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Bill Jelen
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PIVOT TABLE DATA CRUNCHING

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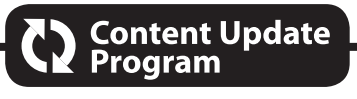

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Excel® 2016 Pivot Table Data Crunching

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Contents at a Glance

Excel 2016 Pivot Table Data Crunching

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Contents

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Dedication

To my friend, the recently departed Professor Simon Benninga
—Bill Jelen

To my 12 fans at datapigtechnologies.com
—Mike Alexander

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Mike Alexander is the funniest guy doing live Excel seminars. I appreciate him as a coauthor on all five editions of this book, which has earned the #1 spot on the Amazon Computer Book bestseller list (for 54 minutes one day in January). Rob Collie of PowerPivotPro.com keeps me up to speed on PowerPivot. At Microsoft, thanks to Aviv Ezrachi and Ben Rampson for always being willing to answer quick questions. At MrExcel.com, thanks to an entire community of people who are passionate about Excel. Finally, thanks to my wife, Mary Ellen, for her support during the writing process.

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—Mike Alexander

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INTRODUCTION

The pivot table is the single most powerful command in all of Excel. Pivot tables came along during the 1990s, when Microsoft and Lotus were locked in a bitter battle for dominance of the spreadsheet market. The race to continually add enhanced features to their respective products during the mid-1990s led to many incredible features, but none as powerful as the pivot table.

With a pivot table, you can transform one million rows of transactional data into a summary report in seconds. If you can drag a mouse, you can create a pivot table. In addition to quickly summarizing and calculating data, pivot tables enable you to change your analysis on the fly by simply moving fields from one area of a report to another.

No other tool in Excel gives you the flexibility and analytical power of a pivot table.

IN THIS INTRODUCTION

What You Will Learn from This Book

It is widely agreed that close to 60% of Excel users leave 80% of Excel untouched. That is, most users do not tap into the full potential of Excel's built-in utilities. Of these utilities, the most prolific by far is the pivot table. Despite the fact that pivot tables have been a cornerstone of Excel for almost 20 years, they remain one of the most underutilized tools in the entire Microsoft Office suite.

Having picked up this book, you are savvy enough to have heard of pivot tables—and you have perhaps even used them on occasion. You have a sense that pivot tables provide a power that you are not using, and you want to learn how to leverage that power to increase your productivity quickly.

Within the first two chapters, you will be able to create basic pivot tables, increase your productivity, and produce reports in minutes instead of hours. Within the first seven chapters, you will be able to

output complex pivot reports with drill-down capabilities and accompanying charts. By the end of the book, you will be able to build a dynamic pivot table reporting system.

What Is New in Excel 2016's Pivot Tables

Luckily, Microsoft continues to invest heavily in business intelligence (BI), and pivot tables are the front end that let you access the new features. Some of the features added to Excel 2016 pivot tables include the following:

- Pivot tables now provide auto grouping for date or time columns. If you add a date column to the Rows or Columns area, Excel will automatically group the data up to Months and collapse to Months. If the data spans more than one year, Excel will add Quarters and Years as well. If you add a time column, Excel will automatically group to Seconds, Minutes, and Hours and collapse to show only the top level.
- Pivot charts offer expand and collapse buttons. If you add two or more fields to the Axis or Legend area of a pivot table, you can use the + and – icons on the pivot chart to zoom in and out on the hierarchy.
- Slicers now offer a Multi-Select icon to allow you to choose multiple items without using the Ctrl key. This feature was added for touchscreens.
- If your data has a geographic field such as for addresses or postal codes, you can build a pivot table on a map by using the 3D Maps icon on the Insert tab.
- If you need to import data for a pivot table, the Power Query tools found under Data, Get & Transform will assist you in cleaning and shaping that data.
- Power Pivot has an automatic feature for creating a calendar table.
- If you select Insert PivotTable from a blank cell, and if there is a Data Model in the workbook, Excel will offer to build the pivot table from the model.
- Power Pivot's Auto-Detect Relationships dialog offers a Manage Relationships button that allows you to review or correct any relationship that was detected.

If you skipped right over Excel 2013, you may not know about some of the new features it introduced. Here are some of the best ones:

- Beginning with 2013, Excel offers thumbnails for 10 recommended pivot tables when you choose Insert, Recommended Pivot Tables. If you are not sure how best to summarize your data, you'll find plenty of inspiration in this dialog.
- A timeline slicer enables you to easily filter a pivot table by month, quarter, or year.
- Excel 2013 introduced the Data Model as a way to build a pivot table from two tables. This is for the versions of Excel that do not offer Power Pivot.
- People using Office Professional Plus, Office 365 Pro Plus, or other high-end editions can enable the Power Pivot add-in. Power Pivot provides drag-and-drop functionality to link tables, worksheets, SQL Server, and more. Power Pivot adds better calculated fields.
- Power View enables you to animate pivot tables in an ad hoc query tool.

Skills Required to Use This Book

This book is a comprehensive enough reference for hard-core analysts yet relevant to casual users of Excel. The bulk of the book covers how to use pivot tables in the Excel user interface. Chapter 10, "Mashing Up Data with Power Pivot," delves into the Power Pivot window. Chapter 14, "Advanced Pivot Table Tips and Techniques," describes how to create pivot tables in Excel's powerful VBA macro language. Any user who has a firm grasp of basics such as preparing data, copying, pasting, and entering simple formulas should not have a problem understanding the concepts in this book.

CASE STUDY: LIFE BEFORE PIVOT TABLES

Say that your manager asks you to create a one-page summary of a sales database. He would like to see total revenue by region and product. Suppose you do not know how to use pivot tables. You will have to use dozens of keystrokes or mouse clicks to complete this task.

First, you have to build the outline of the report:

1. Copy the Product column to a blank section of the worksheet.
2. Select Data, Remove Duplicates to eliminate the duplicates.
3. Delete the Product heading.
4. Copy the unique list of products and then use Paste Special Transpose to turn the list sideways.
5. Delete the vertical list of products.
6. Copy the Region column to a blank section of the worksheet.
7. Select Data, Remove Duplicates to remove the duplicates.
8. Delete the Region heading.
9. Cut and paste the products so they appear left of and below the regions.

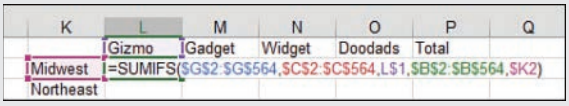
At this point, with 27 mouse clicks or keystrokes, you've built the shell of the final report, but there are no numbers inside yet (see Figure I.1).

Figure I.1
It took 27 clicks to get to this point.

B	C	D	E	F	G	H	I	J	K	L	M	N	O
Region	Product	Date	Customer	Quantity	Revenue	COGS	Profit			Gizmo	Gadget	Widget	Doodads
Midwest	Gizmo	1/1/2017	Association for	1000	22810	10220	12590		Midwest				
Northeast	Gadget	1/2/2017	Bits of Confetti	100	2257	984	1273		Northeast				
South	Gizmo	1/4/2017	Cambia Factor	400	9152	4088	5064		South				
Midwest	Gadget	1/4/2017	Construction Int	800	18552	7872	10680		West				
West	Gadget	1/7/2017	CPASelfStudy.c	1000	21730	9840	11890		Total				
Midwest	Widget	1/7/2017	Data2Impact	400	8456	3388	5068						

Next, you need to build the relatively new SUMIFS function to total the revenue for the intersection of a region and product. As shown in Figure I.2, the formula =SUMIFS($G$2:$G$564,$C$2:$C$564,L$1,$B$2:$B$564,$K2) does the trick. It takes 52 characters plus the Enter key to finish the formula, but I managed to enter the formula in 36 clicks or keystrokes by using some clever navigation tricks I've learned over the years.

Figure I.2
If this were the year 2006, the SUMIFS function would have been an uglier SUMPRODUCT function.



If you are adept at using the fill handle, you need just two more mouse drags to copy the formula to the rest of the table.

Enter the heading Total for the total row and for the total column. You can do this in nine keystrokes if you type the first heading, press Ctrl+Enter to stay in the same cell and then use Copy, select the cell for the second heading, and use Paste.

If you select K1:P6 and press Alt+Equals, you can add the total formulas in three keystrokes.

With this method, which takes 77 clicks or keystrokes, you end up with a nice summary report, as shown in Figure I.3. If you could pull this off in 5 or 10 minutes, you would probably be fairly proud of your Excel prowess; there are some good tricks among those 77 operations.

Figure I.3
A mere 77 operations later, you have a summary report.

	Gizmo	Gadget	Widget	Doodads	Total
Midwest	652651	544772	537965	6036	1741424
Northeast	751724	714009	620019	38860	2124612
South	918588	839551	844186	0	2602325
West	70057	65382	75349	28663	239451
Total	2393020	2163714	2077519	73559	6707812

You hand the report to your manager. Within a few minutes, he comes back with one of the following requests, which will certainly cause a lot of rework:

- Could you put products down the side and regions across the top?
- Could you show me the same report for only the manufacturing customers?
- Could you show profit instead of revenue?
- Could you copy this report for each of the customers?

Invention of the Pivot Table

When the actual pivot table was invented is in dispute. The Excel team coined the term *pivot table*, which appeared in Excel in 1993. However, the concept was not new. Pito Salas and his team at Lotus were working on the pivot table concept in 1986 and released Lotus Improv in 1991. Before then, Javelin offered functionality similar to that of pivot tables.

The core concept behind a pivot table is that the data, formulas, and data views are stored separately. Each column has a name, and you can group and rearrange the data by dragging field names to various positions on the report.

CASE STUDY: LIFE AFTER PIVOT TABLES

Say that you're tired of working so hard to remake reports every time your manager wants a change. You're in luck: You can produce the same report as in the last case study but using a pivot table. Excel 2016 offers you 10 thumbnails of recommended pivot tables to get you close to the goal. Follow these steps:

1. Click the Insert tab of the ribbon.
2. Click Recommended PivotTables. The first recommended item is Revenue by Region (see Figure I.4).

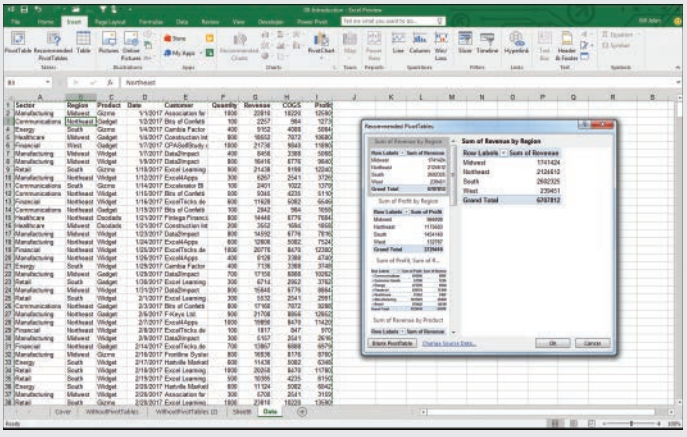


Figure I.4
The first recommended pivot table is as close as you will get to the required report.

3. Click OK to accept the first pivot table.
4. Drag the Product field from the PivotTable Fields list to the Columns area (see Figure I.5).

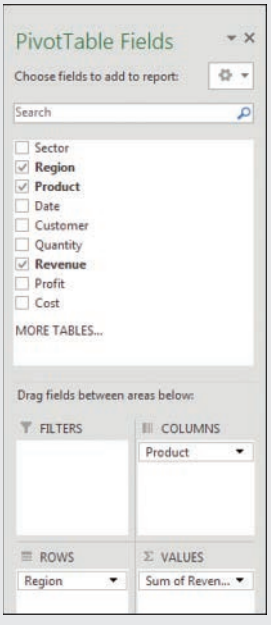


Figure I.5
To finish the report, drag the Product heading to the Columns area.

5. Unselect Field Headers on the right side of the ribbon.

With just five clicks of the mouse, you have the report shown in Figure I.6.

Figure I.6
It took five clicks to create this report.

	A	B	C	D	E	F
1						
2						
3	Sum of Revenue					
4		Doodads	Gadget	Gizmo	Widget	Grand Total
5	Midwest	6036	544772	652651	537965	1741424
6	Northeast	38860	714009	751724	620019	2124612
7	South		839551	918588	844186	2602325
8	West	28663	65382	70057	75349	239451
9	Grand Total	73559	2163714	2393020	2077519	6707812
10						

In addition, when your manager comes back with a request like the ones near the end of the prior case study, you can easily use the pivot table makes to make the changes. Here's a quick overview of the changes you'll learn to make in the chapters that follow:

- Could you put products down the side and regions across the top? (This change will take you 10 seconds: Drag Product to Rows and Region to Columns.)
- Could you show me the same report for only the manufacturing customers? (15 seconds: Select Insert Slicer, Sector; click OK; click Manufacturing.)
- Could you show profit instead of revenue? (10 seconds: Uncheck Revenue, check Profit.)
- Could you copy this report for each of the customers? (30 seconds: Move Customer to Report Filter, open the tiny drop-down next to the Options button, choose Show Report Filter Pages, click OK.)

Sample Files Used in This Book

All data files used throughout this book are available for download from `www.mrexcel.com/pivotbookdata2016.html`. You will find one Excel workbook per chapter and should be able to achieve exactly the same results shown in the figures in this book by starting with the raw data on the Data worksheet. If you simply want to work with the final pivot table, you can find it in the workbook as well.

Conventions Used in This Book

This book follows certain conventions:

- `Monospace`—Code and messages you see onscreen appear in a monospace font.
- **Bold**—Text you type appears in a bold font.

- *Italic*—New and important terms appear in italics.
- Initial Caps—Tab names, dialog names, and dialog elements are presented with initial capital letters so you can identify them easily.

Referring to Ribbon Commands

When the active cell is inside a pivot table, two new tabs appear on the ribbon. In the help files, Microsoft calls these tabs "PivotTable Tools | Analyze" and "PivotTable Tools | Design." For convenience, this book refers to these elements as the Analyze tab and the Design tab, respectively. The Slicer feature has a ribbon tab that Microsoft calls "Slicer Tools | Options." This book refers to this as the Slicer tab. Excel 2013 introduced the "Timeline Tools | Options" tab. This book calls this the Timeline tab.

In some cases, the ribbon icon leads to a drop-down with additional choices. In these cases, the book lists the hierarchy of ribbon, icon, menu choice, and submenu choice. For example, Figure I.7 shows what you would select if the book said "select Design, Report Layout, Repeat All Item Labels."

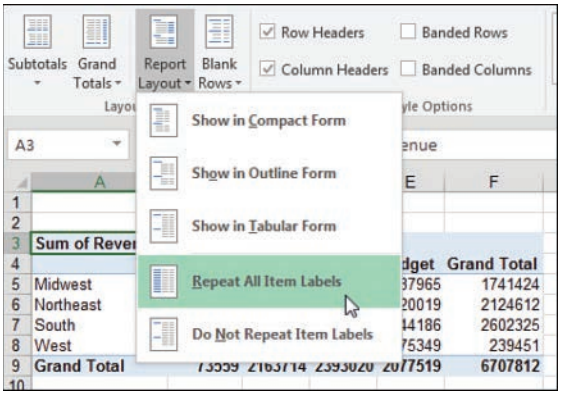


Figure I.7
For shorthand, instructions might say to select Design, Report Layout, Repeat All Item Labels.

Special Elements

This book contains the following special elements:

CASE STUDY

Case studies provide real-world examples involving topics previously introduced in the chapter.

NOTE

Notes provide additional information outside the main thread of the chapter discussion that might be useful for you to know.

TIP

Tips provide quick workarounds and time-saving techniques to help you do your work more efficiently.

CAUTION

Cautions warn you about potential pitfalls you might encounter. Pay attention to cautions because they alert you to problems that could cause you hours of frustration.

Pivot Table Fundamentals

1

IN THIS CHAPTER

Defining a Pivot Table

Imagine that Excel is a large toolbox that contains different tools at your disposal. The pivot table is essentially one tool in your Excel toolbox. If a pivot table were indeed a physical tool that you could hold in your hand, a kaleidoscope would most accurately represent it.

When you look through a kaleidoscope at an object, you see that object in a different way. You can turn the kaleidoscope to move around the details of the object. The object itself doesn't change, and it's not connected to the kaleidoscope. The kaleidoscope is simply a tool you use to create a unique perspective on an ordinary object.

Think of a pivot table as a kaleidoscope that is pointed at a data set. When you look at a data set through a pivot table, you have the opportunity to see details in the data that you might not have noticed before. Furthermore, you can turn your pivot table to see your data from different perspectives. The data set itself doesn't change, and it's not connected to the pivot table. The pivot table is simply a tool you use to create a unique perspective on your data.

A pivot table enables you to create an interactive view of your data set, called a *pivot table report*. With a pivot table report, you can quickly and easily categorize your data into groups, summarize large amounts of data into meaningful information, and perform a variety of calculations in a fraction of the time it takes by hand. But the real power of a pivot table report is that you can use it to interactively drag and drop fields within your report, dynamically change your perspective, and recalculate totals to fit your current view.

1

Why You Should Use a Pivot Table

As a rule, what you do in Excel can be split into two categories:

- Calculating data
- Shaping (formatting) data

Although many built-in tools and formulas facilitate both of these tasks, using a pivot table is often the fastest and most efficient way to calculate and shape data. Let's look at one simple scenario that illustrates this point.

You have just given your manager some revenue information by month, and he has predictably asked for more information. He adds a note to the worksheet and emails it back to you. As you can see in Figure 1.1, he would like you to add a line that shows credits by month.

Figure 1.1
Your manager predictably changes his request after you provide the first pass of a report.

	A	B	C	D	E	F	G	H
1		Jan	Feb	Mar	Apr	May	Jun	Jul
2	Revenues	66,427,076	68,619,453	69,444,496	67,669,316	69,572,075	67,196,220	66,884,7
3	Please add a "credits" line and show the amount of credits for each month							

To meet this new requirement, you run a query from your legacy system that provides the needed data. As usual, the data is formatted specifically to make you suffer. Instead of data by month, the legacy system provides detailed transactional data by day, as shown in Figure 1.2.

Figure 1.2
The data from the legacy system is by day instead of by month.

	A	B	C
1	Document Number	In Balance Date	Credit Amount
2	D29210	01/03/12	(34.54)
3	D15775	01/03/12	(313.64)
4	D46035	01/03/12	(389.04)
5	D45826	01/03/12	(111.56)
6	D69172	01/03/12	(1,630.25)
7	D25388	01/03/12	(3,146.22)
8	D49302	01/03/12	(1,217.37)
9	D91669	01/03/12	(197.44)
10	D14289	01/03/12	(33.75)
11	D38471	01/03/12	(6,759.20)
12	D18645	01/03/12	(214.54)
13	D63807	01/03/12	(19.58)
14	D77943	01/03/12	(136.17)
15	D37446	01/03/12	(128.36)

Your challenge is to calculate the total dollar amount of credits by month and shape the results into an extract that fits the format of the original report. The final extract should look like the data shown in Figure 1.3.

Jan	Feb	Mar	Apr	May	Jun	Jul
-3,695,319	-3,698,537	-3,833,977	-3,624,967	-3,800,526	-3,603,367	-3,746,754

Figure 1.3
Your goal is to produce a summary by month and transpose the data to a horizontal format.

Creating the extract manually would take 18 mouse clicks and 3 keystrokes:

- Format dates to month: 3 clicks
- Create subtotals: 4 clicks
- Extract subtotals: 6 clicks, 3 keystrokes
- Transpose vertical to horizontal: 5 clicks

In contrast, creating the extract with a pivot table would take 9 mouse clicks:

- Create the pivot table report: 5 clicks
- Group dates into months: 3 clicks
- Transpose vertical to horizontal: 1 click

Both methods give you the same extract, which you can paste into the final report, as shown in Figure 1.4.

	A	B	C	D	E	F	G	H
1		Jan	Feb	Mar	Apr	May	Jun	Jul
2	Revenues	66,427,076	68,619,453	69,444,496	67,669,316	69,572,075	67,196,220	66,884,77
3	Credits	-3,695,319	-3,698,537	-3,833,977	-3,624,967	-3,800,526	-3,603,367	-3,746,75
4	Adjusted Revenues	62,731,757	64,920,916	65,610,519	64,044,349	65,771,549	63,592,853	63,138,01

Figure 1.4
After adding credits to the report, you can calculate net revenue.

Advantages of Using a Pivot Table

Using a pivot table to accomplish the task just described not only cuts down the number of actions by more than half but also reduces the possibility of human error. In addition, using a pivot table allows for the quick-and-easy shaping and formatting of the data.

This example shows that using a pivot table is not just about calculating and summarizing your data. Pivot tables can often help you do a number of tasks faster and better than conventional functions and formulas. For example, you can use pivot tables to instantly transpose large groups of data vertically or horizontally. You can use pivot tables to quickly find and count the unique values in your data. You can also use pivot tables to prepare your data to be used in charts.

The bottom line is that pivot tables can help you dramatically increase your efficiency and decrease your errors on a number of tasks you might have to accomplish with Excel. Pivot tables can't do everything for you, but knowing how to use just the basics of pivot table functionality can take your data analysis and productivity to a new level.

When to Use a Pivot Table

Large data sets, ever-changing impromptu data requests, and multilayered reporting are absolute productivity killers if you have to tackle them by hand. Going into hand-to-hand combat with one of these not only is time-consuming, but also opens up the possibility of an untold number of errors in your analysis. So how do you recognize when to use a pivot table before it's too late?

Generally, a pivot table would serve you well in any of the following situations:

- You have a large amount of transactional data that has become increasingly difficult to analyze and summarize in a meaningful way.
- You need to find relationships and groupings within your data.
- You need to find a list of unique values for one field in your data.
- You need to find data trends using various time periods.
- You anticipate frequent requests for changes to your data analysis.
- You need to create subtotals that frequently include new additions.
- You need to organize your data into a format that's easy to chart.

Anatomy of a Pivot Table

Because the anatomy of a pivot table is what gives it its flexibility and, indeed, its ultimate functionality, truly understanding pivot tables would be difficult without understanding their basic structure.

A pivot table is composed of four areas:

- Values area
- Rows area
- Columns area
- Filters area

The data you place in these areas defines both the utility and appearance of the pivot table.

You will go through the process of creating a pivot table in the next chapter, and the following sections prepare you for that by taking a closer look at the four pivot table areas and the functionality around them.

Values Area

The *values area* is shown in Figure 1.5. It is a large rectangular area below and to the right of the headings. In this example, the values area contains a sum of the revenue field.

	A	B	C	D	E	F
1	REGION	(All)				
2						
3	Sum of REVENUE	MONTH				
4	MODEL	January	February	March	April	May
5	2500P	$33,073	$29,104	$25,612	$22,538	$19,834
6	3002C	$35,880	$31,574	$27,785	$24,451	$21,517
7	3002P	$90,258	$79,427	$69,896	$61,508	$54,127
8	4055T	$13,250	$11,660	$10,261	$9,030	$7,946
9	4500C	$100,197	$88,173	$77,593	$68,281	$60,088

Figure 1.5
The heart of the pivot table is the values area. This area typically includes a total of one or more numeric fields.

The values area is the area that calculates. This area is required to include at least one field and one calculation on that field. The data fields you drop here are those you want to measure or calculate. The values area might include Sum of Revenue, Count of Units, and Average of Price.

It is also possible to have the same field dropped in the values area twice but with different calculations. For example, a marketing manager might want to see Minimum of Price, Average Price, and Maximum of Price.

Rows Area

The *rows area*, as shown in Figure 1.6, is composed of the headings that go down the left side of the pivot table.

	A	B	C	D	E	F
1	REGION	(All)				
2						
3	REVENUE	MONTH				
4	MODEL	January	February	March	April	May
5	2500P	$33,073	$29,104	$25,612	$22,538	$19,834
6	3002C	$35,880	$31,574	$27,785	$24,451	$21,517
7	3002P	$90,258	$79,427	$69,896	$61,508	$54,127
8	4055T	$13,250	$11,660	$10,261	$9,030	$7,946
9	4500C	$100,197	$88,173	$77,593	$68,281	$60,088

Figure 1.6
The headings down the left side of the pivot table make up the rows area of the pivot table.

Dropping a field into the rows area displays the unique values from that field down the rows of the left side of the pivot table. The rows area typically has at least one field, although it is possible to have no fields. The example earlier in the chapter where you needed to produce a one-line report of credits is an example where there are no row fields.

The types of data fields you would drop here include those you want to group and categorize—for example, Products, Names, and Locations.

Columns Area

The *columns area* is composed of headings that stretch across the top of columns in the pivot table. In the pivot table in Figure 1.7, the Month field is in the columns area.

Figure 1.7
The columns area stretches across the top of the columns. In this example, it contains the unique list of months in your data set.

	A	B	C	D	E	F
1	REGION	(All)				
2						
3	Sum of REVENUE	MONTH				
4	MODEL	January	February	March	April	May
5	2500P	$33,073	$29,104	$25,612	$22,538	$19,834
6	3002C	$35,880	$31,574	$27,785	$24,451	$21,517
7	3002P	$90,258	$79,427	$69,896	$61,508	$54,127
8	4055T	$13,250	$11,660	$10,261	$9,030	$7,946
9	4500C	$100,197	$88,173	$77,593	$68,281	$60,088

Dropping fields into the columns area would display your items in column-oriented perspective. The columns area is ideal for showing trending over time. The types of data fields you would drop here include those you want to trend or show side by side—for example, Months, Periods, and Years.

Filters Area

The *filters area* is an optional set of one or more drop-downs at the top of the pivot table. In Figure 1.8, the filters area contains the Region field and the pivot table is set to show all regions.

Figure 1.8
Filter fields are great for quickly filtering a report. The Region drop-down in cell B1 enables you to print this report for one particular region manager.

	A	B	C	D	E	F
1	REGION	(All)				
2						
3	Sum of REVENUE	MONTH				
4	MODEL	January	February	March	April	May
5	2500P	$33,073	$29,104	$25,612	$22,538	$19,834
6	3002C	$35,880	$31,574	$27,785	$24,451	$21,517
7	3002P	$90,258	$79,427	$69,896	$61,508	$54,127
8	4055T	$13,250	$11,660	$10,261	$9,030	$7,946
9	4500C	$100,197	$88,173	$77,593	$68,281	$60,088

Dropping fields into the filters area would enable you to filter the data items in your fields. The filters area is optional and comes in handy when you need to filter your results dynamically. The types of data fields you would drop here include those you want to isolate and focus on—for example, Regions, Line of Business, and Employees.

Pivot Tables Behind the Scenes

It's important to know that pivot tables come with a few file space and memory implications for your system. To get an idea of what this means, let's look at what happens behind the scenes when you create a pivot table.

When you initiate the creation of a pivot table report, Excel takes a snapshot of your data set and stores it in a *pivot cache*, which is a special memory subsystem where your data source is duplicated for quick access. Although the pivot cache is not a physical object you can see, you can think of it as a container that stores a snapshot of the data source.

CAUTION

Any changes you make to your data source are not picked up by your pivot table report until you take another snapshot of the data source or "refresh" the pivot cache. Refreshing is easy: Simply right-click the pivot table and click Refresh Data. You can also click the large Refresh button on the Options tab.

The benefit of working against the pivot cache and not your original data source is optimization. Any changes you make to the pivot table report, such as rearranging fields, adding new fields, or hiding items, are made rapidly and with minimal overhead.

Pivot Table Backward Compatibility

With Excel 2007, Microsoft introduced a dramatic increase in the number of rows and columns allowed in one worksheet. This increase in limits led to the creation of a new Excel file type: .xlsx. The.xlsx file type not only allows for more rows and columns than the legacy .xls files (used by Excel 2003 and prior versions), but also comes with limitation increases in many areas, including pivot tables.

Table 1.1 highlights the pivot table limits in both .xls and .xlsx file types. Whereas some of these limitations remain constant, others are highly dependent on available system memory.

Table 1.1 Pivot Table Limitations

Category	.xls Files	.xlsx Files
Number of row fields	Limited by available memory	1,048,576 (could be limited by available memory)
Number of column fields	256	16,384
Number of page fields	256	16,384
Number of data fields	256	16,384
Number of unique items in a single pivot field	32,500	1,048,576 (could be limited by available memory)
Number of calculated items	Limited by available memory	Limited by available memory
Number of pivot table reports on one worksheet	Limited by available memory	Limited by available memory

A Word About Compatibility

As you can imagine, the extraordinary increases in pivot table limitations lead to some serious compatibility questions. For instance, what if you create a pivot table that contains more than 256 column fields and more than 32,500 unique data items? How are users with previous versions of Excel affected by this? Luckily, Excel allows for some precautionary measures that can help you avoid compatibility issues.

The first precautionary measure is Compatibility mode. Compatibility mode is a state that Excel automatically enters when opening an .xls file. When Excel is in Compatibility mode, it artificially takes on the limitations of Excel 2003. This means that while you are working with an .xls file, you cannot exceed any of the .xls file pivot table limitations shown in Table 1.1. This effectively prevents you from unwittingly creating a pivot table that is not compatible with previous versions of Excel. If you want to get out of Compatibility mode, you have to save the .xls file as one of Excel's newer .xlsx or .xslm file formats (.xlsm files are macro-enabled Excel files).

> **CAUTION**
>
> Beware of the Convert option found under the Info section of the File menu. Although this command is designed to convert a previous file from Excel 2003 to Excel 2013, it actually deletes the Excel 2003 copy of the file.

The second precautionary measure is Excel's Compatibility Checker. The Compatibility Checker is a built-in tool that checks for any compatibility issues when you try to save an Excel workbook as an .xls file. If your pivot table exceeds the bounds of .xls file limitations, the Compatibility Checker alerts you with a dialog similar to the one shown in Figure 1.9.

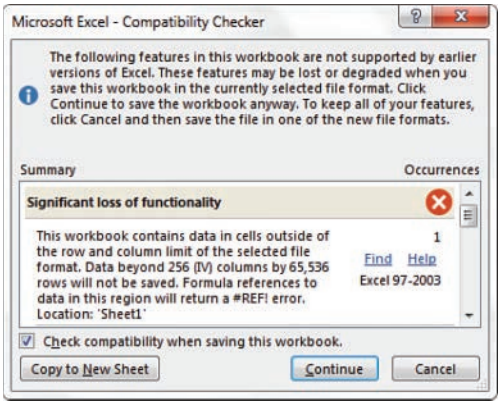


Figure 1.9
The Compatibility Checker alerts you about any compatibility issues before you save to a previous version of Excel.

With this dialog, Excel gives you the option of saving your pivot data as hard values in the new .xls file. If you choose to do so, the data from your pivot table is saved as hard values, but the pivot table object and the pivot cache are lost.

NOTE

For information on Excel's compatibility tools, pick up Que Publishing's *Special Edition Using Microsoft Excel 2016*, by Bill Jelen.

Next Steps

In the next chapter, you'll learn how to prepare your data to be used by a pivot table. Chapter 2, "Creating a Basic Pivot Table," also walks through creating your first pivot table report using the Pivot Table Wizard.

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Creating a Basic Pivot Table

2

IN THIS CHAPTER

Preparing Data for Pivot Table Reporting

When you have a family portrait taken, the photographer takes time to make sure that the lighting is right, the poses are natural, and everyone smiles his or her best smile. This preparation ensures that the resulting photo is effective in its purpose.

When you create a pivot table report, you're the photographer, taking a snapshot of your data. By taking time to make sure your data looks its best, you can ensure that your pivot table report is effective in accomplishing the task at hand.

One of the benefits of working in a spreadsheet is that you have the flexibility of laying out your data to suit your needs. Indeed, the layout you choose depends heavily on the task at hand. However, many of the data layouts used for presentations are not appropriate when used as the source data for a pivot table report.

TIP

As you read the following pages, which discuss preparing your data, keep in mind that pivot tables have only one hard rule pertaining to the data source: The data source must have column headings, which are labels in the first row of the data that describe the information in each column. Without column headings, you cannot create a pivot table report.

However, just because a pivot table report is created successfully does not mean that it's effective. A host of things can go wrong as a result of bad data preparation—from inaccurate reporting to problems with grouping and sorting.

Let's look at a few of the steps you can take to ensure that you end up with a viable pivot table report.

Ensuring That Data Is in a Tabular Layout

A perfect layout for the source data in a pivot table is a tabular layout. In tabular layout, there are no blank rows or columns. Every column has a heading. Every field has a value in every row. Columns do not contain repeating groups of data.

Figure 2.1 shows an example of data structured properly for a pivot table. There are headings for each column. Even though the values in D2:D6 are all the same model, the model number appears in each cell. Month data is organized down the page instead of across the columns.

Figure 2.1
This data is structured properly for use as a pivot table source.

	A	B	C	D	E	F
1	REGION	MARKET	STORE	MODEL	MONTH	REVENUE
2	North	Great Lakes	65061011	4055T	April	$2,354
3	North	Great Lakes	65061011	4055T	February	$3,040
4	North	Great Lakes	65061011	4055T	January	$3,454
5	North	Great Lakes	65061011	4055T	March	$2,675
6	North	Great Lakes	65061011	4055T	May	$2,071
7	North	New England	2105015	2500P	April	$11,851
8	North	New England	2105015	2500P	February	$15,304
9	North	New England	2105015	2500P	January	$17,391
10	North	New England	2105015	2500P	March	$13,468
11	North	New England	2105015	2500P	May	$10,429
12	North	New England	22022012	3002C	April	$256
13	North	New England	22022012	3002C	February	$330
14	North	New England	22022012	3002C	January	$375

Tabular layouts are *database centric*, meaning you would most commonly find these types of layouts in databases. These layouts are designed to store and maintain large amounts of data in a well-structured, scalable format.

> **TIP**
> You might work for a manager who demands that the column labels be split into two rows. For example, he might want the heading Gross Margin to be split, with Gross in row 1 and Margin in row 2. Because pivot tables require a unique heading one row high, your manager's preference can be problematic. To overcome this problem, start typing your heading; for example, type **Gross**. Before leaving the cell, press Alt+Enter and then type **Margin**. The result is a single cell that contains two lines of data.

Avoiding Storing Data in Section Headings

Examine the data in Figure 2.2. This spreadsheet shows a report of sales by month and model for the North region of a company. Because the data in rows 2 through 24 pertains to the North region, the author of the worksheet entered the title North as a single cell in C1. This approach is effective for display of the data, but it's not effective for a pivot table data source.

Figure 2.2
Region and model data are not formatted properly in this data set.

	A	B	C
1			North
2	Model 2500P	January	33,073
3		February	35,880
4		March	90,258
5		April	13,250
6		May	100,197
8	Model 3002P	January	29,104
9		February	31,574
10		March	79,427
11		April	11,660
12		May	88,173
14	Model 4055T	January	35,880
15		February	25,612
16		March	27,785
17		April	69,896
18		May	10,261
20	Model 4500T	January	33,073
21		February	25,612
22		March	27,785
23		April	69,896
24		May	10,261

Also in Figure 2.2, the author was very creative with the model information. The data in rows 2 through 6 applies to Model 2500P, so the author entered this value once in A2 and then applied a fancy vertical format combined with Merge Cells to create an interesting look for the report. Again, although this is a cool format, it is not useful for pivot table reporting.

Also, the worksheet in Figure 2.2 is missing column headings. You can guess that column A is Model, column B is Month, and column C is Sales, but for Excel to create a pivot table, this information must be included in the first row of the data.

Avoiding Repeating Groups as Columns

The format shown in Figure 2.3 is common. A time dimension is presented across several columns. Although it is possible to create a pivot table from this data, this format is not ideal.

Figure 2.3
This matrix format is common but not effective for pivot tables. The Month field is spread across several columns of the report.

	A	B	C	D	E	F	G	H
1								
2	North	MODEL	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE
3		4054T	$2,789	$2,454	$2,160	$1,901	$1,673	$1,472
4		4500C	$32,605	$28,692	$25,249	$22,219	$19,553	$17,207
5		3002P	$52,437	$46,145	$40,607	$35,734	$31,446	$27,673
6		2500P	$17,391	$15,304	$13,468	$11,851	$10,429	$9,178
7		4055T	$2,468	$2,172	$1,911	$1,682	$1,480	$1,302
8		3002C	$375	$330	$290	$256	$225	$198

The problem is that the headings spread across the top of the table pull double duty as column labels and actual data values. In a pivot table, this format would force you to manage and maintain six fields, each representing a different month.

Eliminating Gaps and Blank Cells in the Data Source

Delete all empty columns within your data source. An empty column in the middle of your data source causes your pivot table to fail on creation because the blank column, in most cases, does not have a column name.

Delete all empty rows within your data source. Empty rows may cause you to inadvertently leave out a large portion of your data range, making your pivot table report incomplete.

Fill in as many blank cells in your data source as possible. Although filling in cells is not required to create a workable pivot table, blank cells are generally errors waiting to happen. So a good practice is to represent missing values with some logical missing value code wherever possible.

> **NOTE** Although eliminating gaps and blank cells might seem like a step backward for those of you who are trying to create a nicely formatted report, it pays off in the end. When you are able to create a pivot table, there will be plenty of opportunities to apply some pleasant formatting.

> **NOTE** In Chapter 3, "Customizing a Pivot Table," you'll discover how to apply styles formatting to your pivot tables.

Applying Appropriate Type Formatting to Fields

Formatting fields appropriately helps you avoid a whole host of possible issues, from inaccurate reporting to problems with grouping and sorting.

Make certain that any fields to be used in calculations are explicitly formatted as a number, currency, or any other format appropriate for use in mathematical functions. Fields containing dates should also be formatted as any one of the available date formats.

Summary of Good Data Source Design

The attributes of an effective tabular design are as follows:

- The first row of your data source is made up of field labels or headings that describe the information in each column.
- Each column in your data source represents a unique category of data.
- Each row in your data source represents individual items in each column.
- None of the column names in your data source double as data items that will be used as filters or query criteria (that is, names of months, dates, years, names of locations, or names of employees).

CASE STUDY: CLEANING UP DATA FOR PIVOT TABLE ANALYSIS

The worksheet shown in Figure 2.4 is a great-looking report. However, it cannot be effectively used as a data source for a pivot table. Can you identify the problems with this data set?

Figure 2.4
Someone spent a lot of time formatting this report to look good, but what problems prevent it from being used as a data source for a pivot table?

	A	B	C	D	E	F	G
1	Region	Market		Jan	Feb	Mar	Apr
2	Bar Equipment						
3	Midwest	Chicago		132	106	110	90
4		Kansas City		413	504	2,571	505
5		Omaha		332	543	372	424
6	North	Dakotas		130	136	106	90
7		Great Lakes		488	445	4,140	517
8							
9	Commercial Appliances						
10	Midwest	Chicago		780	76	851	76
11		Kansas City		3,352	76	8,442	2,831
12		Omaha		228	17,628	76	304
13	North	Dakotas		0	0	2,608	0
14		Great Lakes		990	76	11,435	76
15							
16	Concession Equipment						
17	Midwest	Chicago		808	0	3,912	0
18		Kansas City		824	1,761	11,181	1,616
19		Omaha		0	8,147	2,968	3,118
20	North	Dakotas		0	0	5,463	2,370
21		Great Lakes		751	808	13,814	1,632

These are the four problems with the data set and the fixes needed to get the data set pivot table ready:

- The model information does not have its own column. Product category information appears in the Region column. To correct this problem, insert a new column titled Product Category and include the category name on every row.
- There are blank columns and rows in the data. Column C should be deleted. The blank rows between models (such as rows 8 and 15) also should be deleted.
- Blank cells present the data in an outline format. The person reading this worksheet would probably assume that cells A4:A5 fall into the Midwest region. These blank cells need to be filled in with the values from above.

> **TIP**
> Here's a trick for filling in the blank cells. Select the entire range of data. Then select the Home tab on the ribbon and choose the Find & Select icon from the Editing group. This brings up a menu from which you select Go To Special. In the Go To Special dialog, select Blanks. With all the blank cells selected, start a formula by typing the equal sign (=), press the up arrow on your keyboard, and then press Ctrl+Enter to fill this formula in all blank cells. Remember to select the entire range of data again and copy/paste special values in order to convert the formulas to values.

- The worksheet presents the data for each month in several columns (one column per month). Columns D through G need to be reformatted as two columns. Place the month name in one column and the units for that month in the next column. This step either requires a fair amount of copying and pasting or a few lines of VBA macro code.

TIP

For a great book on learning VBA macro programming, read Que Publishing's *VBA and Macros for Microsoft Excel 2016* by Bill Jelen and Tracy Syrstad.

After you make the four changes described here, the data is ready for use as a pivot table data source. As you can see in Figure 2.5, each column has a heading. There are no blank cells, rows, or columns in the data. The monthly data is now presented down column E instead of across several columns.

Figure 2.5
Although this data will take up six times as many rows, it is perfectly formatted for pivot table analysis.

	A	B	C	D	E
1	Product Category	Region	Market	Month	Units
2	Bar Equipment	Midwest	Chicago	Jan	132
3	Bar Equipment	Midwest	Kansas City	Jan	413
4	Bar Equipment	Midwest	Omaha	Jan	332
5	Bar Equipment	North	Dakotas	Jan	130
6	Bar Equipment	North	Great Lakes	Jan	488
7	Commercial Appliances	Midwest	Chicago	Jan	780
8	Commercial Appliances	Midwest	Kansas City	Jan	3,352
9	Commercial Appliances	Midwest	Omaha	Jan	228
10	Commercial Appliances	North	Dakotas	Jan	0
11	Commercial Appliances	North	Great Lakes	Jan	990
12	Concession Equipment	Midwest	Chicago	Jan	808
13	Concession Equipment	Midwest	Kansas City	Jan	824
14	Concession Equipment	Midwest	Omaha	Jan	0
15	Concession Equipment	North	Dakotas	Jan	0
16	Concession Equipment	North	Great Lakes	Jan	751
17	Bar Equipment	Midwest	Chicago	Feb	106
18	Bar Equipment	Midwest	Kansas City	Feb	504

How to Create a Basic Pivot Table

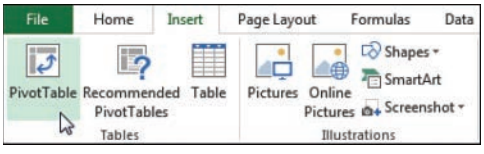
Now that you have a good understanding of the importance of a well-structured data source, let's walk through creating a basic pivot table.

NOTE

The sample data set used throughout this book is available for download at `www.mrexcel.com/pivotbookdata2016.html`.

To ensure that the pivot table captures the range of your data source by default, click any single cell in your data source. Next, select the Insert tab and find the Tables group. In the Tables group, select PivotTable and then choose PivotTable from the drop-down list. Figure 2.6 demonstrates how to start a pivot table.

Figure 2.6
Start a pivot table by selecting PivotTable from the Insert tab.



Choosing these options activates the Create PivotTable dialog, shown in Figure 2.7.

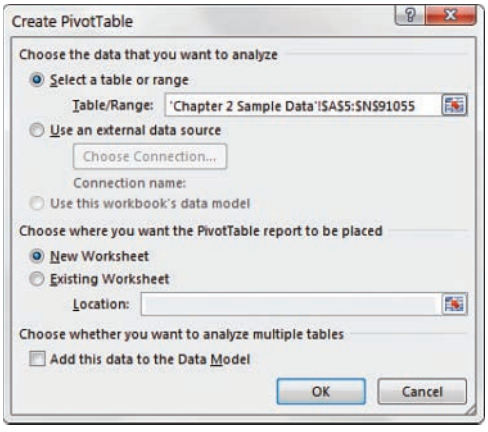


Figure 2.7
The Create PivotTable dialog.

TIP

You can also press the shortcut Alt+N+V to start a pivot table.

As you can see in Figure 2.7, the Create PivotTable dialog asks you only two fundamental questions: Where's the data that you want to analyze? and Where do you want to put the pivot table? Here's how you handle these two sections of the dialog:

- **Choose the Data That You Want to Analyze—**In this section, you tell Excel where your data set is. You can specify a data set that is located within your workbook, or you can tell Excel to look for an external data set. As you can see in Figure 2.7, Excel is smart enough to read your data set and fill in the range for you. However, you always should take note of the range Excel selects to ensure that you are capturing all your data.
- **Choose Where You Want the PivotTable Report to Be Placed—**In this section, you tell Excel where you want your pivot table to be placed. This is set to New Worksheet by default, meaning that your pivot table will be placed in a new worksheet within the current workbook. You will rarely change this setting because there are relatively few times you'll need your pivot table to be placed in a specific location.

NOTE

Note the presence of another option in the Create PivotTable dialog shown in Figure 2.7: the Add This Data to the Data Model option. You would select this option if you were trying to consolidate multiple data sources into one single pivot table.

The Add This Data to the Data Model option is covered this option in detail in Chapter 7, "Analyzing Disparate Data Sources with Pivot Tables," and in Chapter 10, "Mashing Up Data with Power Pivot."

In this chapter, we'll keep it basic by covering the steps to create a pivot table from using a single source, which means you can ignore this particular option.

After you have answered the two questions in the Create PivotTable dialog, simply click the OK button. At this point, Excel adds a new worksheet that contains an empty pivot table report. Next to that is the PivotTable Fields list, shown in Figure 2.8. This pane helps you build your pivot table.

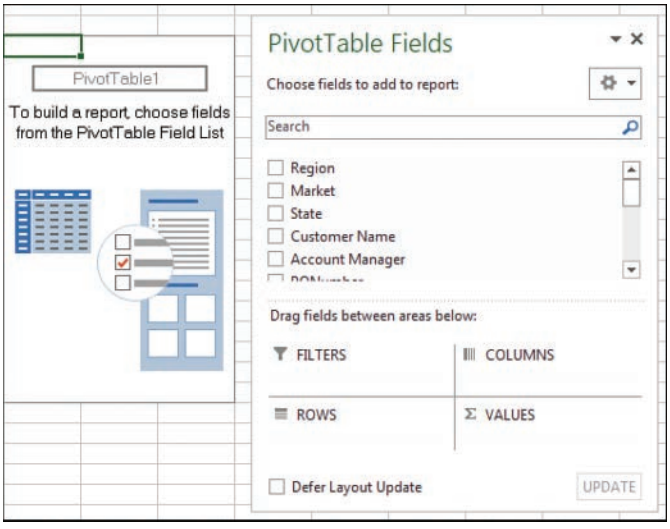


Figure 2.8
You use the PivotTable Fields list to build a pivot table.

FINDING THE PIVOTTABLE FIELDS LIST

The PivotTable Fields list is your main work area in Excel 2016. This is the place where you add fields and make changes to a pivot table report. By default, this pane pops up when you place your cursor anywhere inside a pivot table. However, if you explicitly close this pane, you override the default and essentially tell the pane not to activate when you are in the pivot table.

If clicking on the pivot table does not activate the PivotTable Fields list, you can manually activate it by right-clicking anywhere inside the pivot table and selecting Show Fields list. You can also click anywhere inside the pivot table and then choose the large Fields List icon on the Analyze tab under PivotTable Tools in the ribbon.

Adding Fields to a Report

You can add the fields you need to a pivot table by using the four "areas" found in the PivotTable Fields list: Filters, Columns, Rows, and Values. These areas, which correspond to the four areas of the pivot table, are used to populate your pivot table with data:

NOTE

Review Chapter 1, "Pivot Table Fundamentals," for a refresher on the four areas of a pivot table.

- **Filters**—Adding a field to the Filters area enables you to filter on its unique data items. In previous versions of Excel, this area was known as the Report Filters area.
- **Columns**—Adding a field into the Columns area displays the unique values from that field across the top of the pivot table.
- **Rows**—Adding a field into the Rows area displays the unique values from that field down the left side of the pivot table.
- **Values**—Adding a field into the Values area includes that field in the values area of your pivot table, allowing you to perform a specified calculation using the values in the field.

Fundamentals of Laying Out a Pivot Table Report

Now let's pause a moment and go over some fundamentals of laying out a pivot table report. This is generally the point where most new users get stuck. How do you know which field goes where?

Before you start dropping fields into the various areas, answer two questions: "What am I measuring?" and "How do I want to see it?" The answer to the first question tells you which fields in your data source you need to work with, and the answer to the second question tells you where to place the fields.

Say that in this case, you want to measure the dollar sales by region. This automatically tells you that you need to work with the Sale Amount field and the Region field. How do you want to see it? You want regions to go down the left side of the report and the sales amount to be calculated next to each region.

To achieve this effect, you need to add the Region field to the Rows area and add the Sale Amount field to the Values area.

Find the Region field in the PivotTable Fields list, and place a check in the check box next to it. As you can see in Figure 2.9, not only is the field automatically added to the Rows area, but your pivot table is updated to show the unique region names.

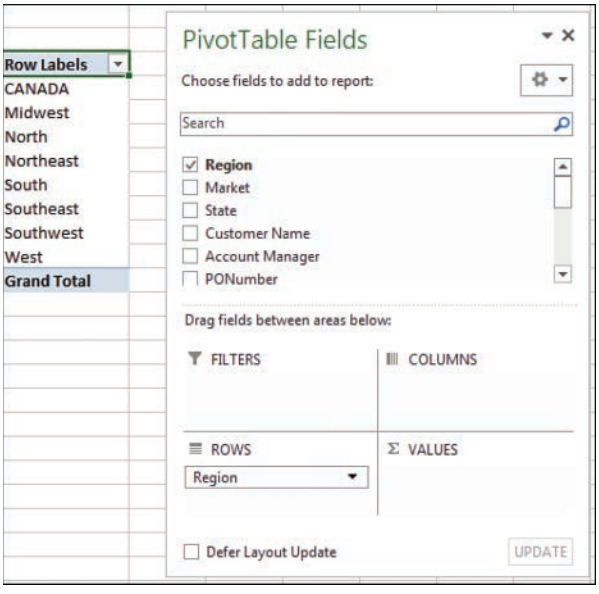


Figure 2.9
Place a check next to the Region field to automatically add that field to your pivot table.

Now that you have regions in your pivot table, it's time to add in the dollar sales. To do that, simply find the Sale Amount field and place a check next to it. As Figure 2.10 illustrates, the Sale Amount field is automatically added to the Values area, and your pivot table report now shows the total dollar sales for each region.

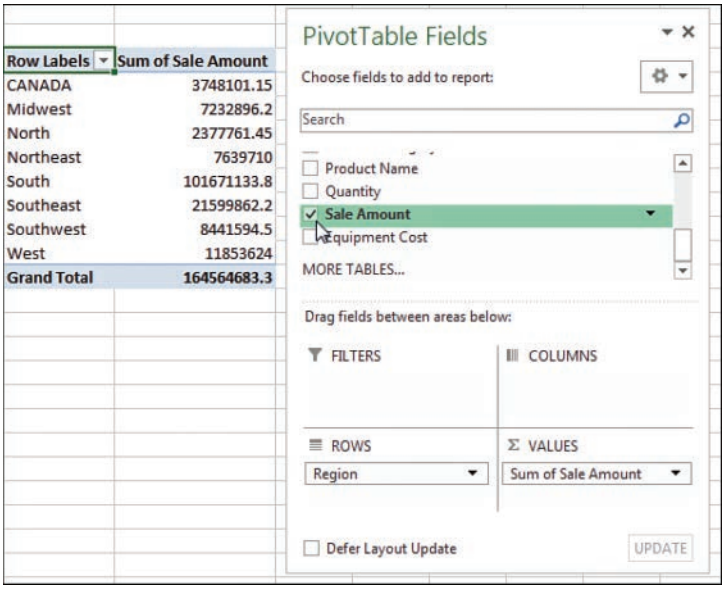


Figure 2.10
Place a check next to the Sale Amount field to add data to your pivot table report.

At this point, you have already created your first pivot table report!

HOW DOES EXCEL KNOW WHERE YOUR FIELDS GO?

As you've just experienced, the PivotTable Fields list interface enables you to add fields to your pivot table by simply placing a check next to each field name. Excel automatically adds the checked fields to the pivot table. But how does Excel know which area to use for a field you check? The answer is that Excel doesn't really know which area to use, but it makes a decision based on data type. Here's how it works: When you place a check next to a field, Excel evaluates the data type for that field. If the data type is numeric, Excel places the field into the Values area; otherwise, Excel places the field into the Rows area. This placement obviously underlines the importance of correctly assigning the data types for your fields.

CAUTION

Watch out for blanks in your numeric fields. If you have even one blank cell in a numeric field, Excel reads that cell as a Text field and therefore places it in the Rows area!

Adding Layers to a Pivot Table

Now you can add another layer of analysis to your report. Say that now you want to measure the amount of dollar sales each region earned by product category. Because your pivot table already contains the Region and Sales Amount fields, all you have to do is place a