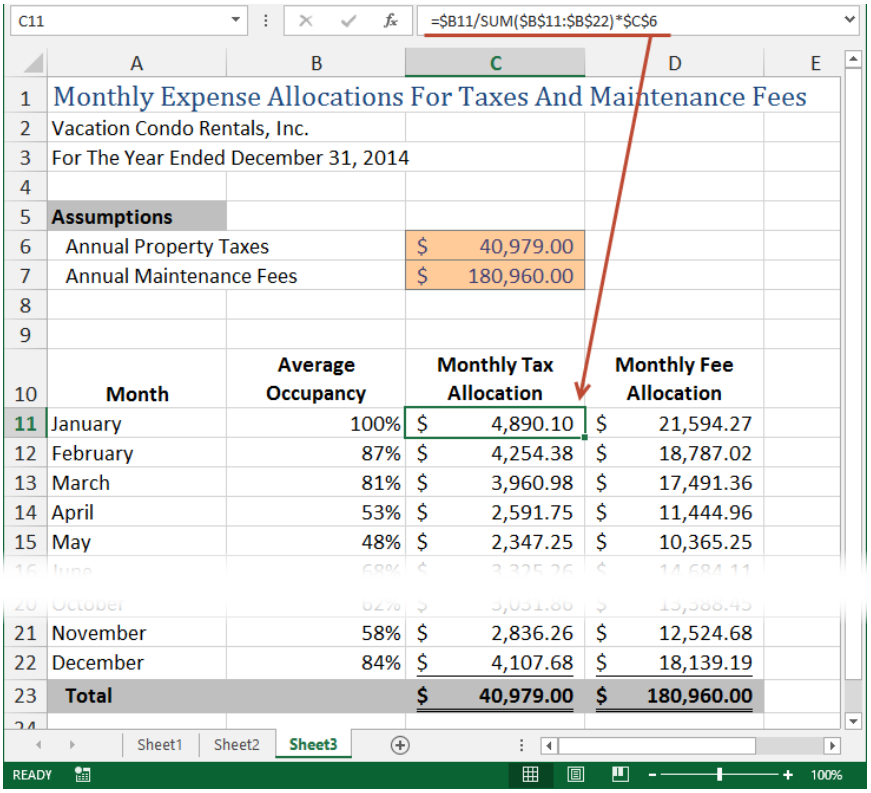


Figure 49 - Allocating Fixed Expenses Based on Occupancy Rate

Allocating and Back-Filling Estimates by Days

As demonstrated in the previous section, it is quite common for organizations to forecast revenues and expenses at annual levels but then to allocate or back-fill these annual forecasts to shorter time periods. In many cases, this is done by simply dividing the annual forecast by twelve in order to generate monthly targets. Monthly estimates calculated in this manner are often sufficiently accurate for most budgeting and forecasting applications. However, in some instances – for example, when monthly revenue forecasts are used as targets in computing incentive compensation for sales staff – a higher degree of accuracy is needed.

Simply dividing estimated annual revenues by twelve results in monthly targets based on an average of 30.416 sales days per month (365/12). Alternatively, annual sales could be allocated with greater precision based on the number of sales days in each month as shown in **Figure 50**.

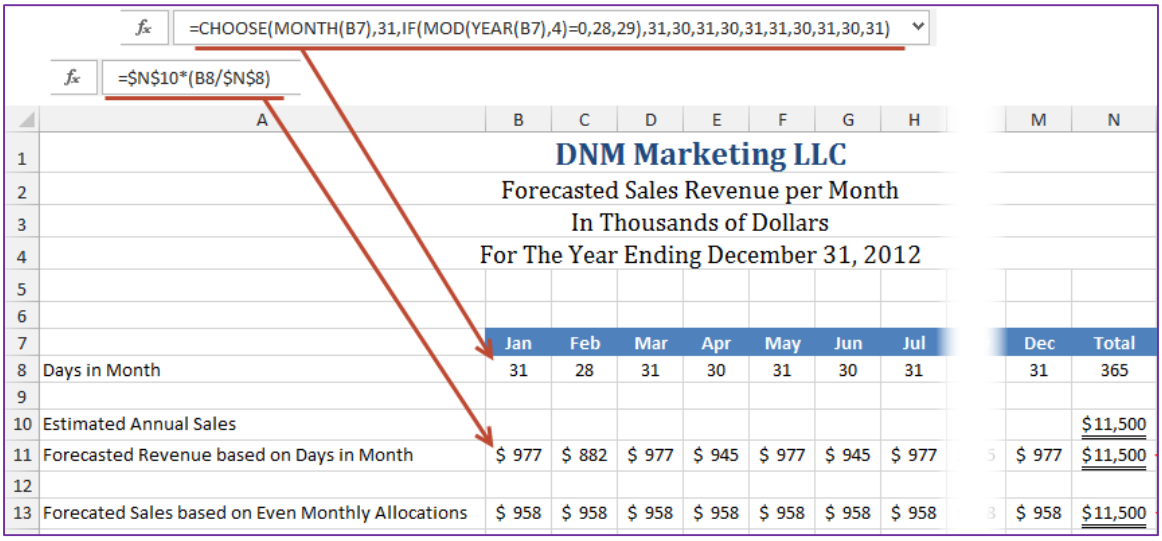


Figure 50 - Allocating Revenues Based on the Number of Days in Each Month

In this example, the CHOOSE function is used in conjunction with the MONTH, YEAR, and MOD functions to specify the number of days in each month. Forecasted annual revenue is then spread across months based on the number of days in each month relative to the number of days in the year.

Does this added precision warrant the additional calculational complexity? In this case, the amount of revenue projected for February using the more precise method is less than what would have been estimated by dividing forecasted annual revenues by twelve. This difference may introduce substantial error in the process of determining whether sales targets in February were achieved.

Monitoring Results with the Watch Window

Excel's Watch Window can prove to be a tremendously valuable tool when building budgeted financial statements. The Watch Window allows a user to monitor the results in one or more cells – cells either in the same workbook or in other workbooks – as changes are being made to other cells. Thus, in a budgeting environment, as changes are made to assumptions, a user can immediately see the impact those changes have on net income and ending cash, for instance, without having to navigate to those cells.

To use Watch Window, navigate to the **Formulas** tab of the Ribbon and click **Watch Window** to open the Watch Window. In the Watch Window, click **Add Watch…** to open the **Add Watch** dialog box. In the Add Watch dialog box, indicate the cell(s) you wish to monitor in the Watch Window and select **Add** as shown in **Figure 51**.

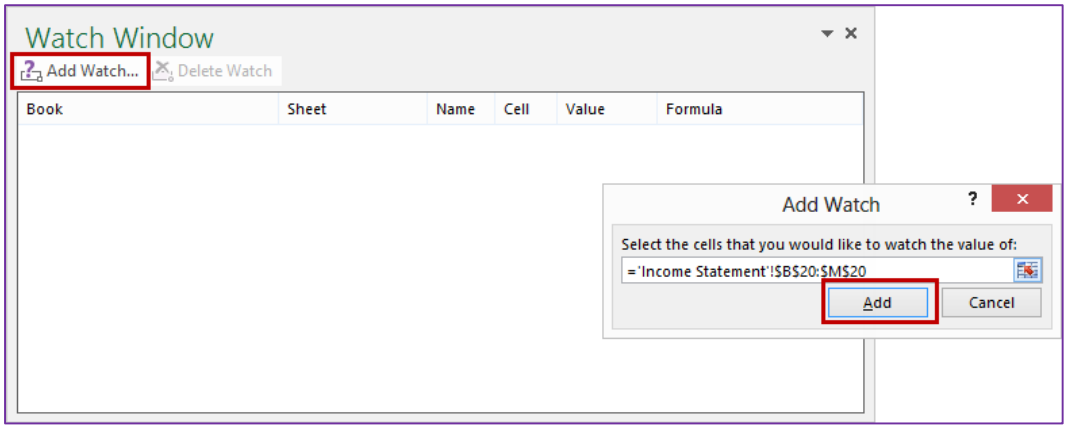
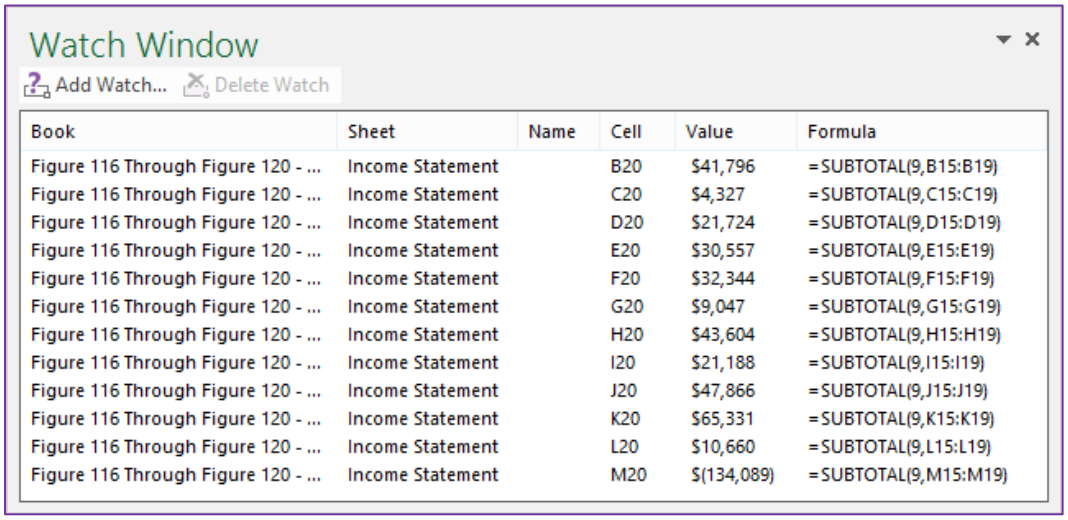


Figure 51 - Setting Up a Watch Window

Upon clicking **Add** the cells to the Watch Window, it appears as shown in **Figure 52**.



Book	Sheet	Name	Cell	Value	Formula
Figure 116 Through Figure 120 - ...	Income Statement		B20	$41,796	=SUBTOTAL(9,B15:B19)
Figure 116 Through Figure 120 - ...	Income Statement		C20	$4,327	=SUBTOTAL(9,C15:C19)
Figure 116 Through Figure 120 - ...	Income Statement		D20	$21,724	=SUBTOTAL(9,D15:D19)
Figure 116 Through Figure 120 - ...	Income Statement		E20	$30,557	=SUBTOTAL(9,E15:E19)
Figure 116 Through Figure 120 - ...	Income Statement		F20	$32,344	=SUBTOTAL(9,F15:F19)
Figure 116 Through Figure 120 - ...	Income Statement		G20	$9,047	=SUBTOTAL(9,G15:G19)
Figure 116 Through Figure 120 - ...	Income Statement		H20	$43,604	=SUBTOTAL(9,H15:H19)
Figure 116 Through Figure 120 - ...	Income Statement		I20	$21,188	=SUBTOTAL(9,I15:I19)
Figure 116 Through Figure 120 - ...	Income Statement		J20	$47,866	=SUBTOTAL(9,J15:J19)
Figure 116 Through Figure 120 - ...	Income Statement		K20	$65,331	=SUBTOTAL(9,K15:K19)
Figure 116 Through Figure 120 - ...	Income Statement		L20	$10,660	=SUBTOTAL(9,L15:L19)
Figure 116 Through Figure 120 - ...	Income Statement		M20	$(134,089)	=SUBTOTAL(9,M15:M19)

Figure 52 - A Watch Window in Excel

Of note, you can "dock" the Watch Window by clicking and dragging it above, to the left of, to the right of, or below the worksheet window. In the example shown, a user docked the Watch Window to the left of the worksheet window so that she could monitor the impact of changing budget assumptions on budgeted net income for the upcoming twelve months.

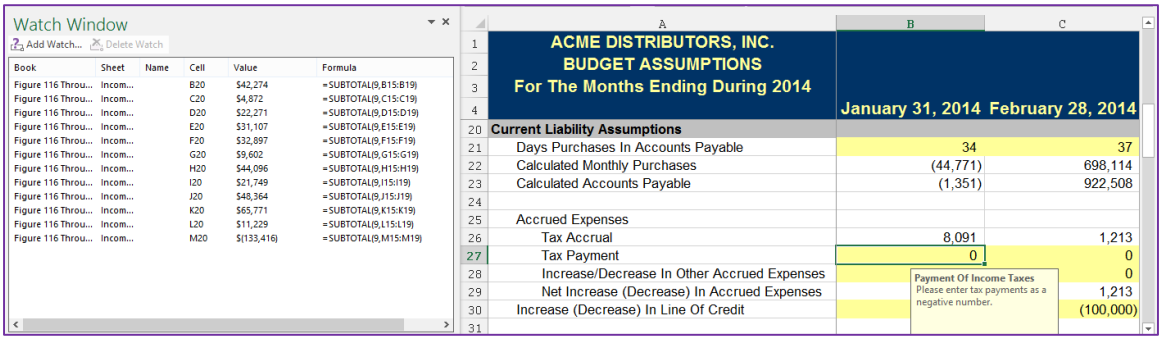


Figure 53 - Docking the Watch Window for Easy Visibility of Key Budget Results

Performing Lookups with VLOOKUP

The **VLOOKUP** and **HLOOKUP** functions provide users with the ability to locate information in Excel lists and to return corresponding values from that list. These two functions operate identically with the exception of the orientation of the referenced list. The VLOOKUP function works with lists arranged vertically, while the HLOOKUP function works with lists arranged horizontally. Because most accounting professionals arrange data in vertical rather than horizontal lists, the VLOOKUP function is used more often than the HLOOKUP function; therefore, VLOOKUP is demonstrated in this section.

One way to use VLOOKUP in creating projected financial statements is to assist in identifying remaining balances on notes payable (or receivable). For instance, assume an amortization schedule for a note payable has been created and is included as a worksheet in a budgeting workbook. Further, assume that the data list containing monthly payment, principal, interest, and remaining balance information has a defined range name of "amortization." As shown below, a VLOOKUP function can locate a value from a particular cell and return a corresponding value from the data list.

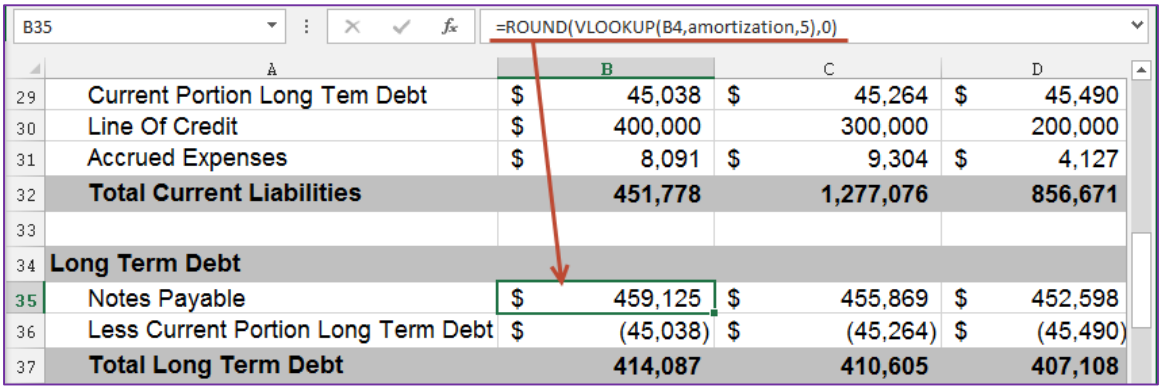


Figure 54 - Using a VLOOKUP Formula on a Budgeted Balance Sheet

The general format of the VLOOKUP function follows.

VLOOKUP(lookup_value, table_array, column_index_num, range_lookup)

In the preceding example, the *lookup_value* is cell "B4," which is a date. The *table_array* is the range name "amortization" the *column_index_num* is "5," which in effect commands VLOOKUP to return the value

from the fifth column of the *table_array*. The *range_lookup* is optional; if TRUE or omitted, it means Excel searches for an approximate match, and, if FALSE, it means Excel searches for an exact match. With these values in place, the VLOOKUP formula in the preceding example searches in the leftmost column of "amortization" for the date in cell B4 and returns the corresponding value from the fifth column of the range.

Another way to use VLOOKUP in generating pro forma financial statements would be to assist in tax calculations. For example, as shown in **Figure 55**, multiple VLOOKUP functions can be used to calculate income tax due from the table of tax rates displayed. Closer inspection of the formula reveals that multiple lookups are required to accommodate the graduated structure of the tax rates.

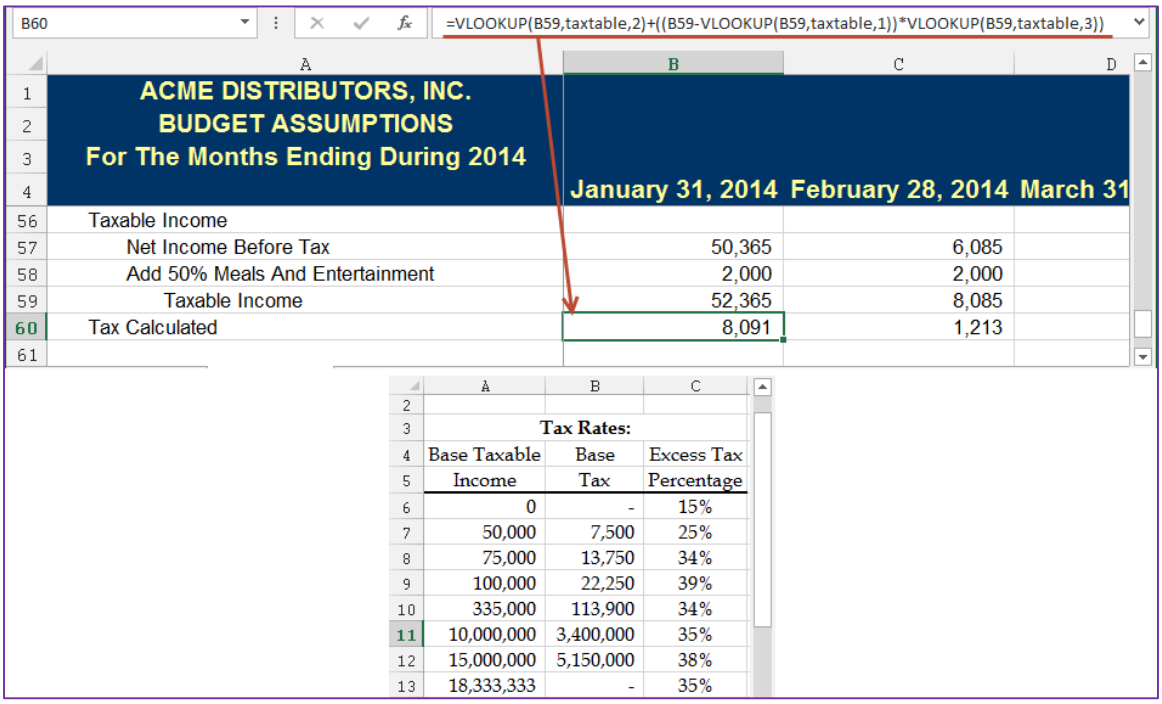


Figure 55 - Using VLOOKUP to Assist in Tax Calculations

Linking Workbooks

When creating budgeted financial statements, it is often necessary to link data from one workbook to another. Most users accomplish this by making formula references to traditional row-and-column addresses, such as the one that follows.

='[Pro Forma Financial Statements.xlsx]Assumptions'!$B$57

This method works fine until the location of the "source" data changes while the "destination" workbook is closed. If that happens, the path in the link to the data no longer works. To solve this problem, use **defined names** to link data from one workbook to another.

What is a defined name? Quite simply, a defined name is nothing more than a nickname or alias for a cell or range of cells. Say, for instance, cell B6 contains total budgeted revenue data for a company on its income statement. We could continue to refer to that cell based on its traditional row-and-column address of "B6," or we could decide to give it a defined name – a nickname – of "Revenue" (or almost any other name we desired). Once we assign a defined name to a cell or range of cells, we can use the defined name virtually any place where we would otherwise use a traditional row-and-column address, including as a reference in multi-workbook environments.

There are a few rules to remember when creating a defined name. Though not intended to be a complete listing, the following bullet points summarize the major rules related to creating defined names.

- Defined names can contain letters and numbers but not spaces or special characters such as punctuation marks.
- Defined names cannot begin with a number.
- Defined names must be 255 characters or less in length.
- Defined names cannot be a combination of letters and numbers that could otherwise be a row-and-column address. Thus, "A100" cannot be a defined name because that is a valid row-and-column address in Excel.

Creating Defined Names

You can create defined names using a number of methods. The simplest and easiest way to do so is to select a cell or cells, click in the **Name Box**, and enter the defined name directly in the Name Box as shown in **Figure 56**.

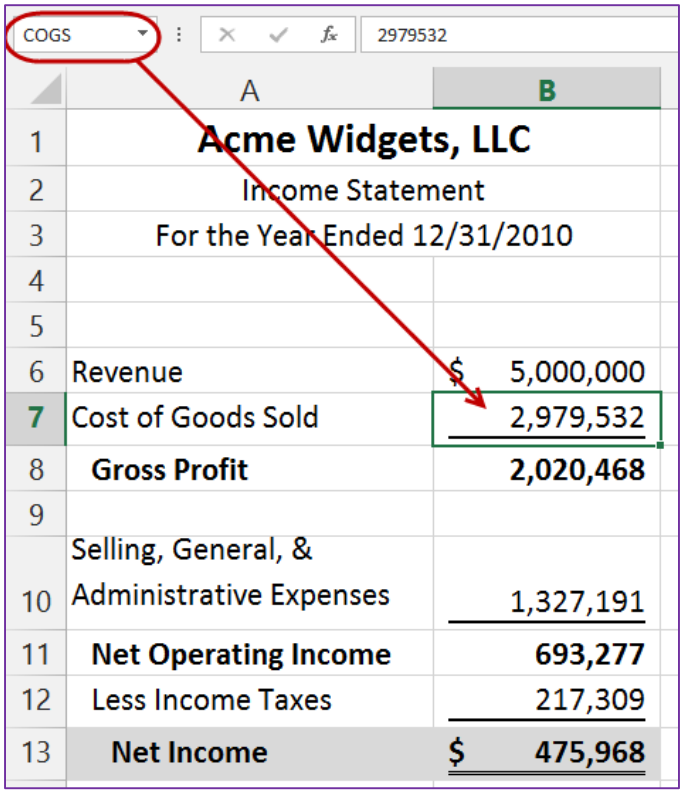


Figure 56 - Creating a Defined Name in Excel's Name Box

Additionally, you can create a defined name by selecting **Define Name** from the **Defined Names** group on the **Formulas** tab of the **Ribbon** to open the **New Name** dialog box. Enter the **Name** and **cell address** to which the name refers as shown in **Figure 57**. You can also access the New Name dialog box by selecting **New** from the **Name Manager** in the **Defined Names** group of the **Formulas** tab of the **Ribbon**.

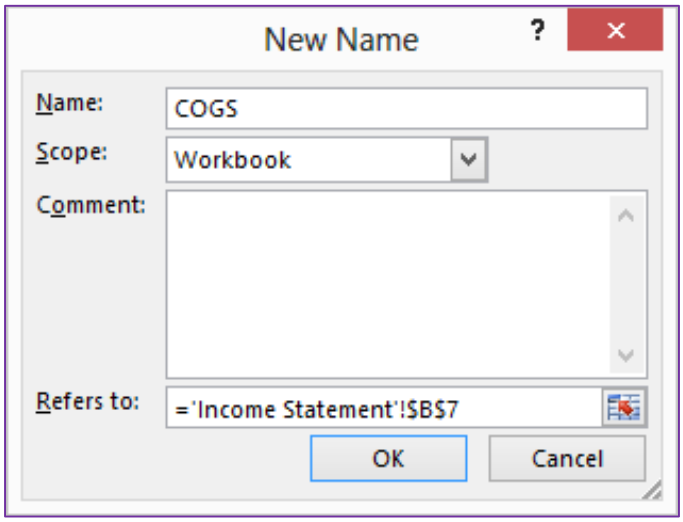


Figure 57 - Creating a Defined Name in Excel's New Name Dialog Box

Excel can also create defined names from labels in adjoining columns or rows. To use this method, select the appropriate range of data, including the rows or columns containing the labels, and select **Create from Selection** in the **Defined Names** group of the **Formulas** tab of the **Ribbon**. This method provides a very fast way of creating multiple defined names simultaneously.

As stated previously, once we create a defined name, we can use it anywhere we would otherwise use a traditional row-and-column address. Thus, returning the formula shown previously in this section, if we had assigned the defined name "Expenses" to cell B57, we could use that name to link that data to another workbook as shown below.

='[Pro Forma Financial Statements.xlsx]Expenses

However, if we construct the links between workbooks based on defined names instead of row-and-column addresses, then the integrity of the data remains intact, even if the location of the data changes within the source workbook. This is because a defined name "follows" a cell; thus, if the location of the cell changes, the reference to that cell within the defined name changes also.

Accommodating Formulas with Circular References

Though it is usually preferable to avoid circular references, they will appear occasionally in preparing pro forma financial statements. One common example is in tax accrual calculations, where federal income tax is deductible on state tax returns. Here, since federal tax is deductible on the state return, and state tax is deductible on the federal return, a circular reference exists by the very nature of the calculation. Another example is in attempting to calculate the amount of cash at the end of the month. This, in part, depends on interest income. Interest income depends on how much cash is available to invest. Again, a circular reference exists by the very nature of the relationships between the variables.

Formula Auditing functions are often used in Excel to prevent circular referencing formulas from occurring. However, it is not always necessary to eliminate these references if users understand why they have appeared, what impact they have on the pro forma statements, and how to ensure that the presence of these formulas is not affecting the accuracy of the statements. Perhaps the most common way of accommodating formulas with circular references is to change the number of iterations calculated by Excel.

By accessing Excel's **Options** and choosing the **Formulas** tab, users can check the box labeled **Enable iterative calculation** as shown in **Figure 58**. This will cause Excel to calculate worksheets containing circular reference formulas up to the number of times specified in the **Maximum iterations** field, or until the value change in the **Maximum change** field is reached. Though 100 iterations is the default maximum number of iterations and 0.001 is the default maximum change value, usually Excel reaches sufficiently accurate results in as few as three iterations.

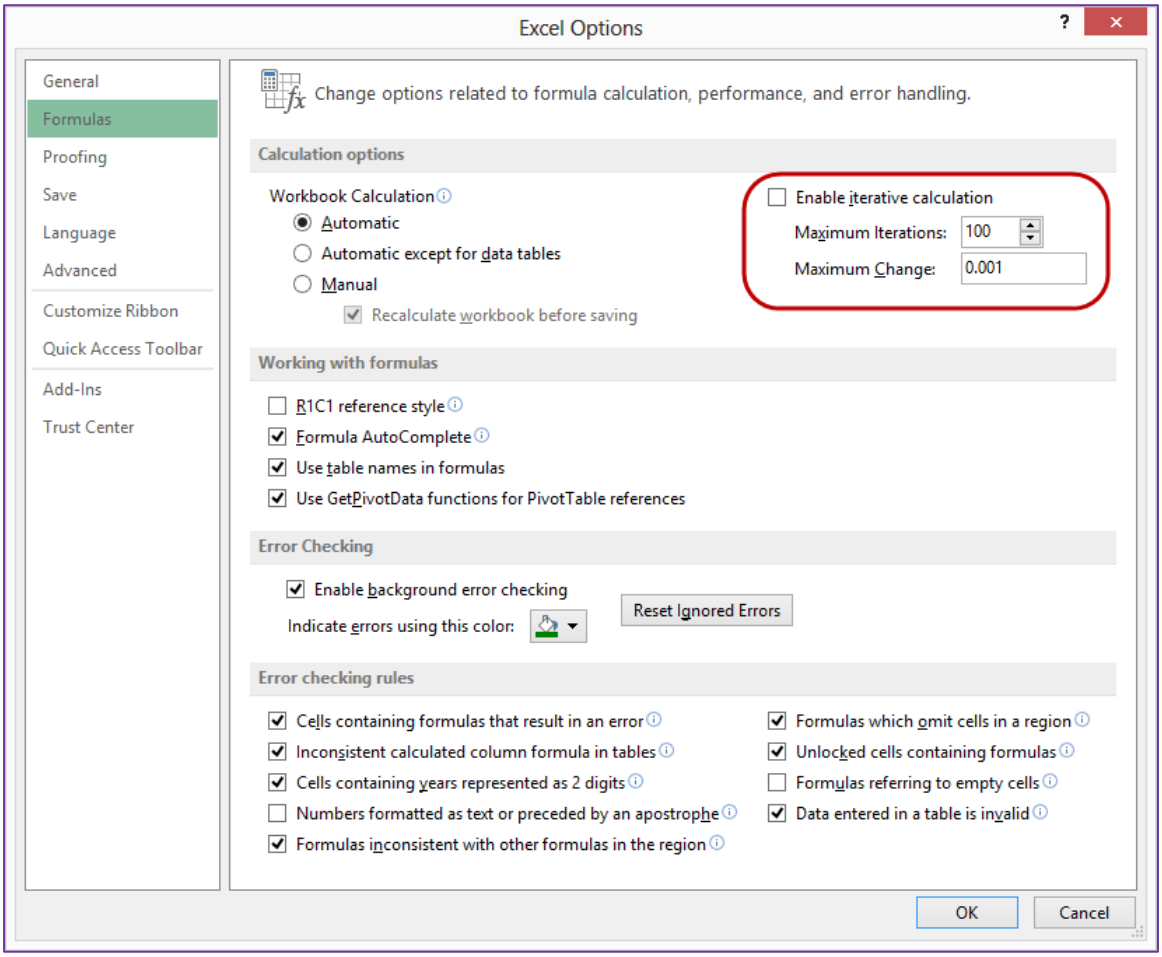


Figure 58 - Enabling Iterative Calculations for Circular References Formulas

Budget Reporting Issues and Solutions

Among the biggest issues facing those who use Excel in budgeting and forecasting applications are 1) how to consolidate data from multiple divisions, profit centers, locations, entities, etc. into a consolidated budget, 2) how to draw readers' attention to budget variances that require management action, and 3) how to facilitate flexible budget-to-actual reporting in Excel, complete with drill down capabilities.

Learning Objectives

Upon completing this section, you should be able to:

- Describe how to consolidate budget data using formulas and Excel's Data Consolidate feature;
- Implement conditional formatting as a means of analyzing data, including identifying significant budget variances; and
- Describe how to work with PivotTables as a comprehensive budget reporting solution.

Consolidating Data

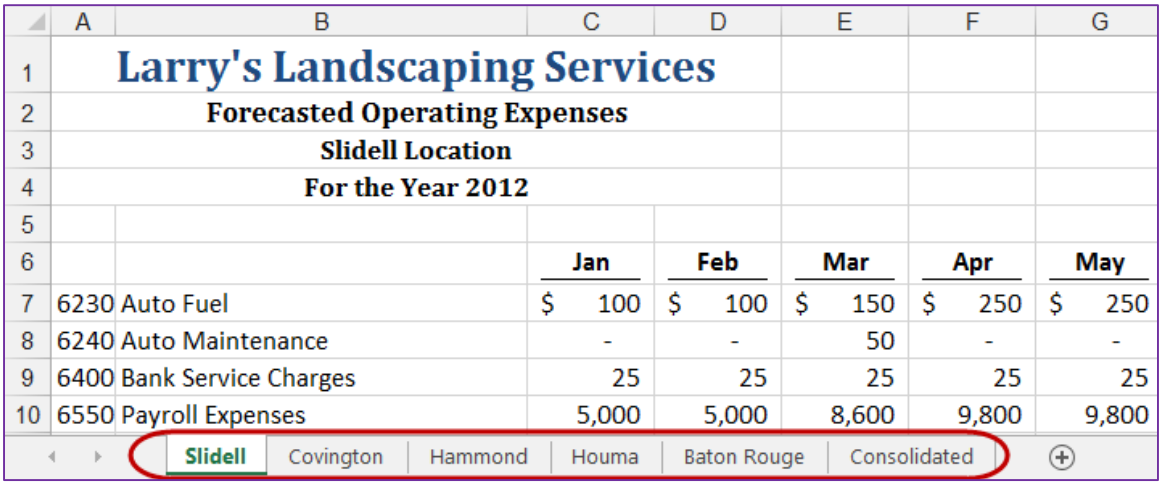
Using Formulas for Data Consolidation

Most accounting professionals routinely face the task of combining or consolidating financial data from several worksheets. The task may require consolidating the results of multiple periods, multiple departments, multiple divisions, or multiple related businesses. In almost every case, practitioners choose to insert a new worksheet to hold the combined or consolidated information and then sum through the existing worksheets to produce consolidated totals.

Generally, a single formula is created and then copied down and across the total worksheet. Extraneous totals, such as where blank lines exist in the layout of the individual data worksheets, are then deleted, and formatting is applied to complete the report. This method is easily understood, can be applied by most moderately experienced users, and is very well suited to those situations where the worksheets being summed have identical layouts – column by column, row by row, and cell by cell. If the worksheets do not have identical layouts, the common workaround is to add rows and/or columns to one or more of the worksheets until the cells align properly.

While some users may create sum-through formulas using a simple arithmetic formulation (**=Sheet1!B15 + Sheet2!B15 + Sheet3!B15**), a more efficient method is to use the SUM function, if the cells are properly aligned. Such a formula would be similar to this one: **=SUM(Sheet1:Sheet3!B15)**.

Let's examine the process of creating and utilizing sum-through formulas that employ the SUM function. Refer to the workbook displayed in **Figure 59** as this process is demonstrated.



	A	B	C	D	E	F	G
1	Larry's Landscaping Services						
2	Forecasted Operating Expenses						
3	Slidell Location						
4	For the Year 2012						
5							
6			Jan	Feb	Mar	Apr	May
7	6230	Auto Fuel	$ 100	$ 100	$ 150	$ 250	$ 250
8	6240	Auto Maintenance	-	-	50	-	-
9	6400	Bank Service Charges	25	25	25	25	25
10	6550	Payroll Expenses	5,000	5,000	8,600	9,800	9,800

Figure 59 - Forecasted Expenses Workbook

The workbook has six worksheets – Slidell, Covington, Hammond, Houma, Baton Rouge, and Consolidated – that contain forecasted expenses for the upcoming year. The Consolidated sheet will contain the total forecasted expenses after we build a sum-through formula and copy it down and across the appropriate worksheet range.

To create the sum-through formula, do the following.

1. Click on the **Consolidated** worksheet tab and put the cursor in the upper left-hand corner of the data range. In this case, place the cursor in cell **C7**.
2. Begin the formula by entering **=SUM(**.
3. Next, click on the sheet tab of the first worksheet in the range, **Slidell**, and then click on cell **C7**.
4. Hold down the **SHIFT** key while clicking on the sheet tab of the last worksheet in the range, **Baton Rouge**, and press **ENTER**.

Excel will have entered the following formula: **=SUM('Slidell:Baton Rouge'!C7)**. Now, copy the formula down and across the appropriate range and then reformat cells, delete rows, and add totals as necessary to complete the worksheet.

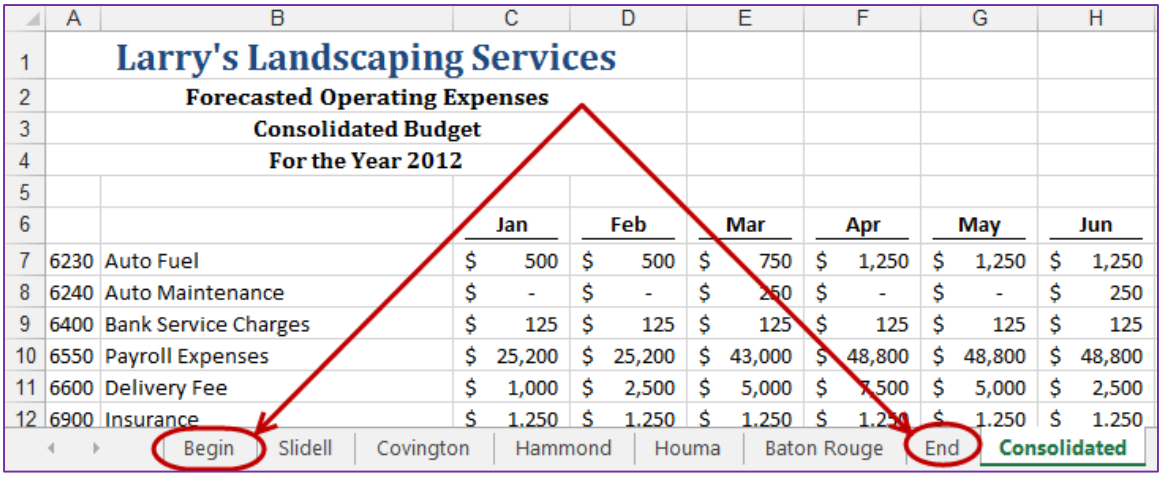
Note the end points of the range of worksheets. In this case, the Slidell and Baton Rouge worksheets act as the end points. The end points of the sum-through formula act in similar fashion to the end points of any other SUM formula. If you add another worksheet for another store location *between* the end points, the forecasted amounts for the new location will be included in the consolidated totals automatically. If you add the new worksheet *outside* of the end points, the consolidated totals will not include the amounts. Note that a user can drag a worksheet outside the end points to remove its amounts from the consolidated totals or drag a worksheet within the end points to include its amounts in the totals. This is a very powerful feature, but it can also cause problems for users unaware of this functionality.

For example, when printing multiple worksheets at the same time, the sheets always print from left to right, regardless of the order in which the sheets were selected. In our example worksheet, let's suppose that a user wanted to print the Slidell, Baton Rouge, Hammond, and Consolidated worksheets in that order.

Seemingly, the way to accomplish that task is to drag the Baton Rouge sheet tab to the left of the Hammond sheet tab.

However, in doing so, the amounts in the Hammond worksheet would no longer be included in the totals on the Consolidated worksheet because the Hammond worksheet is no longer between the end points identified in the formula. Even experienced Excel users inadvertently fall into this subtle trap when dragging sheets to reorder them for printing. In larger workbooks with many sheets, this can be a very pernicious problem because users may not recognize the impact on totals immediately.

A simple solution to this problem is to create dummy worksheets that have no purpose other than to function as *end points for the sum-through formulas*. In other words, create two new sheets, one named **Begin** and the other **End,** that serve as the end points for the sum-through formulas as shown in **Figure 60**.



	A	B	C	D	E	F	G	H
1		**Larry's Landscaping Services**						
2		**Forecasted Operating Expenses**						
3		**Consolidated Budget**						
4		**For the Year 2012**						
5								
6			**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
7	6230	Auto Fuel	$ 500	$ 500	$ 750	$ 1,250	$ 1,250	$ 1,250
8	6240	Auto Maintenance	$ -	$ -	$ 250	$ -	$ -	$ 250
9	6400	Bank Service Charges	$ 125	$ 125	$ 125	$ 125	$ 125	$ 125
10	6550	Payroll Expenses	$ 25,200	$ 25,200	$ 43,000	$ 48,800	$ 48,800	$ 48,800
11	6600	Delivery Fee	$ 1,000	$ 2,500	$ 5,000	$ 7,500	$ 5,000	$ 2,500
12	6900	Insurance	$ 1,250	$ 1,250	$ 1,250	$ 1,250	$ 1,250	$ 1,250

Figure 60 - Using Dummy Worksheets as End Points for Sum-Through Formulas

ⓘ Using dummy sheets as end points can be very useful in situations where users want to report rolling twelve-monthly or quarterly results. The report column where the rolling totals are reported would use sum-through formulas employing dummy end-point sheets. As the financial results from a new month are copied into the workbook, the new sheet is moved between the end points, and the oldest sheet is moved outside the endpoints, thereby easily rolling up the previous twelve months' results without creating a new formula.

Working with Excel's Data Consolidate Function

The Consolidate command provides an effective way of consolidating financial information, whether imported or created in Excel. Using this functionality, we get results similar to sum-through formulas but without building or troubleshooting any formulas. In short, Consolidate allows us to summarize our data quickly and accurately. Data can be consolidated from within the same worksheet, from other worksheets in the same workbook, or from other workbooks. Links to source data can be incorporated to update the totals automatically whenever the source data changes. Once the consolidation has been completed, it can be edited and consolidation ranges added or deleted. If the data ranges are identical, the data can be consolidated *by position*. If the ranges are not identical, Excel can rely on the column headings and/or row labels as cues for determining what cells to sum through. This is termed consolidation *by category*.

To begin the consolidation process, create a worksheet on which to place the consolidated data. If the worksheets containing the data have identical layouts, consolidate *by position*, which requires users to copy the column headings and row labels to the consolidated worksheet as shown in **Figure 61**.

Figure 61 - Copying the Column Headings and Row Labels to the Consolidated Sheet

To consolidate the income statements, do the following.

1. Position the cursor in the upper left-hand corner of the consolidation range. In this case, position the cursor in cell B9.
2. From the **Data** tab, select **Consolidate** to open the dialog box shown in **Figure 62**.
3. Select **SUM** in the **Function** drop-down menu. While SUM will be the function used most often, there are other functions such as AVERAGE, MINIMUM, MAXIMUM, and STANDARD DEVIATION available.

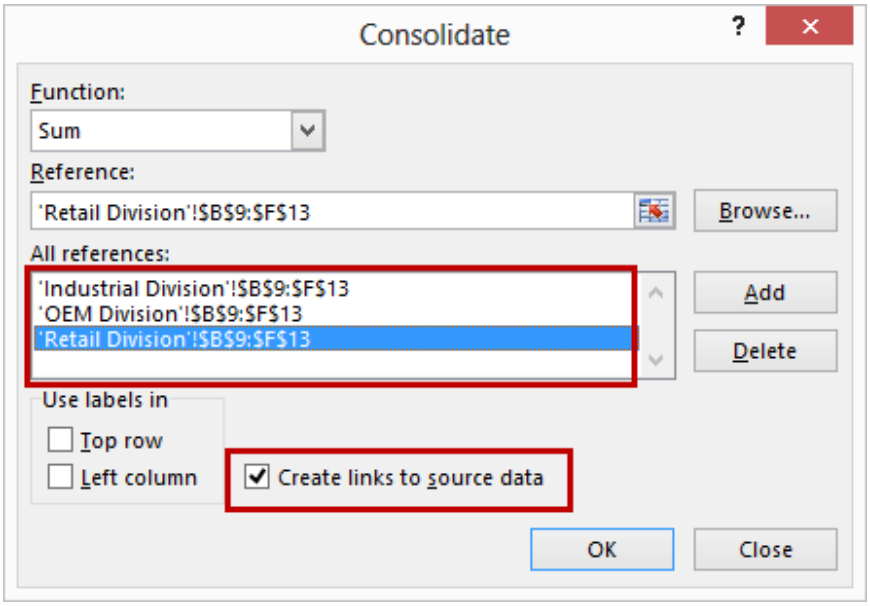


Figure 62 - Using the Data Consolidate Command to Combine Data

4. From the **Reference** box, highlight and add each data range, one after the other, to the **All References** box. Highlight the first range on the Retail Division worksheet and click **Add**, followed by the data ranges on the Industrial and OEM Division worksheets.
5. Since we are combining by position, there is no need to check any of the **Use labels in** boxes. Check **Create links to source data** so that any changes to the data will flow through to the consolidated worksheet.
6. Click **OK** to produce the results displayed in **Figure 63**.

Note that Outlining is enabled so that the detail of any consolidated row can be expanded by clicking the plus sign (+) in the outline symbols on the left. In this case, Cost of Sales is expanded to show the detail from the three data worksheets. Try that with a sum-through formula!

	A	B	C	D	E	F
1	GTM Manufacturing Inc					
2	Retail Sales Division					
3	Summarized Comparative Income Statement					
4	Stated in Millions of US Dollars					
5	For the Year Ended 12/31/2012					
6						
7						
8		1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total
12	Revenue	$ 1,050.00	$ 1,207.50	$ 1,386.00	$ 1,596.00	$ 5,239.50
13		137.50	145.75	154.00	162.25	599.50
14		262.50	278.25	294.00	309.75	1,144.50
15		125.00	132.50	140.00	147.50	545.00
16	Cost of Sales	525.00	556.50	588.00	619.50	2,289.00
20	Gross Margin	525.00	651.00	798.00	976.50	2,950.50
24	SG&A	105.00	136.50	168.00	199.50	609.00
28	Net Income	$ 420.00	$ 514.50	$ 630.00	$ 777.00	$ 2,341.50

Figure 63 - Consolidation Results with Outlining Enabled

Let's review the process. We created a worksheet on which to consolidate the results of three divisions. With the cursor in the upper left-hand corner of the consolidation range, we executed the Consolidate command, highlighted and added the three data ranges to the Consolidate dialog box, and clicked OK. It's easy to see why most users think that this is a superior method when compared to sum-through formulas. The consolidation was performed without building or copying any formulas, the consolidations are computationally accurate, and users can drill down from the results to see the underlying data.

In our previous example, the data ranges were identical, so we could consolidate based solely on the relative position of the data elements within the data ranges. If the data ranges are not identical, that doesn't preclude us from using the Consolidate command. In those circumstances, we must consolidate *by category*, whereby Excel reads the row and/or column labels to determine what data cells should be summed.

For example, if we were combining expense budgets, and one of several departments had extra accounts, we would consolidate by category. Similarly, we would consolidate by category if the order in which the data columns were reported was different. To consolidate by category, simply check **Top row** and/or **Left column** in the **Use labels in** area of the **Consolidate** dialog box as shown in **Figure 64**.

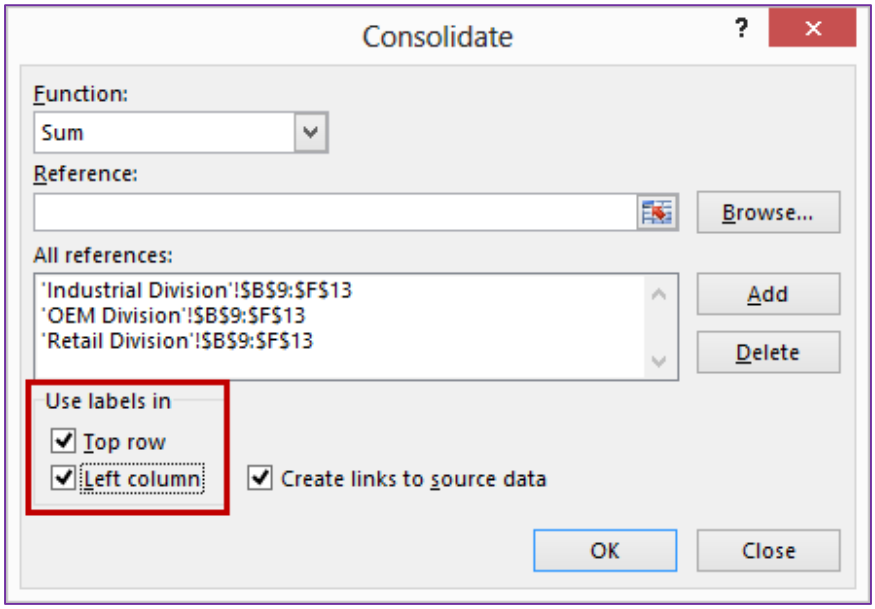


Figure 64 - Checking the Appropriate Boxes to Consolidate by Category

ⓘ Note that users can check the **Use labels in** boxes to automatically create the column headings and row labels when performing a consolidation *by position*. However, if the data to be consolidated consists of formal financial statements that include blank rows or columns for laying out the report properly, all blank rows and blank columns will be treated as a single data element in the final report. In other words, all blank rows will be combined into a single blank row, and all blank columns will be combined into a single blank column.

The report layout of the resulting consolidation will look different because all of the blank rows and columns will be removed. When working with formal reports for which you desire to maintain the original layout, copy the column headings and row labels to the consolidated sheet as we did in our example and then consolidate *by position* without checking the **Use labels in** boxes. For this to work properly, the individual reports must be identical, or rows and/or columns in individual reports must be rearranged until the cells align properly.

Using Conditional Formatting to Identify Trends and Significant Variances

Excel's **Conditional Formatting** options can be excellent ways to call attention to significant values, variances, trends, and other data in budget-centric reports. Though conditional formatting is not a new feature to Excel, this feature is greatly enhanced in versions after 2003.

Conditional Formatting Basics

Conditional Formatting Based on Values

The simplest form of conditional formatting is that based on values. For instance, conditional formatting based on values has been applied in the **Variance $** column shown in **Figure 65**. There, any cell containing an unfavorable variance greater than $15,000 is automatically shaded and the text displayed in red.

	A	B	C	D
1	**K2 Electrical Supplies, Inc.**			
2	Statement of Operating Expenses			
3	*For the Year Ended December 31, 2011*			
4				
5		**Budget**	**Actual**	**Variance $**
6	Advertising	$ 16,000	$ 17,500	$ (1,500)
7	Amortization	2,500	2,500	-
8	Depreciation	47,000	52,500	(5,500)
9	Employee Benefits	350,000	356,200	(6,200)
10	Insurance	417,000	409,000	8,000
11	Meals and Entertainment	49,000	62,000	(13,000)
12	Office Supplies and Expenses	65,000	81,600	(16,600)
13	Payroll Taxes	231,000	229,000	2,000
14	Property Taxes	12,500	13,500	(1,000)
15	Rent	360,000	360,000	-
16	Travel	96,500	110,000	(13,500)
17	Utilities	187,000	226,000	(39,000)
18	Wages and Salaries	2,100,000	2,250,000	(150,000)
19	**Total Operating Expenses**	**$ 3,933,500**	**$ 4,169,800**	**$ (236,300)**

Figure 65 - Conditional Formatting Based on Values

To apply this conditional format, start by selecting the range of cells from D5 through D18. Then, select **Conditional Formatting** from the **Home** tab of the Ribbon and choose **Highlight Cells Rules** followed by **Less Than** to open the dialog box shown in **Figure 66**. In that dialog box, specify both the criteria for the conditional format and the desired format. Click **OK** to apply the conditional format to all selected cells.

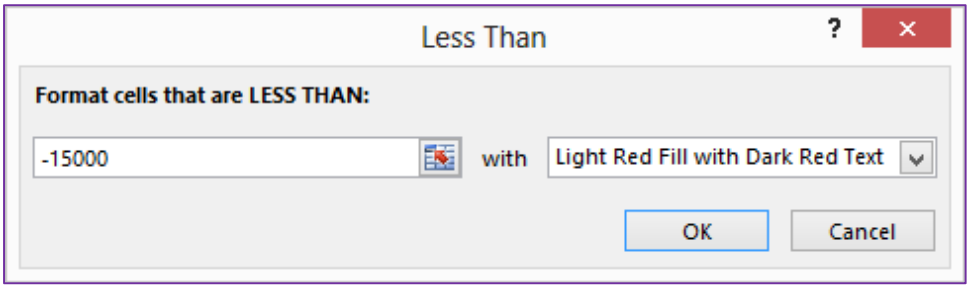


Figure 66 - Defining a Conditional Format Rule

Note that cell references can replace "hard-coded" criteria when creating conditional formats. For instance, in Figure 66, the criteria of "-15000" could be replaced by a cell reference of "G3," thereby allowing a user to rapidly change the materiality threshold of the report interactively. Such a change would produce the results shown in **Figure 67**.

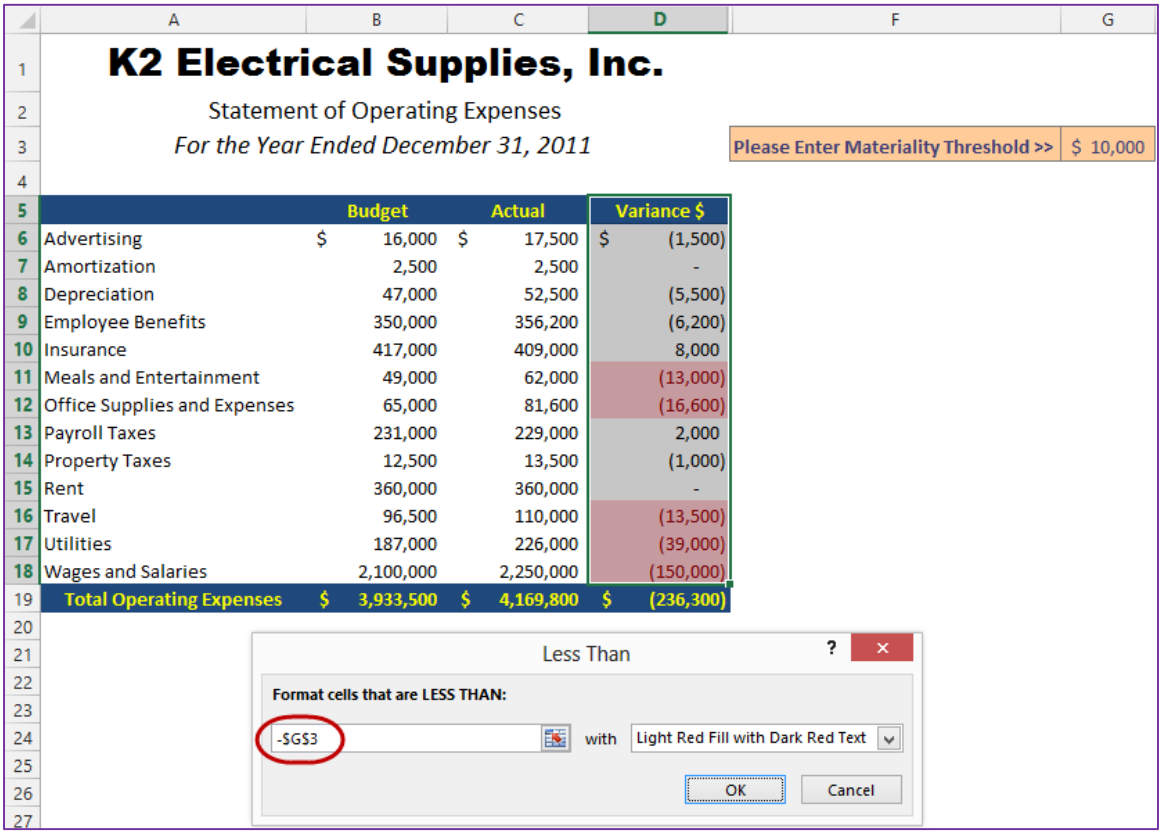


Figure 67 - Conditional Formatting Applied with a Cell Reference

Conditional Formatting Based on Formulas

In addition to applying conditional formatting based on discrete value inputs, conditional formatting can also be applied based on formulas. For instance, formula-based conditional formatting could identify all

unfavorable variances exceeding 15% of the budgeted amount. Such a formula might resemble that shown in **Figure 68**.

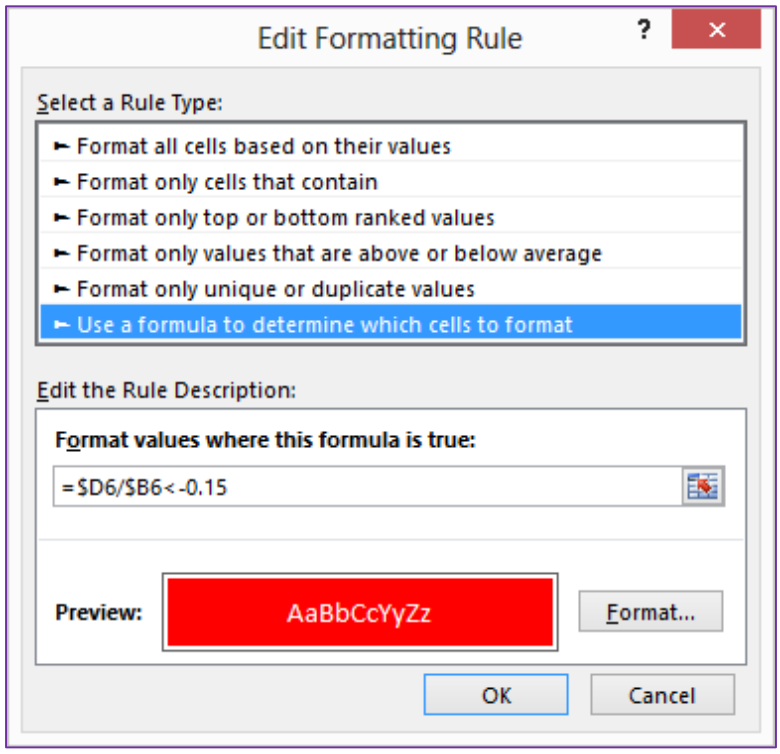
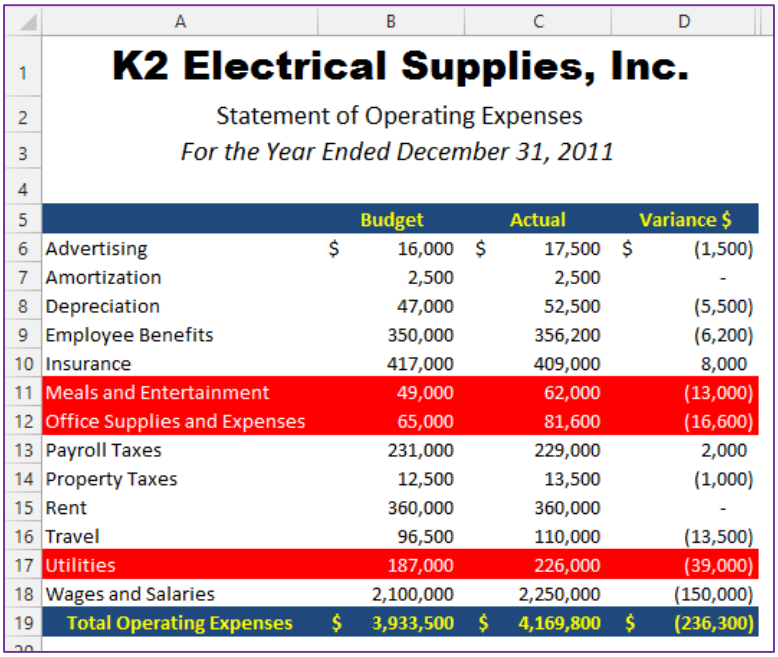


Figure 68 - Conditional Format Applied with a Formula

The formula and format specified in Figure 68 will format any unfavorable variance exceeding 15% of the budgeted amount with a red background and white text as shown in **Figure 69**.



K2 Electrical Supplies, Inc.

Statement of Operating Expenses

For the Year Ended December 31, 2011

	Budget	Actual	Variance $
Advertising	$ 16,000	$ 17,500	$ (1,500)
Amortization	2,500	2,500	-
Depreciation	47,000	52,500	(5,500)
Employee Benefits	350,000	356,200	(6,200)
Insurance	417,000	409,000	8,000
Meals and Entertainment	49,000	62,000	(13,000)
Office Supplies and Expenses	65,000	81,600	(16,600)
Payroll Taxes	231,000	229,000	2,000
Property Taxes	12,500	13,500	(1,000)
Rent	360,000	360,000	-
Travel	96,500	110,000	(13,500)
Utilities	187,000	226,000	(39,000)
Wages and Salaries	2,100,000	2,250,000	(150,000)
Total Operating Expenses	**$ 3,933,500**	**$ 4,169,800**	**$ (236,300)**

Figure 69 - Results of a Conditional Format Applied Via Formula

Because Excel allows report designers to apply multiple conditional formatting rules to the same cells, it is possible to "layer" these rules on top of each other. Perhaps in addition to highlighting unfavorable variances of greater than 15% in red, management wants to highlight favorable variances of greater than 5% in blue. To do so, add a second conditional format rule as shown in **Figure 70**.

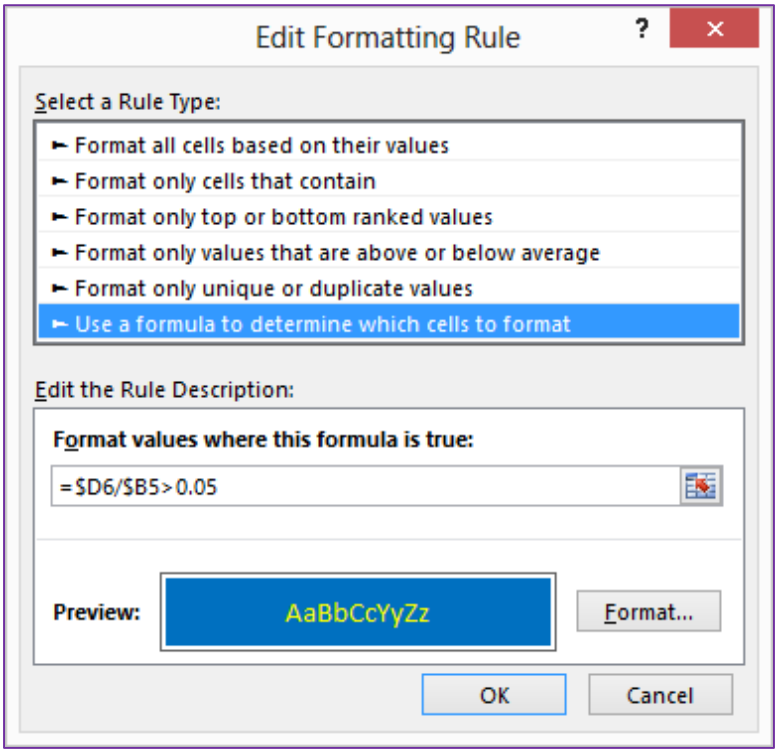


Figure 70 - Adding a Second Conditional Format

With the second conditional format in place, the worksheet might now resemble that shown in **Figure 71**.

	A	B	C	D
1	**K2 Electrical Supplies, Inc.**			
2	Statement of Operating Expenses			
3	*For the Year Ended December 31, 2011*			
4				
5		Budget	Actual	Variance $
6	Advertising	$ 16,000	$ 17,500	$ (1,500)
7	Amortization	2,500	2,500	-
8	Depreciation	47,000	52,500	(5,500)
9	Employee Benefits	350,000	356,200	(6,200)
10	Insurance	417,000	399,000	18,000
11	Meals and Entertainment	49,000	62,000	(13,000)
12	Office Supplies and Expenses	65,000	81,600	(16,600)
13	Payroll Taxes	231,000	229,000	2,000
14	Property Taxes	12,500	13,500	(1,000)
15	Rent	360,000	360,000	-
16	Travel	96,500	110,000	(13,500)
17	Utilities	187,000	226,000	(39,000)
18	Wages and Salaries	2,100,000	2,250,000	(150,000)
19	**Total Operating Expenses**	**$ 3,933,500**	**$ 4,159,800**	**$ (226,300)**

Figure 71 - Multiple Conditional Formats Applied to Same Cells

PivotTables in Budgeting Environments

PivotTables are the most powerful feature of Excel, yet many accountants do not use them in their day-to-day activities. While a complete discussion of PivotTables is beyond the scope of this course, we would be remiss if we did not discuss some of the capabilities of PivotTables in budgeting environments. However, before we can do so, we should cover some PivotTable fundamentals.

What is a PivotTable?

A PivotTable report is an interactive table that automatically extracts, organizes, and summarizes data. A PivotTable report can be used to analyze data — for example, to make comparisons, to detect patterns and relationships, or to uncover trends. PivotTables are extremely useful for summarizing and analyzing large amounts of data efficiently and effectively, including data found in budgeting and forecasting activities. Additionally, PivotTables can consolidate data from multiple data sources, easing some of the consolidation pains discussed previously.

Basic PivotTables

The power of PivotTables surfaces even while working with basic PivotTables. In our first example, consider the budget data presented in **Figure 72**.

	A	B	C
1	**Parent Account**	**Sub Account**	**Annual Budget**
2	Construction Income	Design Income	4,020,000
3	Construction Income	Equipment Rental Income	567,500
4	Construction Income	Labor Income	1,298,700
5	Construction Income	Materials Income	5,100,000
6	Construction Income	Subcontracted Labor Income	3,567,000
7	Construction Income	Less Discounts given	(285,000)
8	Reimbursement Income	Mileage Income	37,500
9	Reimbursement Income	Permit Reimbursement Income	72,000
10	Job Expenses	Bond Expense	70,000
11	Job Expenses	Equipment Rental	400,000
12	Job Expenses	Job Materials	3,750,000
13	Job Expenses	Permits and Licenses	72,000
14	Job Expenses	Subcontractors	2,560,000
15	Job Expenses	Less Discounts Taken	(15,600)

Figure 72 - Sample Budget Data

You have been tasked with the responsibility of summarizing the data shown in a report that groups the budget data by Parent Account; this is an ideal application for a PivotTable. To build a simple PivotTable from the columnar data shown, follow the steps outlined below.

1. Click on any cell in the data range.

2. From the **Insert** tab of the Ribbon, click **PivotTable** to open the **Create PivotTable** dialog box pictured in **Figure 73**.

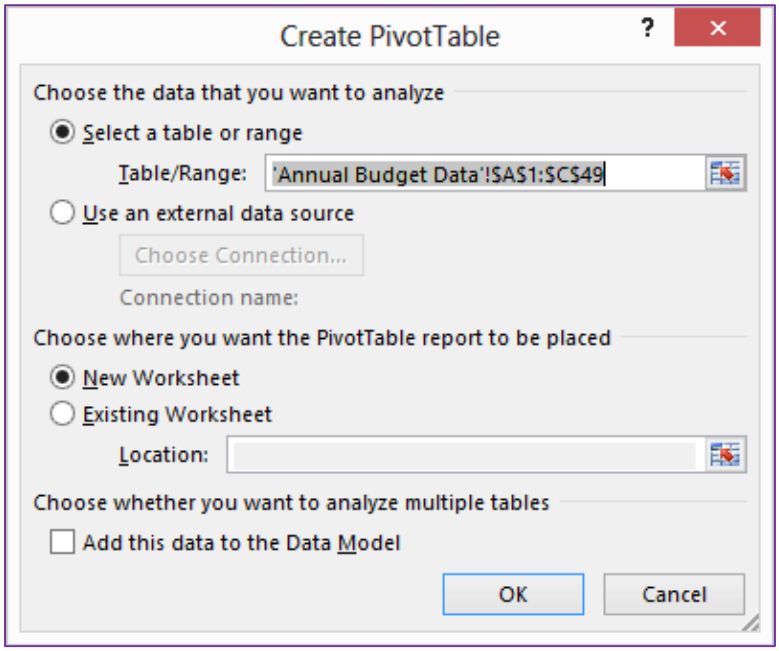


Figure 73 - Create PivotTable Dialog Box

3. Accept the defaults in the Create PivotTable dialog box and click **OK**. Upon doing so, Excel inserts an outline of the PivotTable on a new worksheet and opens the **PivotTable Fields list** as shown in **Figure 74**.

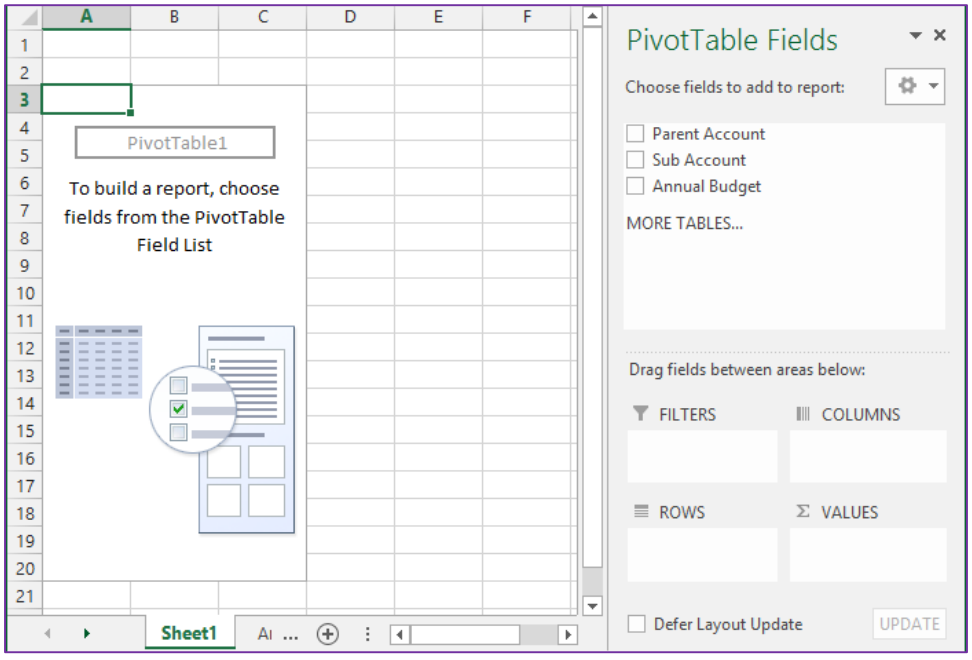


Figure 74 - Creating a PivotTable in a New Worksheet

4. In the PivotTable Field list, click-and-drag each field to the appropriate quadrant in the lower, right-hand corner of the PivotTable Field list as shown in **Figure 75.** Notice that as each field is placed into a quadrant, the PivotTable updates automatically with the data from that field.

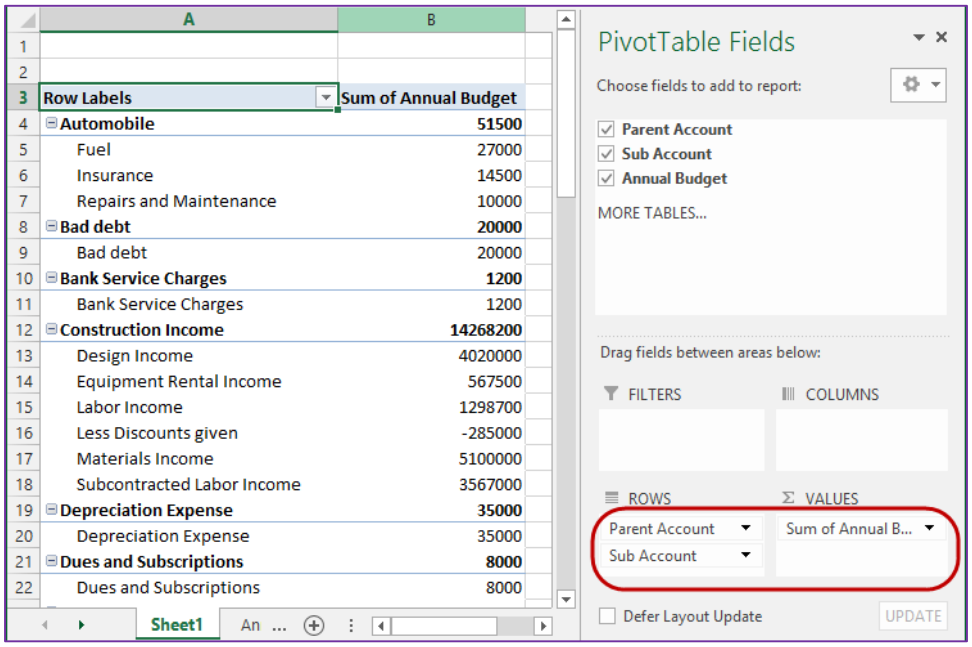


Figure 75 - Dragging Fields in the PivotTable Field List

5. By default, the PivotTable groups and sums each of the accounts based on the Parent Account. Notice, however, that each sum is placed at the top of each group; for most accounting professionals, this is an unacceptable format. To change the location of the subtotals so that they appear at the bottom of each grouping, click the **PivotTable Tools Design** contextual tab followed by **Subtotals**. Next, select **Show Subtotals at the Bottom of the Group** as shown in **Figure 76**. Upon doing so, the location of the subtotals changes to match the preferences of most accounting professionals.

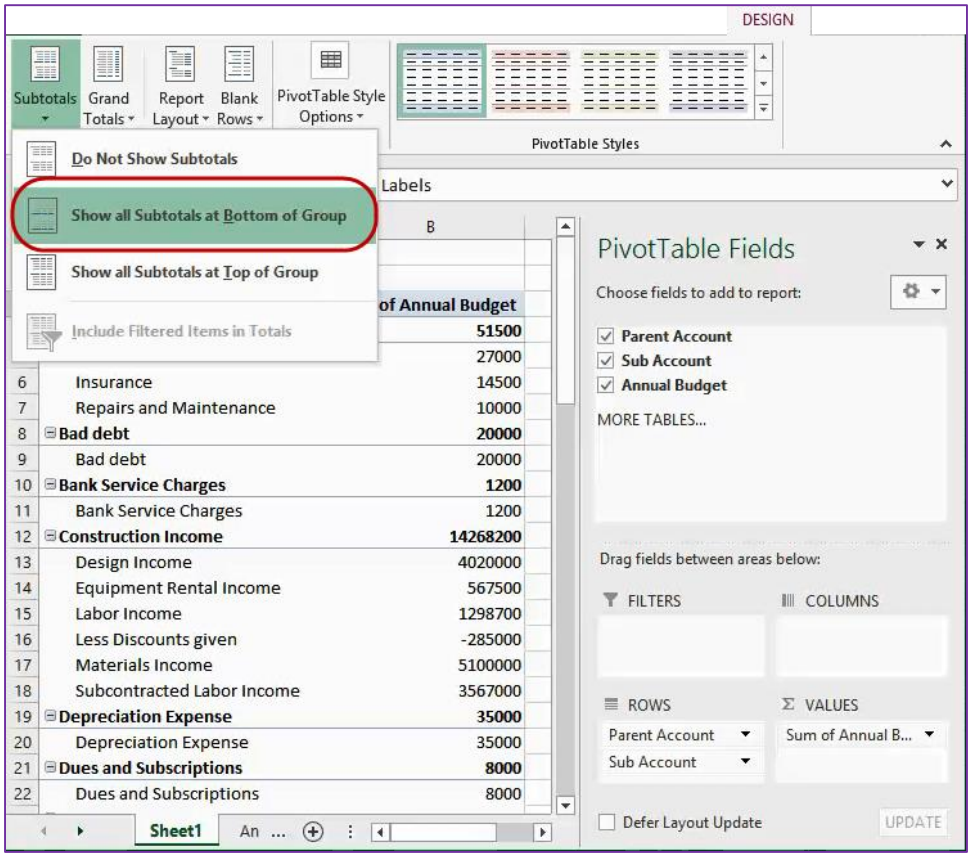


Figure 76 - Changing the Position of PivotTable Subtotals

6. Another formatting issue easily addressed in the PivotTable is that of the number formats. Users can apply any Excel format to the cells in the PivotTable. To do so, simply select a cell, right-click to open a context-sensitive menu, select Number Format, and apply the desired format. In most cases, this is likely to be either the Accounting Format with the currency symbol or the Accounting Format without the currency symbol.

7. At the bottom of the PivotTable, a meaningless Grand Total is present. To disable this Grand Total, click the **PivotTable Tools Design** contextual tab followed by **Grand Totals**. Then, select from the options pictured in **Figure 77**.

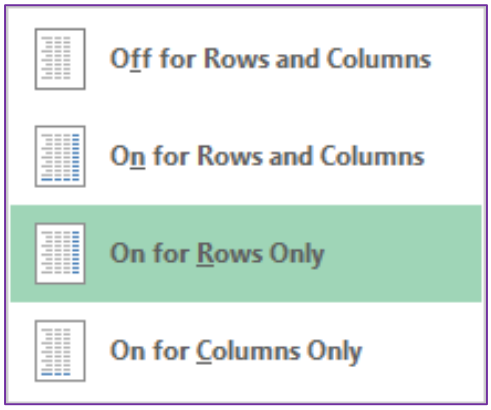


Figure 77 - PivotTable Grand Total Options

8. Another adjustment we will make to this simple PivotTable is to rearrange the Parent Account column so that the accounts are no longer in alphabetical order, but, rather, are in an order acceptable under generally accepted accounting principles. To do so, simply position the mouse pointer on the edge of a cell containing a Parent Account so that the compass rose is visible as shown in **Figure 78** With the compass rose visible, click, drag, and drop the Parent Account to the desired location. Repeat this process for each account you wish to reposition.

	A	B
1		
2		
3	**Row Labels**	**Sum of Annual Budget**
4	**Automobile**	
5	Fuel	$ 27,000
6	Insurance	$ 14,500
7	Repairs and Maintenance	$ 10,000
8	**Automobile Total**	**$ 51,500**
9	**Construction Income**	
10	Design Income	$ 4,020,000
11	Equipment Rental Income	$ 567,500
12	Labor Income	$ 1,298,700
13	Less Discounts given	$ (285,000)
14	Materials Income	$ 5,100,000
15	Subcontracted Labor Income	$ 3,567,000
16	**Construction Income Total**	**$ 14,268,200**
17	**Insurance**	
18	Disability Insurance	$ 32,000
19	Liability Insurance	$ 112,000
20	Workers Compensation	$ 87,500
21	**Insurance Total**	**$ 231,500**

Figure 78 - Rearranging Accounts in a PivotTable

9. Lastly, because our PivotTable does not display a **Gross Profit** calculation, we will add a **Calculated Item** to the PivotTable. Start by selecting a Parent Account cell in the PivotTable, select **Fields, Items, & Sets** from the **Analyze** tab of the Ribbon and select **Calculated Item** as shown in **Figure 79**.

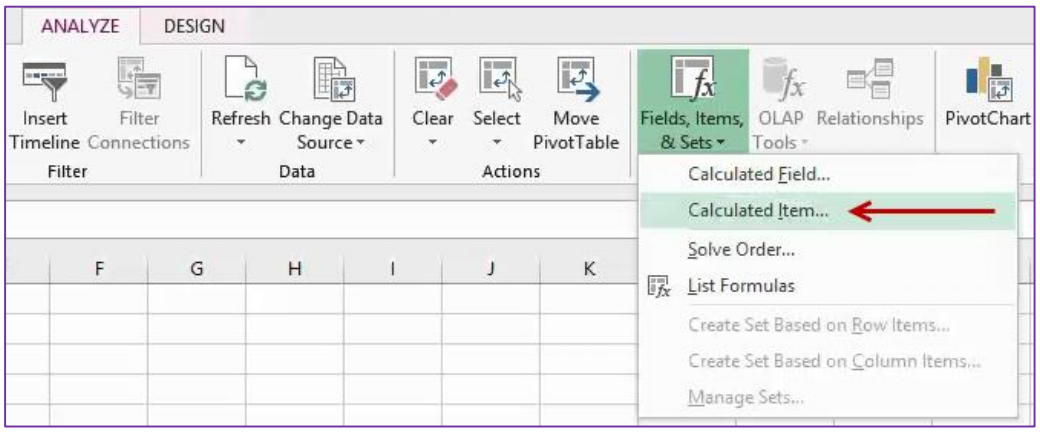


Figure 79 - Creating a Calculated Item in a PivotTable

Selecting Calculated Item causes the **Insert Calculated Item dialog box** pictured in **Figure 80** to open. In the dialog box, enter a **Name** for the Calculated Item and a **Formula** on which the calculation will be based. Finally, click **OK** to create the Calculated Item.

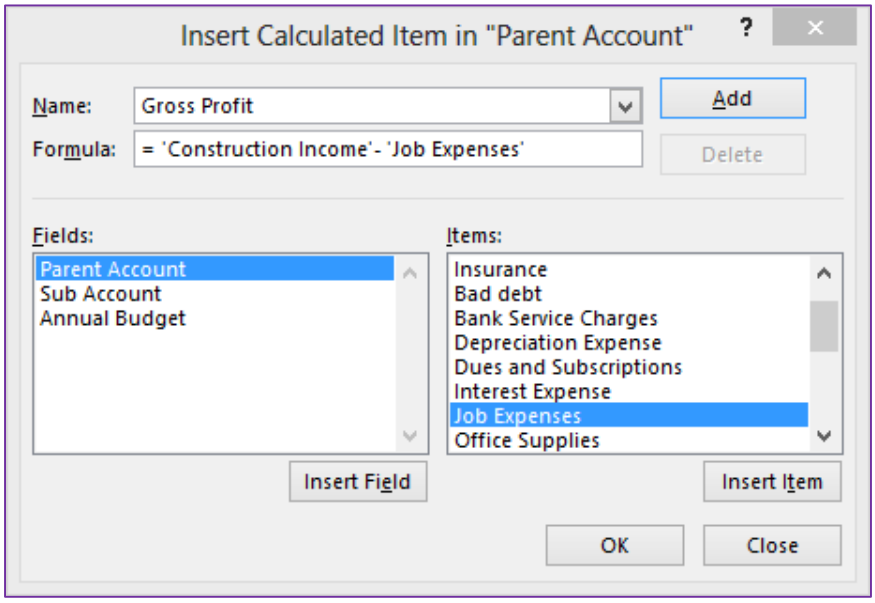


Figure 80 - Insert Calculated Item Dialog Box

This simple PivotTable begins to illustrate just some of the power of the PivotTable. Now, let us begin to complicate the data set so that it more closely resembles the "real world" and is no longer an academic exercise. As shown in **Figure 81**, a "Location" field has been added to the data set.

	A	B	C	D
1	**Location**	**Parent Account**	**Sub Account**	**Annual Budget**
2	Midwest	Construction Income	Design Income	4,582,800
3	North	Construction Income	Design Income	3,497,400
4	Southeast	Construction Income	Design Income	4,020,000
5	West	Construction Income	Design Income	4,944,600
6	Midwest	Construction Income	Equipment Rental Income	550,475
7	North	Construction Income	Equipment Rental Income	709,375
8	Southeast	Construction Income	Equipment Rental Income	567,500
9	West	Construction Income	Equipment Rental Income	533,450

Figure 81 - Modified PivotTable Data Set

Now, retracing the steps previously performed, we create a second PivotTable, except in this instance, we add the new Location field as a **Filter** as shown in **Figure 82**.

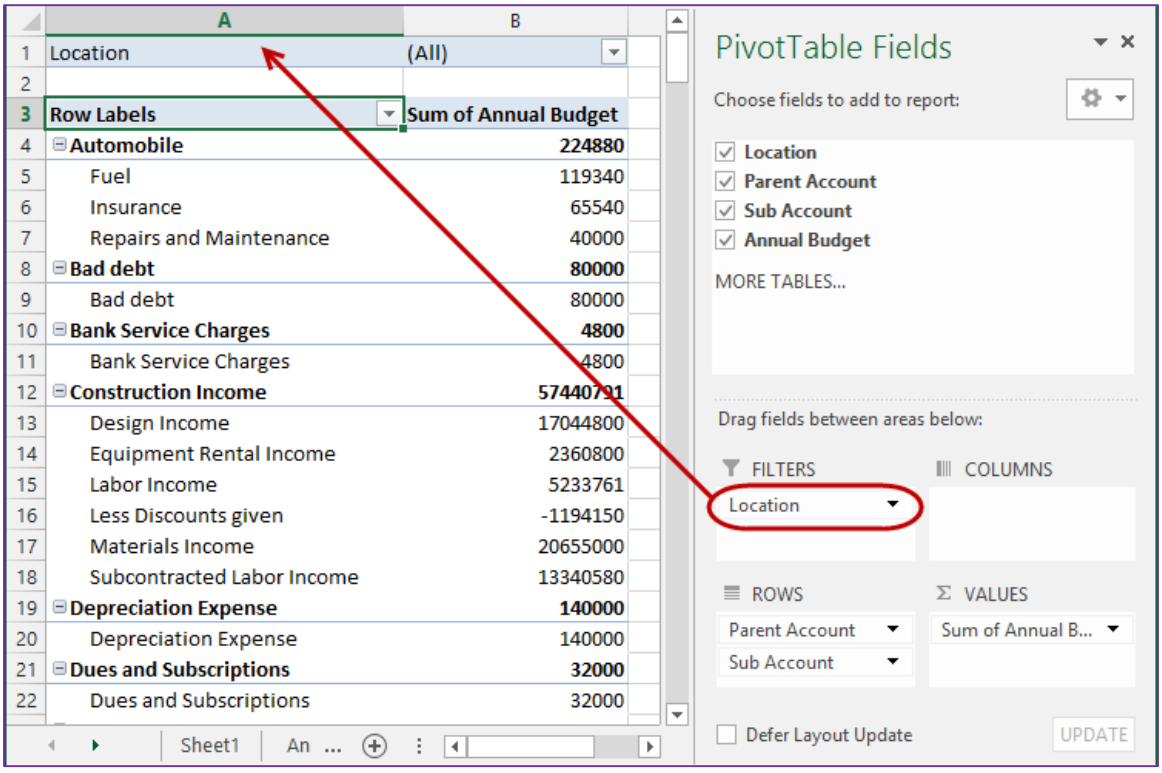


Figure 82 - Adding a Filter to a PivotTable

With the Filter in place, users can easily filter the contents of the PivotTable to one or more locations simply by clicking on the drop-down arrow and selecting the Location(s) to include in the PivotTable. Alternatively, we can add the Location field to the PivotTable as a **Column Label**. Upon doing so, the PivotTable "pivots" so that it appears as pictured in **Figure 83**.

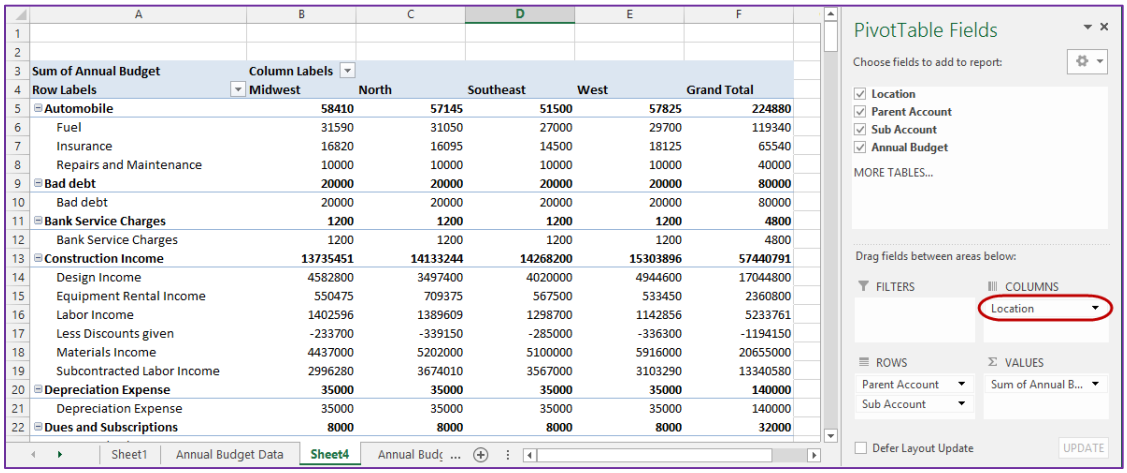


Figure 83 - Modified PivotTable with Location as a Column Label

Creating Multiple Consolidation Range PivotTables

Consolidation PivotTables are used to report data that is already tabulated. For example, if a user wants to combine divisional or departmental budgeted income statements, consolidation PivotTables can be used to produce the combined reports. The only requirement is that the data layout of the individual worksheets to be consolidated is similar, but they need *not* be identical.

The icon for Consolidation PivotTables is *not* available from the Ribbon. Users must add the **PivotTable and PivotChart Wizard** to the **Quick Access Toolbar** (QAT) or **Ribbon** to access this functionality.

In the following example, budgeted product line income statements will be combined into a single report with all of the reporting flexibility of a PivotTable. A sample of the data, which has an identical table for each of three product lines, is shown in **Figure 84**.

	A	B	C	D	E	F	G
1	DNM Distribution Company						
2	Comparative Budgeted Monthly Income Statements						
3							
4	Creams						
5		Jan-2012	Feb-2012	Mar-2012	Apr-2012	May-2012	Jun-2012
6	Revenue	100,000	115,000	132,000	152,000	175,000	201,000
7	Cost of Sales	50,000	53,000	56,000	59,000	62,000	65,000
8	Gross Margin	50,000	62,000	76,000	93,000	113,000	136,000
9	Distribution	10,000	13,000	16,000	19,000	22,000	25,000
10	SG&A	10,000	13,000	16,000	19,000	22,000	25,000
11	Facilities	5,000	5,000	5,000	5,000	5,000	5,000
12	Total Expense	25,000	31,000	37,000	43,000	49,000	55,000
13	Net Income	25,000	31,000	39,000	50,000	64,000	81,000

Figure 84 - Data Summarized Using a Consolidation PivotTable

Simple Consolidating PivotTables

In the first dialog box of the PivotTable Wizard, make sure to select **Multiple consolidation ranges**. Click **Next**. Then, select how the Page fields are to be created. To insure maximum reporting flexibility, choose **I will create the page fields** and then click **Next**. The dialog box for the next step in the wizard appears as shown in **Figure 85**. Now, each of the data ranges in the single page field to be created must be defined, one range for each of the three product lines – Creams, Lotions, and Scrubs.

In our example, all of the ranges to be consolidated are on separate worksheets in a single workbook, but the data ranges can be consolidated from multiple workbooks. To consolidate ranges from multiple workbooks, simply open the other workbooks and point to the data ranges during the PivotTable creation process.

Alternatively, type in the data ranges using the following format.

[workbook name] sheet name ! range

Make sure to include the *brackets* around the workbook name and the *exclamation point* between the sheet name and the range specification. Using defined names to define the data ranges in the individual workbooks will make the task easier and less prone to error.

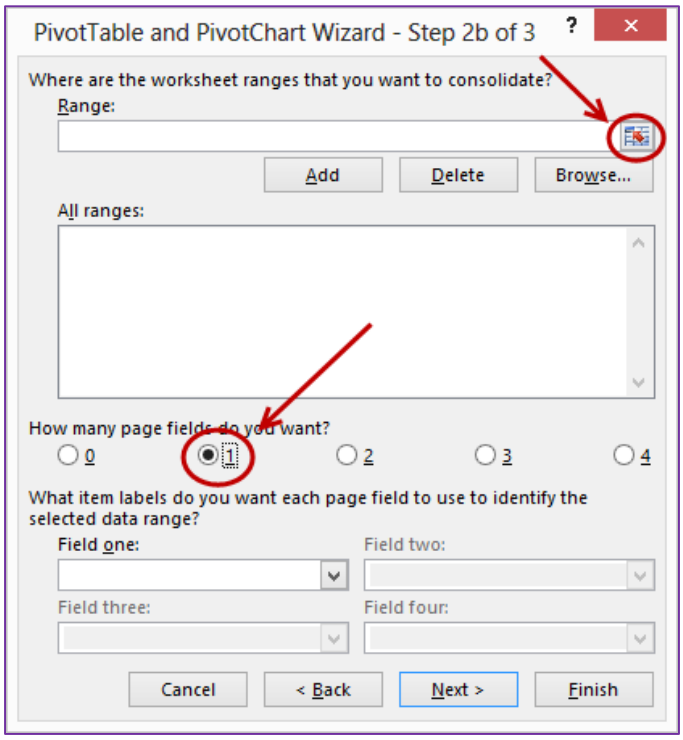


Figure 85 - Using the Collapse Dialog Button when Highlighting Ranges

Click on the **Collapse Dialog** button, shown in **Figure 85** at the right end of the Range box, to hide temporarily the dialog box. Then, using the mouse, highlight the range to be included in the report and click on the **Collapse Dialog** button to redisplay the dialog box. Click **Add** to add the range to the report. In the **Field one** box, enter the item name. Each of the ranges added in the dialog box will have its own item name – in this example, Creams, Lotions, and Scrubs. The completed dialog appears in **Figure 86**.

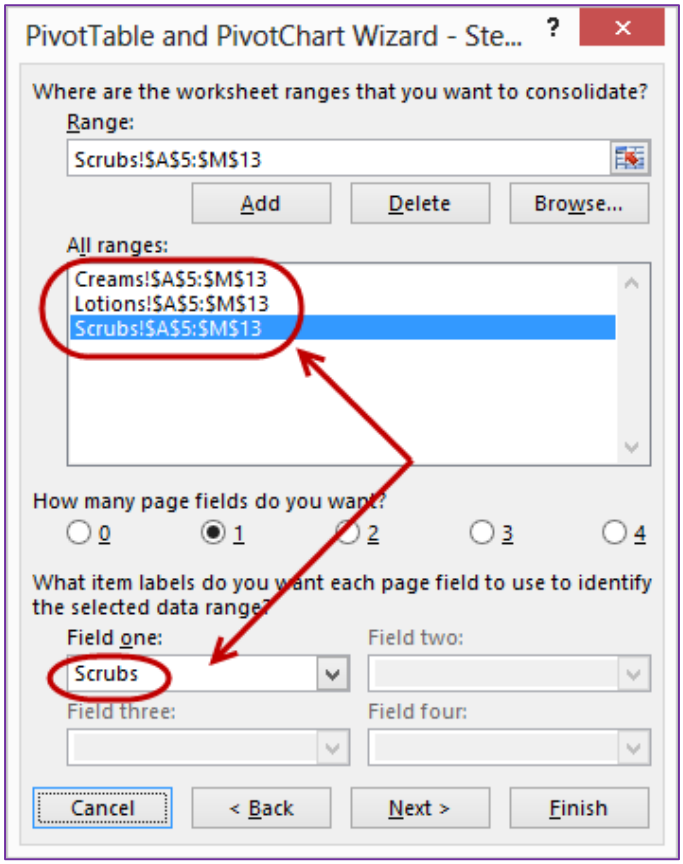


Figure 86 - Naming Each Field When Adding the Field Range

Click **Next**. Choose to create the PivotTable on a new worksheet and then click **Finish**. After grouping Months into Quarters and making some minor formatting changes, the initial PivotTable should resemble the one shown in **Figure 87**.

The items in the report are no longer in income statement order but are in alphabetical order.

	A	B	C	D	E	F
1	Page1	(All)				
2						
3	**Sum of Value**					
4		**Qtr1**	**Qtr2**	**Qtr3**	**Qtr4**	**Grand Total**
5	Cost of Sales	549,000	641,000	733,000	825,000	2,748,000
6	Distribution	135,000	227,000	319,000	414,000	1,095,000
7	Facilities	51,000	51,000	51,000	51,000	204,000
8	Gross Margin	586,000	870,000	1,309,000	1,968,000	4,733,000
9	Net Income	265,000	365,000	620,000	1,089,000	2,339,000
10	Revenue	1,135,000	1,511,000	2,042,000	2,793,000	7,481,000
11	SG&A	135,000	227,000	319,000	414,000	1,095,000
12	Total Expense	321,000	505,000	689,000	879,000	2,394,000
13	**Grand Total**	**3,177,000**	**4,397,000**	**6,082,000**	**8,433,000**	**22,089,000**

Figure 87 - Initial Consolidation PivotTable Created from Product Data

Review Questions

The review questions accompanying this course are designed to assist you in achieving the course learning objectives. The review section is not graded; do not submit it in place of your final exam. While completing the review questions, it may be helpful to study any unfamiliar terms in the glossary in addition to course content. After completing the review questions, proceed to the review question answers and rationales.

1. Which of the following is accurate regarding single variable data tables?

    a. In order to begin the function, you must create a formula at the top of the column as the "instruction" to Excel on how the math for that variable will function.
    b. A single variable data table is very beneficial in forecasting because the formulas can be very complex.
    c. A single variable data table is also referred to a pivot table.
    d. Reference to a "table" refers to a single variable data table in Excel "lingo."

2. All of the following functions can be found under the What-if icon **EXCEPT**:

    a. Scenario manager.
    b. Goal seek.
    c. Forecast sheet.
    d. Data table.

3. The primary benefit of using scenario manager is:

    a. To eliminate multiple Excel files of the same budget and facilitate changing a single formal or variable across multiple scenarios.
    b. To track different people's changes to the assumptions.
    c. To keep track of the timeline of the document creation.
    d. To store and track the rationale for various scenario inputs.

4. Which of the following tools would help the user validate a sales forecast submitted by the sales director?

    a. Multi-variable data table.
    b. Scenario Manager.
    c. Regression analysis.
    d. Solver.

5. To create a trend line, the user must first:

    a. Create a new scenario.
    b. Create a graph of the data.
    c. Use solver to get the defined result for each period.
    d. Create a new data table.

6. The moving averages function is accessed by:

    a. Clicking on the developer tab.
    b. Right-clicking on any cell in a data table.
    c. Clicking on the formula tab.
    d. Clicking on the data analyzer add-in.

7. Which of the following statements regarding the NPV function in Excel is accurate?

    a. Users cannot calculate NPV in Excel due to the uneven and irregular nature of "real world" cash flows.
    b. The Excel NPV cash flow formula gives a good starting point for analyzing the net present value of a project's cash flows.
    c. The NPV function in Excel requires some adjustment because the "zero time period" actually calculates as 1 year from today rather than as today.
    d. The IRR formula in Excel functions has a better NPV calculation than the NPV formula.

8. Which of the following is accurate about "good spreadsheet" creation?

    a. Formulas should only contain cell references especially as they relate to assumptions.
    b. The user should create a log with references to all formulas.
    c. Comments should be displayed in order to assist the user.
    d. Assumptions contained within formulas should contain a comment indicating such.

9. Which of the following statements is accurate regarding the watch window?

    a. The watch window remains open on the right hand side of the spreadsheet in a separate section outside the spreadsheet.
    b. The watch window can hold any cells within the current spreadsheet or any tab within the current workbook only.
    c. The watch window is found through the add-in function of Excel.
    d. The watch window can contain cells from other linked workbooks as well as cells within the current workbook.

10. Which of the following statements is accurate regarding best practices for linked workbooks?

    a. Use a point and click link to tie the workbooks together.
    b. Add comments in the destination workbook to provide the reference to the source workbook.
    c. Use a defined name in the source workbook prior to creating the link.
    d. Use FindLink when creating links between workbooks.

11. Which of the following statements regarding data consolidate is accurate?

    a. In order to consolidate data on different tabs, you need to make sure your rows and columns are consistent across the sheets.
    b. When consolidating data, you can consolidate data in asymmetrical data ranges.
    c. When selecting the data to consolidate, you must include the row and column headers in your range.
    d. In order to consolidate data, you must define and name the ranges.

12. PivotTables are:

    a. Accessed through an add-in.
    b. A data analytics tool.
    c. Primarily used for reporting.
    d. Created via named arrays.

Review Question Answers and Rationales

Review question answer choices are accompanied by unique, logical reasoning (rationales) as to why an answer is correct or incorrect. Evaluative feedback to incorrect responses and reinforcement feedback to correct responses are both provided.

1. Which of the following is accurate regarding single variable data tables?

    a. In order to begin the function, you must create a formula at the top of the column as the "instruction" to Excel on how the math for that variable will function. Correct. Excel needs to have a basis for creating the calculations and that is done by putting in the formula at the top of the column.
    b. A single variable data table is very beneficial in forecasting because the formulas can be very complex. Incorrect. A single variable data table is not very complex and a formula could be substituted fairly easily.
    c. A single variable data table is also referred to a pivot table. Incorrect. A pivot table is an entirely different tool than a data table.
    d. Reference to a "table" refers to a single variable data table in Excel "lingo." Incorrect. A table and a data table are two unique tools.

2. All of the following functions can be found under the What-if icon **EXCEPT**:

    a. Scenario manager. Incorrect. Scenario manager is located under the What-if icon.
    b. Goal seek. Incorrect. Goal seek is part of the What-if functions.
    c. Forecast sheet. Correct. Forecast Sheet has its own icon on the data tab.
    d. Data table. Incorrect. Data table is part of the What-if functionality.

3. The primary benefit of using scenario manager is:

    a. To eliminate multiple Excel files of the same budget and facilitate changing a single formal or variable across multiple scenarios. Correct. Rather than having a bunch of different spreadsheets for each scenario, scenario manager keeps these integrated so that a single change to a formula or constraint will update across all versions.
    b. To track different people's changes to the assumptions. Incorrect. The primary benefit is not in change tracking or managing, rather it is keeping track of the final version of multiple scenarios.
    c. To keep track of the timeline of the document creation. Incorrect. The primary benefit is not in the tracking over time.
    d. To store and track the rationale for various scenario inputs. Incorrect. Any such notes about rationales or assumptions need to be noted somewhere within the document itself.

4. Which of the following tools would help the user validate a sales forecast submitted by the sales director?

   a. Multi-variable data table. Incorrect. This tool may help to prepare such a forecast but is not the best tool for validating it.
   b. Scenario Manager. Incorrect. This can help with preparing different scenarios for review and analysis, but it is not the best tool for testing a forecast.
   c. Regression analysis. Correct. Regression analysis can help check the validity of a forecast using past actual results.
   d. Solver. Incorrect. Solver is a good tool for getting to a result.

5. To create a trend line, the user must first:

   a. Create a new scenario. Incorrect. It is not necessary to be in a scenario in order to create a trend line.
   b. Create a graph of the data. Correct. Once the user has a graph, he/she right-clicks on a data point in order to create the trend line.
   c. Use solver to get the defined result for each period. Incorrect. It is not necessary to use solver; the user may have the data points for the graph.
   d. Create a new data table. Incorrect. A data table is not necessary for using the trend line function; the user just needs data which can be put in graphical format.

6. The moving averages function is accessed by:

   a. Clicking on the developer tab. Incorrect. The user must access the data tab to get to the data analyzer.
   b. Right-clicking on any cell in a data table. Incorrect. Moving averages is a data analysis tool located in the data analysis add-in.
   c. Clicking on the formula tab. Incorrect. The data analyzer is found under the data tab.
   d. Clicking on the data analyzer add-in. Correct. The moving averages function can be accessed by clicking on the data analyzer tab.

7. Which of the following statements regarding the NPV function in Excel is accurate?

   a. Users cannot calculate NPV in Excel due to the uneven and irregular nature of "real world" cash flows. Incorrect. You can use the formula, with some adjustments, or you can set up the uneven cash flows and calculate the NPV outside of the Excel formula.
   b. The Excel NPV cash flow formula gives a good starting point for analyzing the net present value of a project's cash flows. Incorrect. The formula as is, must be adjusted to be technically accurate and it does not provide the flexibility to adapt to uneven cash flows.
   c. The NPV function in Excel requires some adjustment because the "zero time period" actually calculates as 1 year from today rather than as today. Correct. The user can start with the NPV formula but must make some adjustments since the formula actually adds 1 discount period to each year which is not accurate.
   d. The IRR formula in Excel functions has a better NPV calculation than the NPV formula. Incorrect. The IRR calculation is completely different from the NPV formula.

8. Which of the following is accurate about "good spreadsheet" creation?

   a. Formulas should only contain cell references especially as they relate to assumptions. Correct. Assumptions and other "hard-coded" numbers should not be put in formulas as it makes it difficult to facilitate changes and identify assumptions.
   b. The user should create a log with references to all formulas. Incorrect. That would be time-consuming and inefficient.
   c. Comments should be displayed in order to assist the user. Incorrect. This is personal preference, but does tend to cover other areas of the worksheet.
   d. Assumptions contained within formulas should contain a comment indicating such. Incorrect. Comments are certainly helpful regarding the source of the data or who provided it but numbers, especially, assumptions should not be coded into the formula rather there should just be cell references so that the numbers and assumptions can be easily seen and changed as needed.

9. Which of the following statements is accurate regarding the watch window?

    a. The watch window remains open on the right hand side of the spreadsheet in a separate section outside the spreadsheet. Incorrect. The user can place the watch window on the right hand side, or he/she can layer the window on the spreadsheet or move it or resize it as needed.
    b. The watch window can hold any cells within the current spreadsheet or any tab within the current workbook only. Incorrect. The watch window can hold cells within the current spreadsheet or any tab within the current workbook as well as cells from linked workbooks.
    c. The watch window is found through the add-in function of Excel. Incorrect. The watch window is found on the Formulas tab.
    d. The watch window can contain cells from other linked workbooks as well as cells within the current workbook. Correct. The user can update to watch cells in other linked workbooks as well as any cells within the current workbook.

10. Which of the following statements is accurate regarding best practices for linked workbooks?

    a. Use a point and click link to tie the workbooks together. Incorrect. Using a point and click link to tie the workbooks together is the process for creating a link, however, a best practice is to use defined names in the source workbook to help ensure that simple changes in the source workbook don't destroy the integrity of the linked data.
    b. Add comments in the destination workbook to provide the reference to the source workbook. Incorrect. The formula itself provides the details of the source workbook and cell.
    c. Use a defined name in the source workbook prior to creating the link. Correct. By using a defined name, the user will ensure the integrity of the cell and the link.
    d. Use FindLink when creating links between workbooks. Incorrect. This is a nice tool to help the user uncover broken links, but is not a best practice in the creation of the links.

11. Which of the following statements regarding data consolidate is accurate?

    a. In order to consolidate data on different tabs, you need to make sure your rows and columns are consistent across the sheets. Incorrect. You can consolidate asymmetrical ranges, but you need to include the row and column headers.
    b. When consolidating data, you can consolidate data in asymmetrical data ranges. Correct. To do this, you must include the row and column headers in the range.
    c. When selecting the data to consolidate, you must include the row and column headers in your range. Incorrect. You do not need to include row and column headers if the data on all of the sheets is symmetrical.
    d. In order to consolidate data, you must define and name the ranges. Incorrect. You simply point and click to select the range of cells; they do not need to be defined.

12. PivotTables are:

    a. Accessed through an add-in. Incorrect. PivotTables are a standard tool within Excel.
    b. A data analytics tool. Incorrect. PivotTables are not primarily a data analytics tool like one of the statistical tools; rather PivotTables are for the presentation and reporting of data.
    c. Primarily used for reporting. Correct. PivotTables are a powerful presentation tool for aggregating data for reporting.
    d. Created via named arrays. Incorrect. PivotTables are created through the insert PivotTable icon.

Glossary

This is a glossary of key terms with definitions. Please review any terms with which you are not familiar.

Add-ins: Certain functions which are not inherent in the normal installation of Excel and which have to be specifically added in order to be accessed.

Analysis Tool Pack Add-in: An add-in that provides more powerful analysis tools than the simple trend line.

Array: A special type of formula within Excel that is capable of various powerful functions. It is represented in a formula with braces { }. In order to edit a formula containing an array without destroying the array, you must press Ctrl+Alt+Enter at the same time.

Budget: A committed financial plan of action.

Capital budgeting: The process of evaluating and planning for acquisitions of assets to be used in the business.

Circular references: Formulas where one number depends on another which is dependent on that number. For example, taxes where the federal calculation depends on the amount of state tax, but the amount of state tax depends on the amount of federal tax. It is best to avoid such references whenever possible, however, if the situation cannot be avoided, go to File>Options>Formulas>Enable iterative calculations. Keep in mind that this is a “session” setting – it only applies until the workbook is closed.

Coefficients: The fixed and variable outputs.

Data consolidate: A function which consolidates data from multiple sheets within the workbook.

Data tables: A functionality within Excel that assists with the performance and presentation of “what if” scenarios.

Defined names: A tool that allows the user to create usable names for reference rather than seeing a cell reference that is not meaningful for understanding the data represented in that cell.

Find link: An Excel add-on which helps to locate broken links.

Forecast: A tool used to feed budgets or other planning tools.

Forecast function: A tool that helps to forecast the future based on past experience.

Goal seeking functionality: A function that allows the user to specify the end result and Excel will identify the inputs which deliver that result.

Internal Rate of Return (IRR): The rate of return which will discount all of the cash flows of a project to zero.

Monte Carlo Simulation: A tool for calculating probability distributions.

Moving averages: A tool to help smooth out seasonal fluctuations.

Multi-variable data table: One of two forms of data tables within Excel.

Net Present Value (NPV): A form of analysis used in decision-making for capital outlays. It involves discounting the cash flows. A positive NPV means that the project should be accepted.

Nominal dollars: Projections of cash flows which include the impact of inflation.

Probability distribution: A forecasting strategy used as an alternative to single point estimates.

R^2: A measure of the "fit" of the data. This is used in regression analysis and the creation of trend lines. R^2 of .8 to 1.0 (either positive or negative) is indicative of a good fit.

Real dollars: Projections of cash flows which exclude the impact of inflation.

Regression analysis: A tool used to help with forecasting both from the side of creating forecasts based on past results and from the side of validating someone else's forecast.

RiskAMP: A tool which uses Monte Carlo methodology in budgeting.

Scenario manager: A tool designed to help manage multiple iterations of a budget or forecast.

Scenario summary report: A report within scenario manager that allows the user to present all of the managed scenarios side-by-side.

Single point estimate: An estimate that is almost always wrong (sales will be $X). An alternative is to use probability distribution.

Single variable data table: One of two forms of data tables within Excel.

Slope: A function within data analysis that tells the user the impact of 1 unit of input (in the instructor example, 1 dollar of advertising is the input and 85.179 is the resulting increase in sales.)

Solver: A function that allows the user to solve multi-variable equations which are closer to real life examples and can incorporate constraints.

Sum-through formula: A method of summing the same cell reference in a range of worksheets within the same workbook.

Trend line: A function within a graph that essentially performs a regression analysis on the data.

Time period zero: In NPV calculations, time period zero means today.

VLOOKUP Function: An Excel formula that uses one known piece of data to then go to a table and lookup a related piece of data. For example, using an employee's name to lookup their employee ID number, phone number, etc. from a table which contains all of the related data.

Watch window: A function which allows the user to watch certain cells when changes are made to other identified cells.

What if analysis: A process of analyzing different scenarios to take into consideration that many inputs are estimates and can could be different than projected. What if analysis provides insight into the result if this or that data input is higher or lower.

XIRR function: A function which solves the IRR problem of uneven cash flows.

XNPV function: A function which solves Excel's NPV calculation problem and the problem of uneven cash flows.

Index

X

Qualified Assessment

Excel Budgeting and Forecasting
Course # 2164594, Version 1706
Publication/Revision Date:
June 2017

Course Expiration Date

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1. The table function in Excel is designed specifically to help solve which of the following problems?

   a. Data formatting.
   b. Highlighting important information.
   c. Performing "what if" analysis.
   d. Subtotaling.

2. In order to create a data table, click on the _____ tab.

   a. Formula.
   b. Developer.
   c. Page Layout.
   d. Data.

3. After selecting the goal seeking option, the user is asked to specify _____ inputs into the goal seeking equation.

   a. 2.
   b. 3.
   c. 4.
   d. 5.

4. A significant weakness with respect to goal seeking is:

   a. The complexity of setting up the scenario.
   b. The difficulty of interpreting the calculated result.
   c. It ignores constraints.
   d. The limited uses.

5. In order to access “add-ins” for Excel, the user must:

   a. Go online to the Microsoft Office website and download them.
   b. Purchase a special add-in bundle.
   c. Go to the data tab and right-click on the analysis section to access the add-ins.
   d. Go to File/Options/Add-in and activate the add-in.

6. Scenario manager is engaged on a worksheet-by-worksheet basis within a workbook and each scenario can be used to drive up to _____ different variables.

   a. 8.
   b. 16.
   c. 32.
   d. 64.

7. The scenario summary report breaks the information by scenario into:

   a. Assumptions and results.
   b. Inputs and results.
   c. Options and output.
   d. Inputs and outputs.

8. The forecast function is actually building a _____ behind the scenes.

   a. Regression analysis.
   b. Forecast worksheet.
   c. Scenario.
   d. Graph.

9. To calculate a moving average, one of the first things that you need to define in the dialogue box is:

   a. Output option.
   b. Chart output.
   c. Input range.
   d. Data labels.

10. Which of the following statements about RiskAMP is accurate?

    a. RiskAMP can compute normal probability distributions.
    b. RiskAMP is a component within the data analyzer add-in.
    c. RiskAMP requires the user to perform some minor programming to get the optimal results.
    d. RiskAMP is used to project certainty in the budget.

11. When analyzing the results of the Monte Carlo simulation, the risk inherent in the project can be determined by looking at the:

    a. Bin and frequency.
    b. Frequency and value.
    c. Percentile and value.
    d. Value and bin.

12. Capital budgeting should be done using:

    a. LINEST.
    b. RiskAMP.
    c. Solver.
    d. Net present value.

13. In capital budgeting, which of the following statements is accurate?

    a. The analysis should use real dollars.
    b. The analysis should use inflation-adjusted dollars.
    c. The analysis should use nominal dollars.
    d. The analysis can use either nominal dollars or real dollars as long as the variable is used consistently throughout the analysis.

14. In order to have cell comments print along with the document, the user must:

    a. Go to the File/Options section in order to find comments.
    b. Make a selection on the Page Setup dialogue box to enable comments to print.
    c. Go under the File/options/advanced to find the comments settings.
    d. Show comments on the page and then print.

15. The IFERROR function:

    a. Identifies inaccurate formula parameters.
    b. Substitutes another value for any invalid calculations like dividing by 0.
    c. Finds inconsistencies in formulas throughout the spreadsheet row or column.
    d. Provides conditional formatting when identified errors are detected.

16. In a VLOOKUP formula, if you want the lookup to find an exact match for the lookup, you must put _____ on the end of the formula; otherwise, it will find an approximate match.

    a. False.
    b. 1.
    c. 0.
    d. No.

17. In order to enable “iterative calculations” for circular references, the user must:

    a. Enable the “calculation” add-on.
    b. Enable iterative calculations in the Options section under the File menu.
    c. Enable calculator on the Data tab.
    d. Right-click on the circular reference cell and click “enable calculation.”

18. The estimated error rate for Excel workbook formulas is:

    a. 25%.
    b. 40%.
    c. 65%.
    d. 90%.

19. The data consolidate function is located under the _____ tab.

    a. Add-ins.
    b. Formula.
    c. Data.
    d. Developer.

20. In order to create conditional formats, the user must:

    a. Create an array.
    b. Create a rule.
    c. Name a data range.
    d. Use a formula.

WESTERN CPE

Answer Sheet

Excel Budgeting and Forecasting
Course # 2164594, Version 1706
4 CPE Credits

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VISA/MC/Discover/Amex # _____ Exp. _____

Course expires **1 Year** from date of purchase or enrollment

***Online Grading*: visit www.westerncpe.com to complete your assessment online and receive your certificate of completion and results *instantly*.**

1. ___	5. ___	9. ___	13. ___	17. ___
2. ___	6. ___	10. ___	14. ___	18. ___
3. ___	7. ___	11. ___	15. ___	19. ___
4. ___	8. ___	12. ___	16. ___	20. ___

WESTERN CPE

Course Evaluation

Excel Budgeting and Forecasting
Course # 2164594, Version 1706

Thank you for taking the time to fill out this course and customer experience evaluation. Your responses help us to build better courses and maintain the highest levels of service. If you have comments not covered by this evaluation, or need immediate assistance, please contact us at 800.822.4194 or wcpe@westerncpe.com.

Course and Instructor Evaluation

1. Please answer the following related to the content of the course:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The stated learning objectives were met.	O	O	O	O	O
The course materials were accurate, relevant, and contributed to the achievement of the learning objectives.	O	O	O	O	O
The stated prerequisites were appropriate and sufficient.	O	O	O	O	O
Based on 50 minutes per credit hour, the time to take this course accurately reflects the credit hours assigned to it.	O	O	O	O	O
The instructor was knowledgeable and effective.	O	O	O	O	O

2. Were there any questions you felt were confusing or had incorrect answers listed? If so, please give the question number and a brief description of the issue:

3. Please provide any additional comments specific to the educational content or author of this course:

4. Do you have ideas for future course topics? If so, please list them along with any known subject matter experts we might contact to develop the course:

Customer Experience

5. Please rate your overall experience with Western CPE:

	Unsatisfactory	Improvement Needed	Meets Expectations	Exceeds Expectations	Exceptional
If you interacted with our Customer Service team, please rate the quality of service you received.	O	O	O	O	O
If you purchased your course online, please rate the quality of your e-commerce experience.	O	O	O	O	O
"My Account" information includes the tools necessary to access courses and track those completed.	O	O	O	O	O

6. Please indicate the likelihood of your purchasing the listed course formats from Western CPE:

	Not at all	Not very likely	Possibly	Likely	Highly Likely
Self-Study	O	O	O	O	O
Webcast OnDemand	O	O	O	O	O
Live Webcast	O	O	O	O	O
Resort Conference or Seminar	O	O	O	O	O

7. Please use the box below to provide any additional comments related to your educational experience with Western CPE.

8. If you are willing to provide a quote about this course, or Western CPE in general, that we may use in our promotional materials, please state it below. Be sure to include your name, title, city, and state.