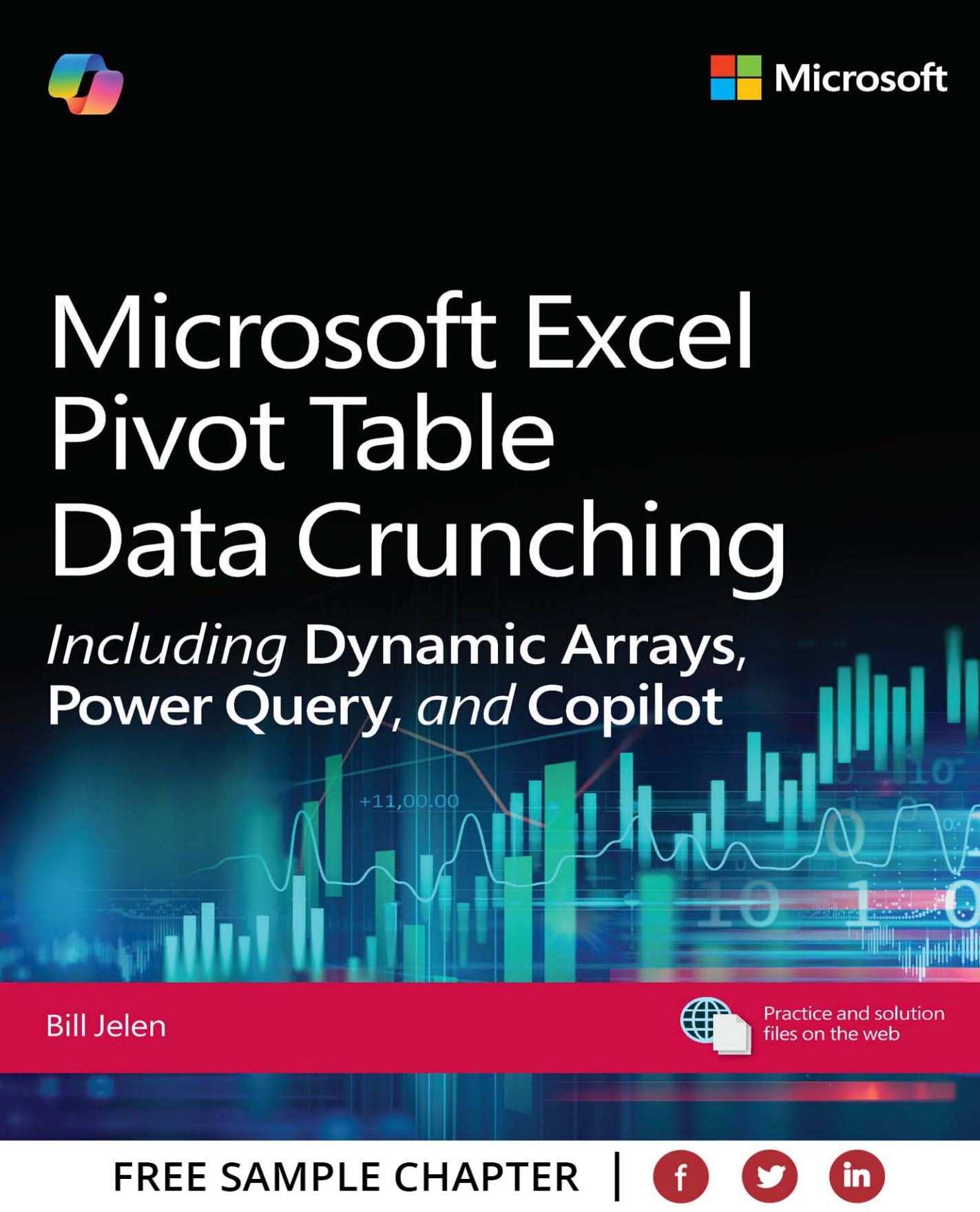
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Microsoft Excel Pivot Table Data Crunching

Including Dynamic Arrays, Power Query, and Copilot

Bill Jelen

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Microsoft Pivot Table Data Crunching: Including Dynamic Arrays, Power Query, and Copilot

Bill Jelen

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Dedication

To Kim Sekas and Stacie Fuss from my morning workout crew in the Supernatural VR headset. Any time that I started posting irrelevant Excel analyses, they would remind me that I had chapters to update.

—Bill Jelen

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Introduction

The pivot table is the single most powerful tool 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. The Power Query tools that debuted between Excel 2013 and Excel 2016 come close to the power of a pivot table. You will see some Power Query examples in Chapter 17, "Pivoting without a pivot table using formulas, Python, or Power Query," and Chapter 18, "Unpivoting in Power Query."

What you will learn from this book

It is widely agreed that close to 60 percent of Excel customers leave 80 percent of Excel untouched—that is, most people 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 30 years, they remain one of the most underused 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 received 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.

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What is new in Microsoft Excel's pivot tables

Microsoft introduced two new array functions to make it easier to replicate a pivot table using a formula: PIVOTBY and GROUPBY. One advantage of formulas over pivot tables is that formulas will automatically recalculate when the underlying data changes. There are times when you are creating dashboards for the manager three levels up, and you really can't count on them to know to click the Refresh button on the pivot table menu. In these cases, the PIVOTBY function can make sure your dashboard is up to date.

For several years, Microsoft offered the Analyze Data feature where you could often create a pivot table just by asking a question about your data. The Analyze Data feature is tested and reliable and will always produce a reliable result. For this edition of the book, a brand new Copilot feature is available in Excel. You have to pay extra. It will often produce a report as accurate as the same report as Analyze Data. However, it will sometimes produce the wrong report or an inaccurate report. At the very least, having Copilot on the other side of a paywall should make you appreciate the superior Analyze Data feature that is freely available in Microsoft 365.

You can now create a pivot table while using Excel Online. It does not offer all the features of Excel for Windows, but being able to create a pivot table in Excel Online is a giant leap for the online version of Excel. It was just few years ago that I wrote in the previous edition of this book that Excel Online would never allow you to create pivot tables, and now, they do it. You can't tweak them like you can in Windows, but you can create pivot tables.

Office 365 offers a new Analyze Data feature that is powered by Artificial Intelligence. Select a data set with up to 250,000 cells and ask Excel to analyze the data. Excel will suggest about 30 interesting analyses, including several pivot tables.

The Analyze Data feature allows you to ask a question about your data. There is a fairly high chance that the answer will be provided as a pivot table or a pivot chart. So, Analyze Data and Ask a Question become new entry points for creating pivot tables.

If you missed the 2019 edition of this book, these features were new since Excel 2016:

- You can specify default settings for all future pivot tables.
- The automatic date grouping introduced in Excel 2016 pivot tables can now be turned off. A mix of empty cells and numeric cells will be treated like a numeric column and will default to Sum instead of Count.
- Power Pivot is now included in all Windows versions of Excel 2019 and Office 365.

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Case study: Life without pivot tables

Say that your manager asks you to create a one-page summary of a sales database. They 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.

This sample data set (included with the download files for the book—see page xxxii)—has headings in row 1, data in rows 2 through 564, and columns in column A through column I.

First, you have to get a sorted, unique list of products down the left side of the summary report and a sorted, unique list of products across the top. In the past, this might involve an Advanced Filter or the Remove Duplicates command. But today, it is easiest with a formula.

1. Enter =SORT(UNIQUE(B2:B564)) in cell K2. You will have a list of the unique region names spilling to K2:K5.
2. To get a list of unique products across the top of the report, enter =TRANSPOSE (SORT(UNIQUE(C2:C564))) in cell L1.

At this point, with 57 keystrokes, you've built the shell of the final report, but there are no numbers inside yet (see Figure I-1).

	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Region	Product	Date	Customer	Quantity	Revenue	COGS	Profit			Doodads	Gadget	Gizmo	Widget
2	Midwest	Gizmo	1/1/2029	Ford	1000	22810	10220	12590		Midwest				
3	Northeast	Gadget	1/2/2029	Verizon	100	2257	984	1273		Northeast				
4	South	Gizmo	1/4/2029	Valero Energy	400	9152	4088	5064		South				
5	Midwest	Gadget	1/4/2029	Cardinal Hea	800	18552	7872	10680		West				

FIGURE I-1 It took 57 keystrokes to get to this point.

Next, you need to build a SUMIFS function to total the revenue for each Region and Product. As shown in Figure I-2, the formula =SUMIFS(G2:G564,B2:B564,K2#,C2:C564,L1#) does the trick. It takes 40 characters plus the Enter key to finish the formula.

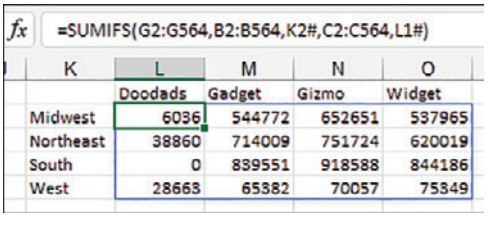

FIGURE I-2 Before Dynamic Arrays were introduced, the formula in L2 would have needed dollar signs and then been copied to all 16 cells showing numbers.

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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+= (that is, Alt and the equal sign key), you can add the total formula in three keystrokes.

With this method, which takes 110 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 110 operations.

K	L	M	N	O	P
	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

FIGURE I-3 A mere 110 operations later, you have a summary report.

You hand the report to your manager. Within a few minutes, they come 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.

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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 use a pivot table instead. Excel 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. Scroll through the list of suggested pivot tables, looking for one with Revenue, Product, and Region. You might have to click See All 10 Results below the fourth suggestion. As shown in Figure I-4, you could choose either Revenue By Region And Product or Revenue By Product And Region. Either one is fine. Choose the + Existing Sheet button beneath Revenue By Region And Product.
3. Excel will ask you to specify a starting cell for the pivot table. It is a good idea to leave a blank column to the right of your data and then have the pivot table start in cell K2. The initial pivot table will have both Region and Product in the first column of the pivot table. Your goal is to have the products appear along the top of the pivot table.
4. Drag the Product field from the Rows area to the Columns area (see Figure I-5).

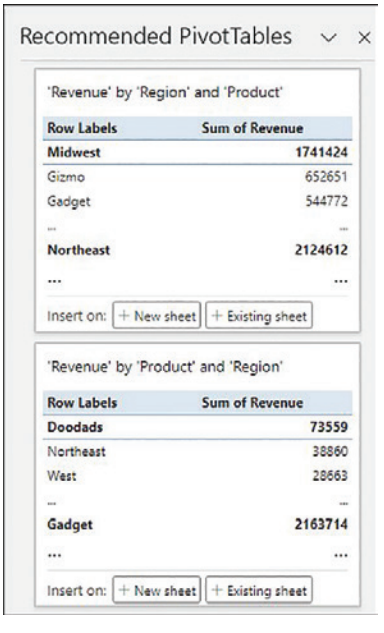

FIGURE I-4 Choose a recommended pivot table that is as close as you will get to the desired report.

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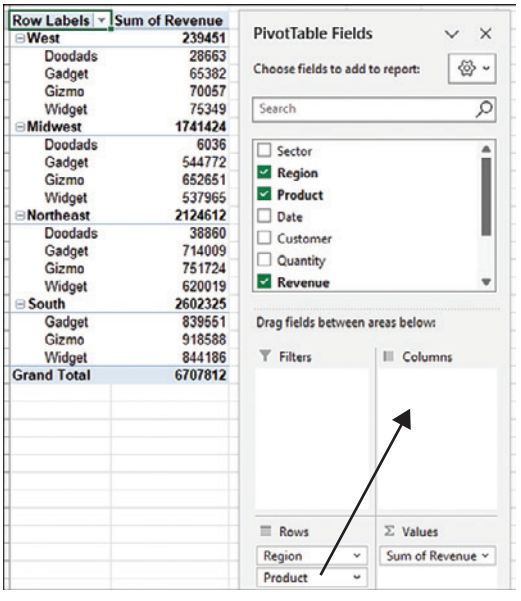

FIGURE I-5 To finish the report, drag the Product heading to the Columns area.

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

3	Sum of Revenue	Product				
4	Region	Doodads	Gadget	Gizmo	Widget	Grand Total
5	West	28663	65382	70057	75349	239451
6	Midwest	6036	544772	652651	537965	1741424
7	Northeast	38860	714009	751724	620019	2124612
8	South	0	839551	918588	844186	2602325
9	Grand Total	73559	2163714	2393020	2077519	6707812

FIGURE I-6 It took a few clicks to create this report.

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 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. Then, click OK and click Manufacturing.)
- Could you show profit instead of revenue? (10 seconds: Clear the Revenue check-box and select the Profit checkbox.)

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- Could you copy this report for each of the customers? (30 seconds: Move Customer to Report Filter, open the tiny dropdown next to the Options button, choose Show Report Filter Pages, and click OK. For more details, see Tip 17: Use a pivot table to explode a data set to different tabs in Chapter 14).

Creating a pivot table using Artificial Intelligence

The new Analyze Data tool uses artificial intelligence to analyze a data set. You can type a question in natural language, and Excel will create a pivot table.

With one cell in your data set selected, choose the Analyze Data command on the right side of the Home tab. The Analyze Data pane appears with several suggested analyses. In the Ask a Question box at the top, type **Revenue by Product and Region as Table** and press Enter.

Excel will draw a thumbnail of your report. Click +Insert PivotTable at the bottom of the thumbnail.

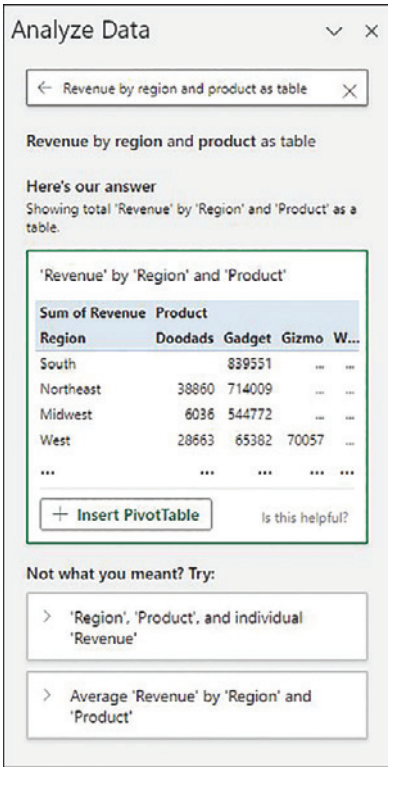

FIGURE I-7 Slightly more typing, but certainly easier to create.

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Who this book is for

This book is a comprehensive-enough reference for hard-core analysts yet relevant to casual users of Excel.

We assume that you are comfortable navigating in Excel and that you have some large data sets that you need to summarize.

How this book is organized

The bulk of the book covers how to use pivot tables in the Excel user interface. Chapter 10, "Unlocking features with the Data Model and Power Pivot," delves into the Power Pivot window. Chapter 13, "Using VBA or TypeScript to create pivot tables," describes how to create pivot tables in Excel's powerful VBA macro language. Chapter 18, "Using Artificial Intelligence and Copilot for Building Pivot Tables, describes using artificial intelligence and Copilot to create analyses. Anyone 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.

About the companion content

The download files for this book include all of the data sets used to produce the book, so you can practice the concepts in the book. For access to these companion files, and other resources, visit *MicrosoftPressStore.com/register*, sign in or create a new account, and register ISBN 9780135408797 by December 31, 2027.

System requirements

You need the following software and hardware to build and run the code samples for this book:

You will need Microsoft Excel running on a Windows computer. (Yes, Excel runs on an iPad, on an Android tablet, but none of those are going to support the creation of pivot tables anytime soon.) For people using Excel on a Mac, some of the basic pivot table concepts will apply. Power Query and Power Pivot will not run on a Mac. For people using Excel Online, you can make many of the pivot tables in this book, but you won't be able to do as much formatting.

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Compact versus tabular layout

Microsoft changed the default layout of pivot tables in 2007 to something that it calls Compact layout. For various reasons that I will explain here, I am not a fan of Compact layout and have changed settings in Excel options so that my pivot tables are created in Tabular layout. As you work through this book, it will help if you can quickly recognize the contrast between how Compact and Tabular layouts show the same data.

In Figure I-8, columns N:Q show a traditional pivot table in tabular layout. Each of the three row fields appears in a different column with meaningful headings such as Region, Product, and Sector.

In contrast, columns S:T show the same data in compact layout. The meaningful headings from N2:P2 are replaced by a single heading of "Row Labels" in S2. The values for Region, Product, and Sector are intermingled in column S with a different indent level showing if you are looking at a region, product name, or sector name.

	N	O	P	Q	R	S	T
2	Region	Product	Sector	Sum of Revenue		Row Labels	Sum of Revenue
3	West	Widget	Energy	26406		West	239451
4	West	Widget	Financial	13853		Widget	75349
5	West	Widget	Manufacturing	17840		Energy	26406
6	West	Widget	Retail	17250		Financial	13853
7	West	Widget Total		75349		Manufacturing	17840
8	West	Gizmo	Energy	7032		Retail	17250
9	West	Gizmo	Financial	19544		Gizmo	70057
10	West	Gizmo	Manufacturing	25861		Energy	7032
11	West	Gizmo	Retail	17620		Financial	19544
12	West	Gizmo Total		70057		Manufacturing	25861
13	West	Gadget	Energy	20610		Retail	17620
14	West	Gadget	Financial	26484		Gadget	65382
15	West	Gadget	Healthcare	2358		Energy	20610
16	West	Gadget	Manufacturing	11550		Financial	26484
17	West	Gadget	Retail	4380		Healthcare	2358
18	West	Gadget Total		65382		Manufacturing	11550
19	West	Doodads	Healthcare	28663		Retail	4380
20	West	Doodads Total		28663		Doodads	28663
21	West Total			239451		Healthcare	28663
22	Midwest	Gizmo	Consumer Goods	61125		Midwest	1741424
23	Midwest	Gizmo	Healthcare	17728		Gizmo	652651

FIGURE I-8 The Row Labels heading in S2 is the clue that your pivot tables are defaulting to Compact layout.

My irritation with the Compact layout is how Excel mixes Regions, Products, and Sectors in column S. Any human reading the report can tell the difference by noticing the indent levels. But there is no calculation function that can tell the difference between a field indented by eight spaces instead of four spaces.

I know that in many cases, I will be converting the pivot table to values and using the static version of the table for other uses. Those other uses will always need each field in its own column.

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If you are following along with the examples in this book and end up with a pivot table in Compact layout, rest assured that the numbers in your pivot table and the numbers in the book are the same, just with different formatting.

You can switch one pivot table to a new layout using the Design tab in the ribbon. Open the Report Layout dropdown and choose between Compact and Tabular.

If you happen to agree that the pivot table shown in columns N:Q of Figure I-8 is superior to the pivot table shown in columns S:T, then follow these steps to change your pivot table defaults on your computer.

1. Open the File menu and choose Excel Options.
2. In the Excel Options dialog, choose the Data category from the left navigation bar.
3. Click the top button for Edit Default Layout next to Make Changes To The Default Layout Of Pivot Tables.
4. Open the Report Layout dropdown and choose Show in Tabular Form.
5. Choose the box next to Repeat All Item Labels.
6. Click the PivotTable Options... button in the lower-right part of the Edit Default Layout dialog. There are five tabs across the top of the PivotTable Options dialog.
7. On the Layout & Format tab, click in the For Empty Cells Show box and type a zero (**0**). Click OK three times to close all of the open dialogs.

Your pivot tables will now default to the format shown on the left side of Figure I.8.

Errata, updates, and book support

We've made every effort to ensure the accuracy of this book and its companion content. You can access updates to this book—in the form of a list of submitted errata and their related corrections—at the following page:

MicrosoftPressStore.com/Excel365pivotdata/errata

If you discover an error that is not already listed, please submit it to us at the same page.

For additional book support and information, please visit:

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CHAPTER 2

Creating a basic pivot table

In this chapter, you will:

- Format your source data before creating a pivot table
- Learn how to create a basic pivot table
- Understand the Recommended PivotTable and the Analyze Data features
- Use slicers to filter your report
- Keep up with changes in the data source
- Share the pivot cache
- Save time with PivotTable tools

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 their 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.

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Format your source data before creating a pivot table

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 in most cases. 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.

	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

FIGURE 2-1 This data is structured properly for use as a pivot table source.

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, they 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 a 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 displaying the data, but it's not effective for a pivot table data source.

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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.

	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

FIGURE 2-2 Region and model data are not formatted properly in this data set.

In addition, 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. However, 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.

	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

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.

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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. 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 style 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.

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- 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?

	A	B	C	D	E	F
1	Sector	Customer		Jan	Feb	Mar
2	Associations	IMA Houston Chapter		0	0	0
3		Association for Computers & Taxation		30094	0	0
4						
5	Consultants	Andrew Spain Consulting		89581	114596	112012
6		Data2Impact		21730	0	0
7		Cambia Factor		0	0	0
8		Fintega Financial Modelling		21015	0	0
9		Excelerator BI		0	0	0
10		Construction Intelligence & Analytics, Inc.		22104	0	2484
11						
12	Professional	Serving Brevard Realty		0	7152	24224
13		WM Squared Inc.		0	0	0
14		Juliet Babcock-Hyde CPA, PLLC		0	0	0
15						
16	Retail	Hartville MarketPlace and Flea Market		34132	40608	12427

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?

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

- There are blank rows and columns in the data. Column C should be deleted. The blank rows between sectors (such as rows 4, 11, 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 A6:A10 fall into the Consultants sector. These blank cells need to be filled in with the values from above.
- The worksheet presents the data for each month in several columns (one column per month). Columns D through O need to be reformatted as two columns. Place the month name in one column and the units for that month in the next column.

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Cleaning this data used to require some VBA code or a bunch of manual steps in Excel. The Get & Transform tools that debuted in Excel 2016 will make it very easy to clean this data. Follow these steps:

1. Select the entire range of data. In the sample file, it would be A1:O33.
2. Click in the Name box and type a one-word name, such as **UglyData**. Press Enter to name the range.
3. On the Data tab, in the Get & Transform Data group, choose From Table/Range (see Figure 2-5).

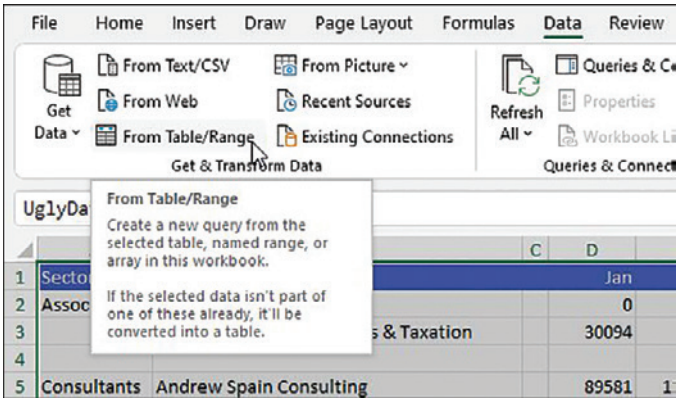

FIGURE 2-5 Originally called Power Query but later rebranded as Get & Transform Data, these new tools that appeared on the Data tab in 2016 are amazing.

The Power Query Editor will open. Notice you have ribbon tabs for Home, Transform, Add Column, and View. Follow these steps in the Power Query Editor.

4. The formerly blank column C now has a heading of Column 3. Click that heading and choose Remove Columns from the Home tab (see Figure 2-6).

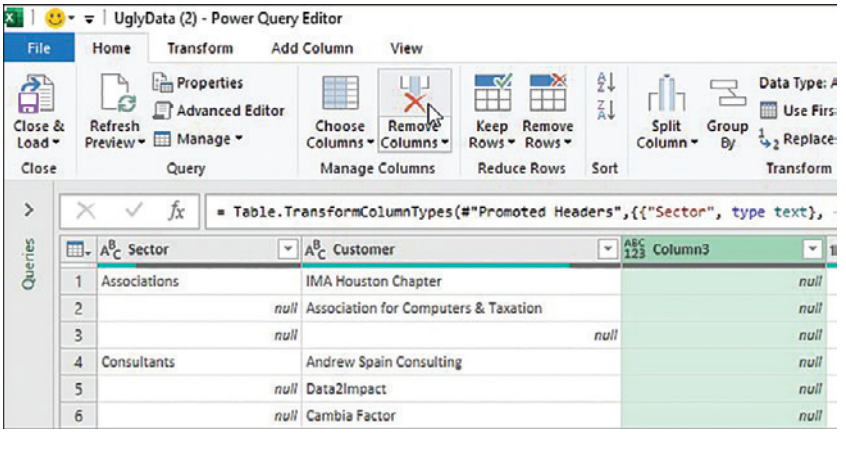

FIGURE 2-6 The Power Query Editor offers tools that are often better than their Excel equivalents.

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5. Click the Customer heading. Choose Home | Remove Rows | Remove Blank Rows (see Figure 2-7).

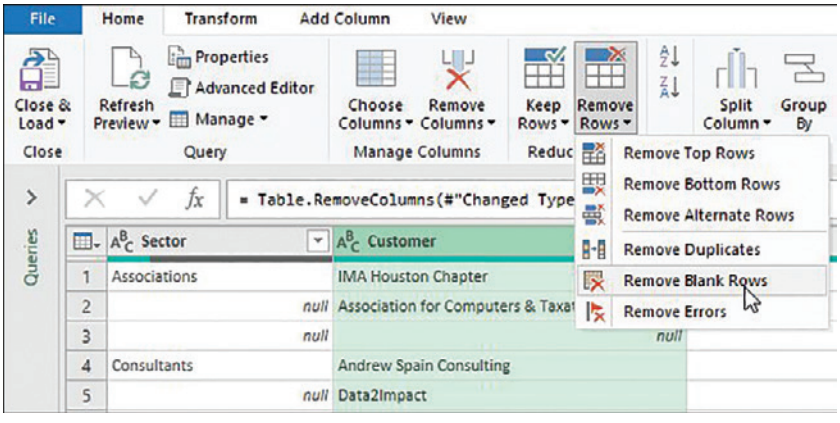

FIGURE 2-7 Deleting blank rows is a built-in command in Power Query.

6. Select the Sector column header. From the Transform tab, choose Fill | Down (see Figure 2-8). This amazing command will replace all the null cells with the value from above.

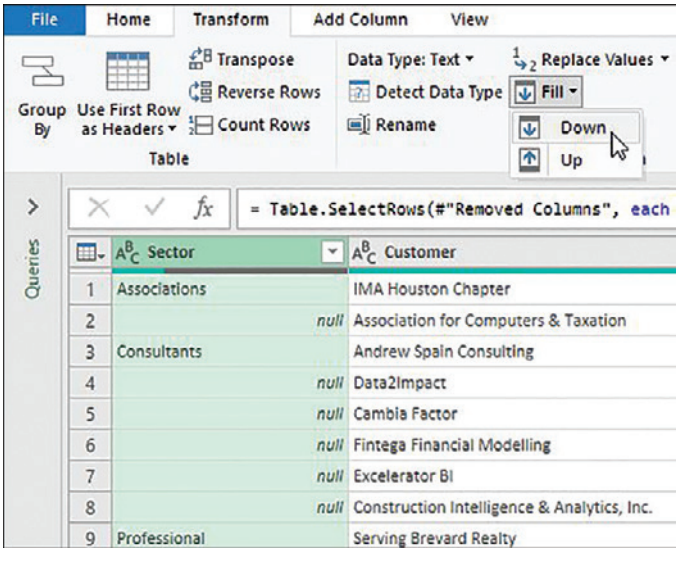

FIGURE 2-8 Fill Down replaces Home | Find & Select | Go To Special | Blanks | OK, and then entering =A2 and pressing Ctrl+Enter. It is far easier to remember one command instead of many obscure commands strung together.

7. Select both the Sector and Customer headings.

8. Open the Unpivot Columns dropdown on the Transform tab and choose Unpivot Other Columns. The result is shown in Figure 2-9. Pause for a moment to admire the sheer

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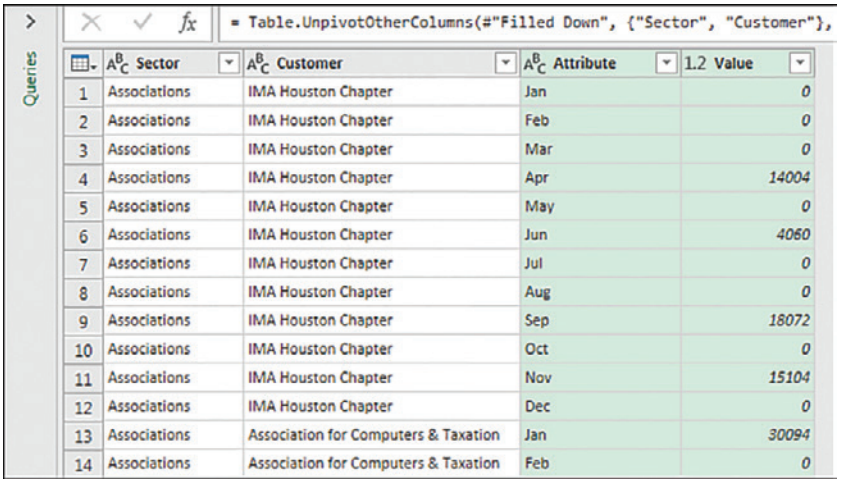
simplicity of steps 5 through 8. Those are three new tools that replace far more complicated tasks in Excel. Although the data could be returned to Excel at this point, there are a few simple clean-up steps left.



Queries

= Table.UnpivotOtherColumns(#"Filled Down", {"Sector", "Customer"},

	Sector	Customer	Attribute	Value
1	Associations	IMA Houston Chapter	Jan	0
2	Associations	IMA Houston Chapter	Feb	0
3	Associations	IMA Houston Chapter	Mar	0
4	Associations	IMA Houston Chapter	Apr	14004
5	Associations	IMA Houston Chapter	May	0
6	Associations	IMA Houston Chapter	Jun	4060
7	Associations	IMA Houston Chapter	Jul	0
8	Associations	IMA Houston Chapter	Aug	0
9	Associations	IMA Houston Chapter	Sep	18072
10	Associations	IMA Houston Chapter	Oct	0
11	Associations	IMA Houston Chapter	Nov	15104
12	Associations	IMA Houston Chapter	Dec	0
13	Associations	Association for Computers & Taxation	Jan	30094
14	Associations	Association for Computers & Taxation	Feb	0

FIGURE 2-9 At this point, you could return the data to Excel for pivoting.

9. Right-click the Value column. Choose Rename and type **Revenue**.
10. Open the Filter dropdown for Revenue. Unselect 0 to remove all the zero values.
11. Select the Attribute Column. On the Add Column tab, choose Column From Example. The first row in your data might read "Apr." If this data applies to the year 2029, type a value of **Apr 1, 2029** in the new column. Power Query fills in the remaining rows and offers a Merged heading. Click OK (see Figure 2-10).

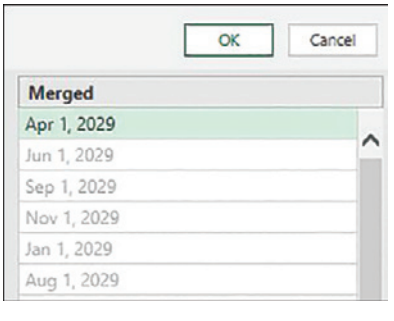


FIGURE 2-10 Add Column From Example is similar to Flash Fill in Excel, but it actually creates a formula that can be reused.

12. Right-click the heading for the new Merged column. Choose Rename and type **Date** as the heading name.

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13. With the Date column selected, click the Transform tab. Open the Date Type dropdown and choose Date. The text dates are converted to real dates.

14. You no longer need the month abbreviations shown in the Attribute column. Choose the Attribute column and then Home | Remove Columns. Before you return to Excel, look at the right side of the Power Query window for the list of Applied Steps. This is the world's greatest Undo stack. You can click any step and see what the data looked like at that point. If you made a mistake several steps ago, you can click that step and make a correction. If you want to be more impressed, select the View tab and choose Advanced Editor. All that code is a programming language called "M." By doing steps 4 through 13, you successfully wrote a program that can be reused the next time you download similar data from the IT department.

15. Select Home | Close | Load. Your original data stays on Sheet1, and a new Sheet2 is added to the workbook (see Figure 2-11). The cleaned data is narrow and tall. In general, narrow and tall data sets are better for pivoting.

	A	B	C	D
1	Sector	Customer	Revenue	Date
2	Associations	IMA Houston Chapter	24004	4/1/2029
3	Associations	IMA Houston Chapter	4060	6/1/2029
4	Associations	IMA Houston Chapter	18072	9/1/2029
5	Associations	IMA Houston Chapter	15104	11/1/2029
6	Associations	Association for Computers & Taxation	30094	1/1/2029
7	Associations	Association for Computers & Taxation	4270	8/1/2029
8	Consultants	Andrew Spain Consulting	89581	1/1/2029
9	Consultants	Andrew Spain Consulting	114596	2/1/2029
10	Consultants	Andrew Spain Consulting	112012	3/1/2029
11	Consultants	Andrew Spain Consulting	67408	4/1/2029
12	Consultants	Andrew Spain Consulting	84383	5/1/2029

FIGURE 2-11 Just 11 steps in Power Query quickly cleaned the ugly data.

Not only is Power Query fast, it makes it easy to redo the data cleansing. Go back to Sheet1 and change any number in the original data. Go to Sheet2. Expand the Queries & Connections panel so you can click the Refresh icon on the far right of the UglyData query. Power Query repeats all the steps and updates the result.

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.microsoftpressstore.com/ExcelPivotTable/downloads.

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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 From Table/Range from the dropdown. Figure 2-12 demonstrates how to start a pivot table.

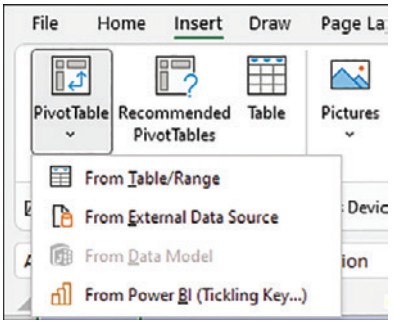

FIGURE 2-12 Start a pivot table by selecting PivotTable from the Insert tab.

Choosing these options activates the Create PivotTable dialog, shown in Figure 2-13.

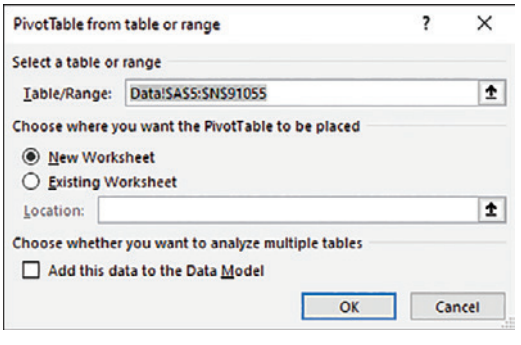

FIGURE 2-13 The Create PivotTable dialog.

Tip You can also press the shortcut to start a pivot table: Press and release Alt, press and release N, and then press and release V.

As you can see in Figure 2-13, the Create PivotTable dialog asks you only two fundamental questions:

- Where's the data that you want to analyze?
- 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

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look for an external data set. As you can see in Figure 2-13, Excel is smart enough to read your data set and fill in the range for you. However, you should always 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 2-13: the Add This Data To The Data Model option. You would select this option if you were trying to consolidate multiple data sources into a single pivot table.

The Add This Data To The Data Model option is covered in detail in Chapter 7, "Analyzing disparate data sources with pivot tables," and in Chapter 10, "Unlocking features with the Data Model and Power Pivot."

In this chapter, we'll keep it basic by covering the steps to create a pivot table by 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 2-14. This pane helps you build your pivot table.

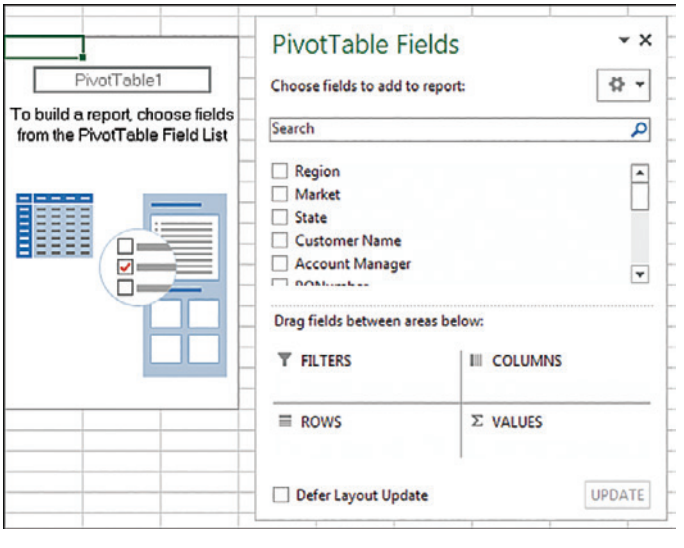

FIGURE 2-14 You use the PivotTable Fields list to build a pivot table.

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Caution The icons for Columns and Rows in Figure 2-14 are reversed. A summer intern at Microsoft inadvertently reversed the icons several versions ago, and no one noticed. After Bill pointed this out to the correct project manager, Microsoft pledged to restore the icons to the correct location. The dark-gray portion of the icon is supposed to show where the data will be displayed when you drop a field here. Any data dropped into the Columns area will display across the top of the report (as illustrated in the icon currently in the Rows area). It feels sort of goofy to show the wrong icons in this book on pivot tables, but that's the way it appears to us at press time.

Tip **Finding the PivotTable Fields list**

The PivotTable Fields list is your main work area in Excel. 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 Field 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:

- **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.

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

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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 Excel customers 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?"
- "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.

Let's say you wanted to measure the dollar sales by region. This would automatically tell you that you need to work with the Sale Amount and Region fields. 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 select the checkbox next to it. As you can see in Figure 2-15, not only is the field automatically added to the Rows area, but also your pivot table is updated to show the unique region names.

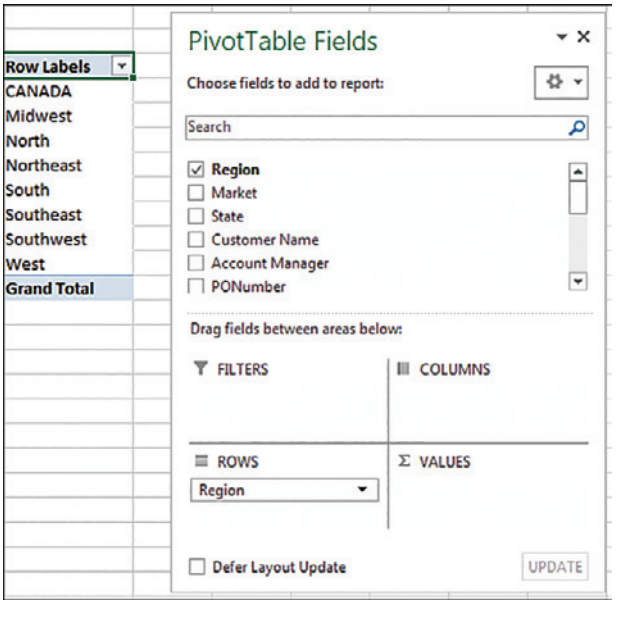

FIGURE 2-15 Select the checkbox next to the Region field to automatically add that field to your pivot table.

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Tip If you see a region that is repeated in the Rows area, it usually means that there are one or more trailing spaces after some of the rows for that region. You should find those cells, delete the trailing spaces, and then Refresh the 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 select the checkbox next to it. As Figure 2-16 shows, 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.

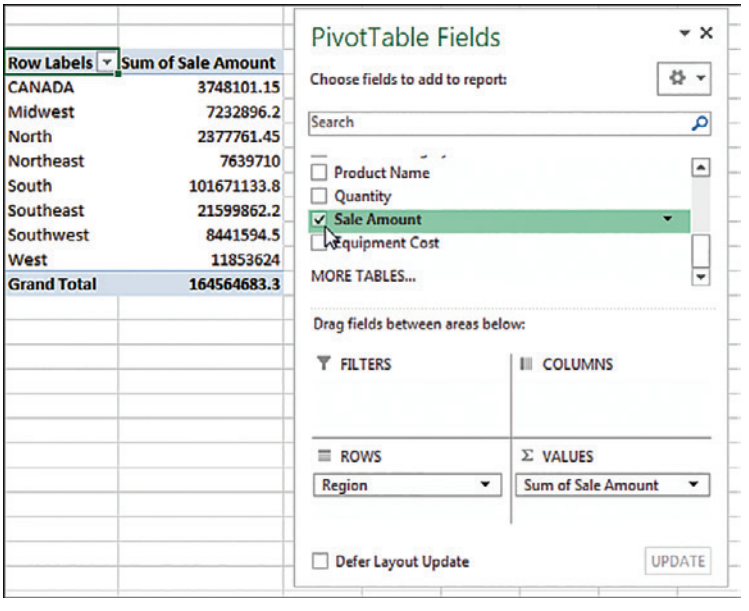

FIGURE 2-16 Select the checkbox next to the Sale Amount field to add data to your pivot table report.

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

Tip **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 selecting the checkbox next to each field name. Excel automatically adds the selected fields to the pivot table. But how does Excel know which area to use for a field you select? 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 select a checkbox next to a field, Excel evaluates the data type for that field. If the data type is numeric, Excel places the field in the Values area; otherwise, Excel places the field in the Rows area. This placement obviously underlines the importance of correctly assigning the data types for your fields.

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Note Blank cells in your numeric columns previously caused the column to be treated as text. A change in early 2018 for Office 365 subscribers changed this behavior. Now, a column with a mix of numbers and empty cells will be treated as values, and the field will go to the Values area with a default calculation of Sum.

If you have someone who clears out cells by mashing down the spacebar several times instead of using the Delete key, Excel will treat those spaces as text. A mix of numbers and text in a column will cause Excel to default to counting the column instead of summing.

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 select the checkbox next to the Product Category field. As you can see in Figure 2-17, your pivot table automatically added a layer for the Product Category and refreshed the calculations to include subtotals for each region. Because the data is stored efficiently in the pivot cache, this change took less than a second.

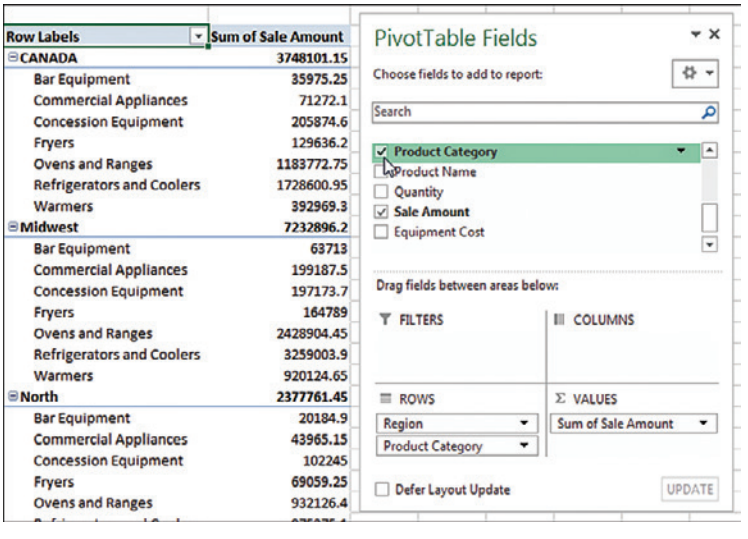

FIGURE 2-17 Without pivot tables, adding layers to analyses requires hours of work and complex formulas.

Rearranging a pivot table

Suppose that the view you've created doesn't work for your manager. He wants to see Product Categories across the top of the pivot table report. To make this change, simply drag the Product Category field from the Rows area to the Columns area, as illustrated in Figure 2-18.

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Note You don't have to move your fields into an area to be able to drag them around. You can actually drag fields directly from the list of fields in the PivotTable Fields list to the desired area. You can also move a field into an area by using that field's context menu: Click the black triangle next to the field name and then select the desired area.

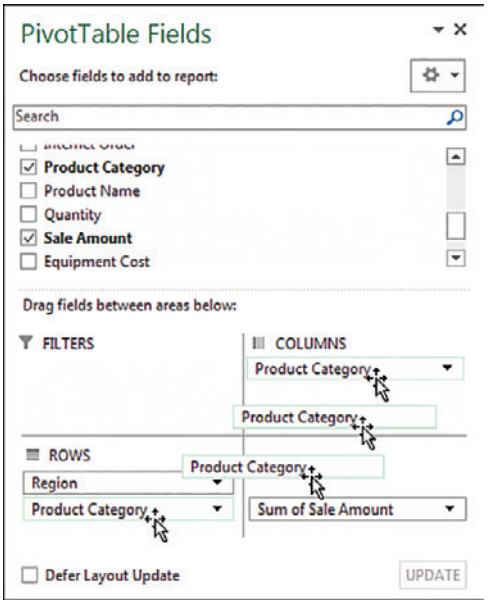

FIGURE 2-18 Rearranging a pivot table is as simple as dragging fields from one area to another.

The report is instantly restructured, as shown in Figure 2-19.

Sum of Sale Amount	Column Labels			
Row Labels	Bar Equipment	Commercial Appliances	Concession Equipment	Fryers
CANADA	35975.25	71272.1	205874.6	129636.2
Midwest	63713	199187.5	197173.7	164789
North	20184.9	43965.15	102245	69059.25
Northeast	68407.1	285103.35	258557.4	190152.4
South	1191742.35	5923096.6	6971902.45	2420745
Southeast	283902.15	1525894.3	1569948.6	452579.35
Southwest	73528.5	289526.5	355845.45	268554.85
West	68684.65	296291.55	422201.2	276443.05
Grand Total	**1806137.9**	**8634337.05**	**10083748.4**	**3971959.1**

FIGURE 2-19 Your product categories are now column-oriented.

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Tip **Longing for drag-and-drop functionality?**

In Excel 2003 and previous versions, you could drag and drop fields directly onto the pivot table layout. This functionality is allowed only within the PivotTable Fields list (dragging into areas). However, Microsoft has provided the option of working with a classic pivot table layout, which enables drag-and-drop functionality.

To activate the classic pivot table layout, right-click anywhere inside the pivot table and select PivotTable Options. In the PivotTable Options dialog, select the Display tab and select the checkbox next to Classic PivotTable Layout, as demonstrated in Figure 2-20. Click the OK button to apply the change.

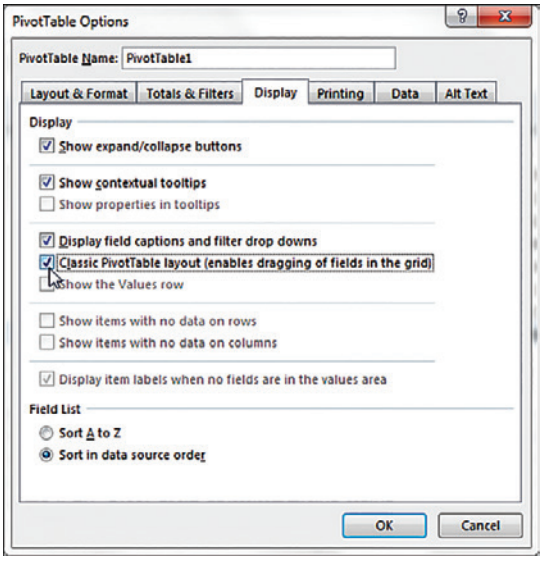

FIGURE 2-20 Select the checkbox next to Classic PivotTable Layout.

At this point, you can drag and drop fields directly onto your pivot table layout. If you always want your pivot tables to be in Classic layout, follow these steps:

1. Select File | Options. A new Data category is added along the left panel starting in 2017 for Microsoft 365 subscribers.
2. In the Data category, the first setting is Make Changes To The Default Layout Of Pivot-Tables. Click Edit Default Layout.
3. The Edit Default Layout dialog offers a few common choices. Apparently, Classic layout did not make it to the top few choices. Click the PivotTable Options button in the Edit Default Layout dialog. You will see a dialog similar to Figure 2-20. Choose the Display tab and the Classic PivotTable Layout. Click OK three times to close each of the open dialogs. All future pivot tables can be built in Classic mode.

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Creating a report filter

You might be asked to produce different reports for particular regions, markets, or products. Instead of building separate pivot table reports for every possible analysis scenario, you can use the Filter field to create a report filter. For example, you can create a region-filtered report by simply dragging the Region field to the Filters area and the Product Category field to the Rows area. This way, you can analyze one particular region at a time. Figure 2-21 shows the totals for just the North region.

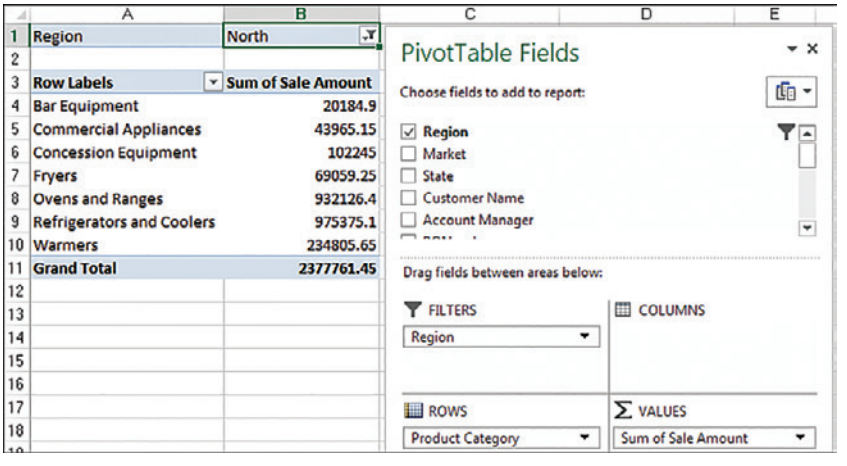

FIGURE 2-21 With this setup, you not only can see revenues by product clearly, but also can click the Region dropdown to focus on one region.

Understanding the Analyze Data, Copilot, and Recommended PivotTable features

As this book is being written in the summer of 2024, the Artificial Intelligence industry is moving at the speed of sound. At this point, Copilot is still in preview and will be coming out to General Availability later in 2024.

At this moment, the Analyze Data feature is the mature option for creating pivot tables and pivot charts using Artificial Intelligence. In 2024, Microsoft changed the legacy Recommended PivotTable functionality to use the same algorithm as the Analyze Data. Looking forward, the ability for Copilot to create a pivot table has been trained using the existing Analyze Data feature.

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Tip **Analyze Data feature uses artificial intelligence**

The Analyze Data feature uses artificial intelligence to analyze up to 250,000 cells of your data. It offers descriptive pivot tables and then offers far more advanced analyses. The Analyze Data feature often produces over 30 choices. Figures 2-22 and 2-23 show some results available from it.

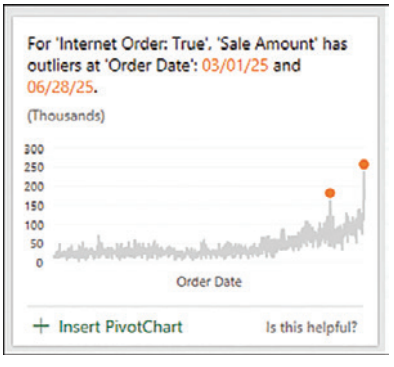

FIGURE 2-22 Artificial Intelligence detected a pair of outliers in this segment of the data.

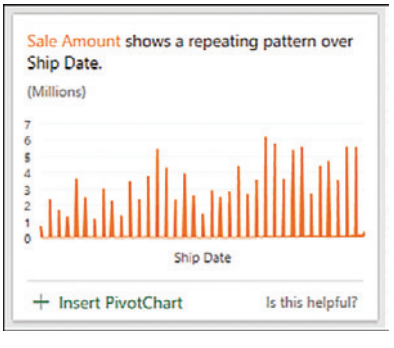

FIGURE 2-23 Ideas detected a repeating pattern. This might indicate some weekly or monthly seasonality.

Unfortunately, customers who purchased a perpetual license to Excel 2021 or Excel 2024 will not have the feature in either location. Microsoft's stance is that if you are not continuing to pay a monthly subscription fee, you cannot make use of the Office intelligent services.

In late 2019, a second iteration of artificial intelligence was added that allows you to ask a natural-language question about your data. See Figure 7 in the Introduction for an example.

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Using slicers to filter your report

With Excel 2010, Microsoft introduced a feature called *slicers*. Slicers enable you to filter your pivot table in much the same way as Filter fields filter a pivot table. The difference is that slicers offer a user-friendly interface that enables you to easily see the current filter state, even when multiple items are selected.

Creating a standard slicer

To understand the concept behind slicers, place your cursor anywhere inside your pivot table and then select the Insert tab on the ribbon. Click the Slicer icon (see Figure 2-24).

FIGURE 2-24 Inserting a slicer.

The Insert Slicers dialog, shown in Figure 2-25, opens. The idea is to select the dimensions you want to filter. In this example, the Region and Market slicers are selected.

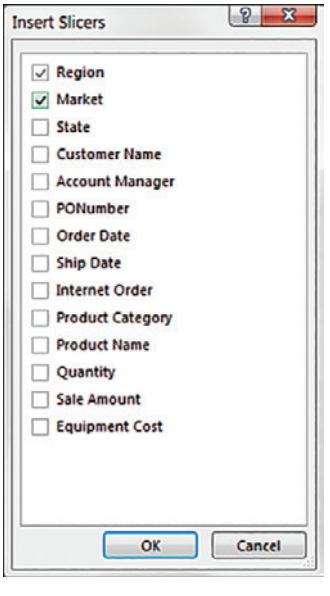

FIGURE 2-25 Select the dimensions for which you want to create slicers.

After the slicers are created, you can simply click the filter values to filter your pivot table. As you can see in Figure 2-26, clicking Midwest in the Region slicer filters your pivot table, and also the Market slicer responds by highlighting the markets that belong to the Midwest region.

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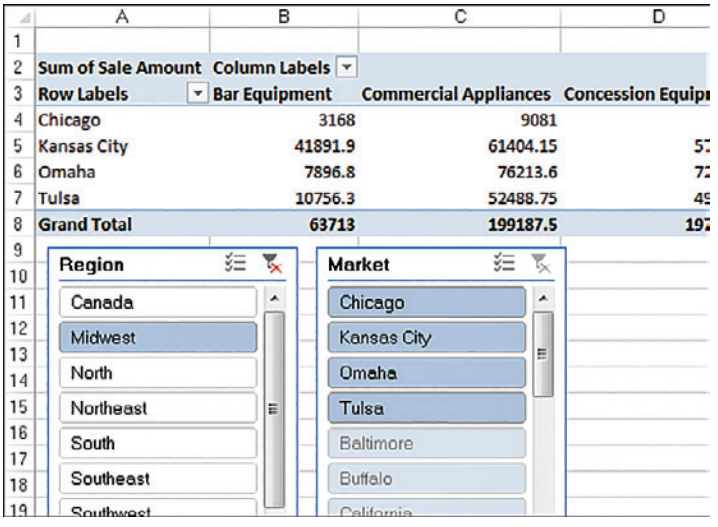

FIGURE 2-26 Select the dimensions you want to filter using slicers.

Tip You can select multiple values by holding down the Ctrl key on your keyboard while selecting the needed filters. Alternatively, you can enable the Multi-Select toggle next to the filter icon at the top of the slicer.

In Figure 2-27, the Multi-Select toggle was enabled and then Baltimore, California, Charlotte, and Chicago were selected. Note that Excel highlights the selected markets in the Market slicer and also highlights their associated regions in the Region slicer.

Another advantage you gain with slicers is that you can tie each slicer to more than one pivot table. In other words, any filter you apply to your slicer can be applied to multiple pivot tables.

To connect a slicer to more than one pivot table, simply right-click the slicer and select Report Connections. The Report Connections dialog, shown in Figure 2-28, opens. Select the checkbox next to any pivot table that you want to filter using the current slicer.

At this point, any filter applied via the slicer is applied to all the connected pivot tables. Again, slicers have a unique advantage over Filter fields in that they can control the filter state of multiple pivot tables. Filter fields can control only the pivot table in which they live.

Note that the choices in Figure 2-28 are the pivot tables that rely on the same pivot table cache. If you want to use a slicer to control data coming from two different data sets, see "Tip 22 – Slicer to control data from two different data sets" in Chapter 14.

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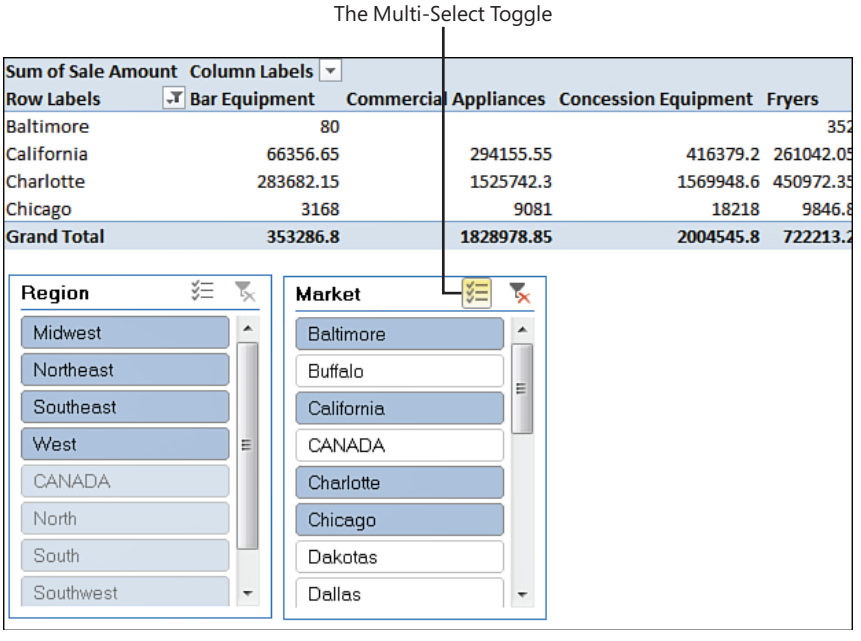

FIGURE 2-27 The fact that they enable you to see the current filter state gives slicers a unique advantage over the Filter field.

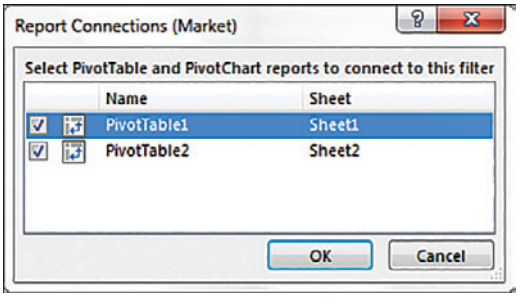

FIGURE 2-28 Choose the pivot tables you want to filter using this slicer.

Tip Notice that in Figure 2-28, the list of pivot tables is a bit ambiguous (PivotTable1, PivotTable2). Excel automatically gives your pivot tables these generic names, which it uses to identify them. You can imagine how difficult it would be to know which pivot table is which when working with more than a handful of pivots. Therefore, you might want to consider giving your pivot tables user-friendly names so you can recognize them in dialogs, such as the one you see in Figure 2-28.

You can easily change the name of a pivot table by placing your cursor anywhere inside the pivot table, selecting the PivotTable Analyze tab, and entering a friendly name in the PivotTable Name input box found on the far left.

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Creating a Timeline slicer

The Timeline slicer (introduced with Excel 2013) works in the same way as a standard slicer in that it lets you filter a pivot table using a visual selection mechanism instead of the old Filter fields. The difference is that the Timeline slicer is designed to work exclusively with date fields, and it provides an excellent visual method to filter and group the dates in a pivot table.

Note In order to create a Timeline slicer, your pivot table must contain a field where *all* the data is formatted as dates. This means that your source data table must contain at least one column where all the values are formatted as valid dates. If even only one value in the source date column is blank or not a valid date, Excel does not create a Timeline slicer.

To create a Timeline slicer, place your cursor anywhere inside your pivot table, select the Insert tab on the ribbon, and then click the Timeline icon.

The Insert Timelines dialog opens, showing you all the available date fields in the chosen pivot table. Here, you select the date fields for which you want to create slicers.

After your Timeline slicer is created, you can filter the data in your pivot table by using this dynamic data-selection mechanism. As you can see in Figure 2-29, clicking the April slicer filters the data in the pivot table to show only April data.

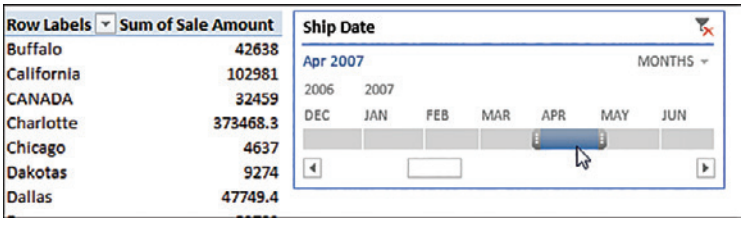

FIGURE 2-29 Click a date selection to filter your pivot table.

Figure 2-30 demonstrates how you can expand the slicer range with the mouse to include a wider range of dates in your filtered numbers.

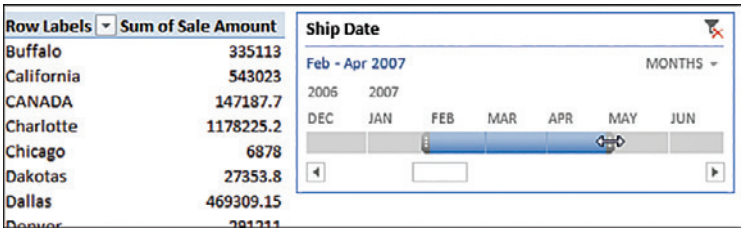

FIGURE 2-30 You can expand the range on the Timeline slicer to include more data in the filtered numbers.

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Want to quickly filter your pivot table by quarters? Well, you can easily do it with a Timeline slicer. Click the time period dropdown and select Quarters. As you can see in Figure 2-31, you also can select Years, Months, or Days, if needed.

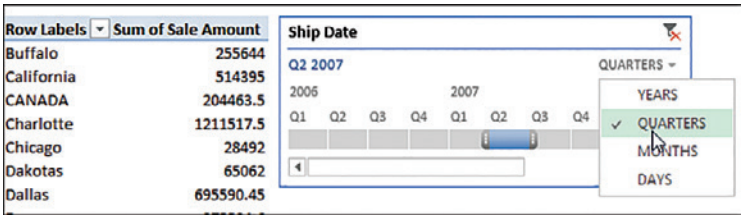

FIGURE 2-31 Quickly switch between filtering by years, quarters, months, and days.

Note Be aware that Timeline slicers are not backward compatible with Excel 2010 or earlier.

Case study: Analyzing activity by market

Your organization has 18 markets that sell 7 types of products. You have been asked to build a report that breaks out each market and highlights the dollar sales for each product. You are starting with an intimidating transaction table that contains more than 91,000 rows of data. To start your report, do the following:

1. Place your cursor inside the data set, select the Insert tab, and click PivotTable.
2. When the Create PivotTable dialog appears, click the OK button. At this point, you should see an empty pivot table with the PivotTable Fields list.
3. Find the Market field in the PivotTable Fields list and select the checkbox next to it.
4. Find the Sale Amount field in the PivotTable Fields list and select the checkbox next to it.
5. To get the product breakouts, find the Product Category field in the PivotTable Fields list and drag it into the Columns area.

In five easy steps, you have calculated and designed a report that satisfies the requirements. After a little formatting, your pivot table report should look similar to the one shown in Figure 2-32.

Lest you lose sight of the analytical power you just harnessed, keep in mind that your data source has more than 91,000 rows and 14 columns, which is a hefty set of data by Excel standards. Despite the amount of data, you produced a relatively robust analysis in a matter of minutes.

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Sum of Sale Amount	Column Labels			
Row Labels	Bar Equipment	Commercial Appliances	Concession Equipment	Fryer
Baltimore	80			
Buffalo	37397.9	237297.85	187711	127
California	66356.65	294155.55	416379.2	2610
CANADA	35975.25	71272.1	205874.6	129
Charlotte	283682.15	1525742.3	1569948.6	4509
Chicago	3168	9081	18218	9
Dakotas	3386.5	7287.05	30619.2	180
Dallas	59580.3	255146	306037	151
Denver	34558.85	70068.8	75712.8	1200
Florida	1132162.05	5667950.6	6665865.45	2269
Great Lakes	16798.4	36678.1	71625.8	51
Kansas City	41891.9	61404.15	57300.7	50
Knoxville	220	152		

FIGURE 2-32 This summary can be created in less than a minute.

Keeping up with changes in the data source

Let's go back to the family portrait analogy. As years go by, your family will change in appearance and might even grow to include some new members. The family portrait that was taken years ago remains static and no longer represents the family today. So, another portrait needs to be taken.

As time goes by, your data might change and grow with newly added rows and columns. However, the pivot cache that feeds your pivot table report is disconnected from your data source, so it cannot represent any of the changes you make to your data source until you take another snapshot.

The action of updating your pivot cache by taking another snapshot of your data source is called *refreshing* your data. There are two reasons you might have to refresh your pivot table report:

- Changes have been made to your existing data source.
- Your data source's range has been expanded with the addition of rows or columns.

The following sections explain how to keep your pivot table synchronized with the changes in your data source.

Dealing with changes made to the existing data source

If a few cells in your pivot table's source data have changed due to edits or updates, you can refresh your pivot table report with a few clicks. Simply right-click inside your pivot table report and select Refresh. This selection takes another snapshot of your data set, overwriting your previous pivot cache with the latest data.

Note You can also refresh the data in a pivot table by selecting the Refresh icon on the PivotTable Analyze tab or Refresh All on the Data tab.

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Tip Clicking anywhere inside a pivot table activates the PivotTable tabs in the ribbon.

Dealing with an expanded data source range due to the addition of rows or columns

When changes have been made to your data source that affect its range (for example, if you've added rows or columns), you have to update the range being captured by the pivot cache.

To do this, click anywhere inside the pivot table and then select the PivotTable Analyze tab in the ribbon. From here, select Change Data Source. This selection triggers the dialog shown in Figure 2-33.

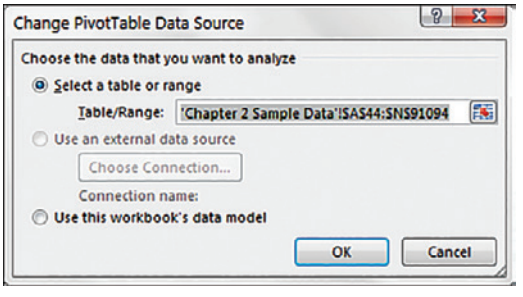

FIGURE 2-33 The Change PivotTable Data Source dialog enables you to redefine the source data for your pivot table.

All you have to do here is update the range to include new rows and columns. After you have specified the appropriate range, click the OK button.

Note that if you format your pivot table source data as a table by choosing Home | Format As Table; Insert | Table; or pressing Ctrl+T, the Pivot Table Source range will automatically expand as the data grows. You will still have to click Refresh to pick up the new rows.

Sharing the pivot cache or creating a new cache

You quite often need to analyze the same data set in multiple ways. In most cases, this process requires you to create separate pivot tables from the same data source. Keep in mind that every time you create a pivot table, you are storing a snapshot of the entire data set in a pivot cache. Every pivot cache that is created increases your memory usage and file size. For this reason, you should consider sharing your pivot cache.

Note In situations where you need to create multiple pivot tables from the same data source, you can use the same pivot cache to feed multiple pivot tables. By using the same pivot cache for multiple pivot tables, you gain a certain level of efficiency when it comes to memory usage and file size.

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In legacy versions of Excel, when you created a pivot table using a data set that was already being used in another pivot table, Excel actually gave you the option of using the same pivot cache. However, Excel today does not give you such an option.

Instead, each time you create a new pivot table in Excel, Excel automatically shares the pivot cache. Most of the time, this is beneficial: You can link as many pivot tables as you want to the same pivot cache with a negligible increase in memory and file size.

On the flip side, when you group one pivot table by month and year, all the pivot tables are grouped similarly. If you want one pivot table by month and another pivot table by week, you have to force a separate pivot cache. You can force Excel to create a separate pivot cache by taking the following steps:

1. Select one cell in your original data set.
2. Press and release Alt+D, and then press P to launch the PivotTable Wizard.
3. Click the Next button to get past the first screen of the wizard.
4. On the second screen, select the range for your pivot table and click the Next button.
5. Excel displays a wordy message saying that you can use less memory if you click Yes. Instead, click No.
6. On the next screen, click the Finish button.

At this point, you have a blank pivot table that pulls from its own pivot cache.

Tip If you already have an existing pivot table, you can use an alternative method for creating a separate pivot cache: Copy and paste the existing table to a new workbook and then copy and paste the pivot table back to a new sheet in the original workbook.

Side effects of sharing a pivot cache

It's important to note that there are a few side effects to sharing a pivot cache. For example, suppose you have two pivot tables using the same pivot cache. Certain actions affect both pivot tables, each of which is discussed further in Chapter 5, "Performing calculations in pivot tables":

- **Refreshing your data—**You cannot refresh one pivot table and not the other. Refreshing affects both tables.
- **Adding a calculated field—**If you create a calculated field in one pivot table, your newly created calculated field shows up in the PivotTable Fields list of the other pivot table.
- **Adding a calculated item—**If you create a calculated item in one pivot table, it shows in the other as well.

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- **Grouping or ungrouping fields—**Any grouping or ungrouping you perform affects both pivot tables. For instance, suppose you group a date field in one pivot table to show months. The same date field in the other pivot table is also grouped to show months.

Although none of these side effects are critical flaws in the concept of sharing a pivot cache, it is important to keep them in mind when determining whether using a pivot table as your data source is the best option for your situation.

Saving time with PivotTable tools

Microsoft has invested a lot of time and effort in the overall pivot table experience. The results of these efforts are tools that make pivot table functionality more accessible and easier to use. The following sections look at a few of the tools that help you save time when managing pivot tables.

Deferring layout updates

The frustrating part of building a pivot table from a large data source is that each time you add a field to a pivot area, you are left waiting while Excel crunches through all that data. This can become a maddeningly time-consuming process if you have to add several fields to your pivot table.

Excel offers some relief for this problem by providing a way to defer layout changes until you are ready to apply them. You can activate this option by selecting the relatively inconspicuous Defer Layout Update checkbox in the PivotTable Fields list, as shown in Figure 2-34.

Here's how this feature works: With the Defer Layout Update checkbox selected, you prevent your pivot table from making real-time updates as you move your fields around without your pivot table. When you are ready to apply your changes, click the Update button on the lower-right corner of the PivotTable Fields list.

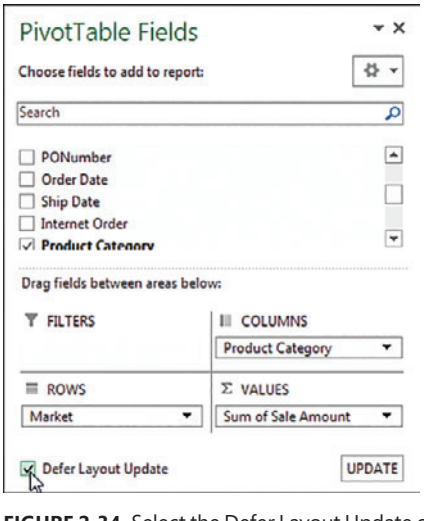

FIGURE 2-34 Select the Defer Layout Update checkbox to prevent your pivot table from updating while you add fields.

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Note Remember to clear the checkmark from the Defer Layout Update checkbox when you are done building your pivot table. Leaving it selected results in your pivot table remaining in a state of manual updates, preventing you from using other features of the pivot table, such as sorting, filtering, and grouping.

Tip Incidentally, the Defer Layout Update option is available through VBA. It can help improve the performance of any macro that automates the creation of pivot tables.

Note For detailed information on how to use VBA to create pivot tables, refer to Chapter 13, "Using VBA or TypeScript to create pivot tables."

Starting over with one click

Often, you might want to start from scratch when working with your pivot table layouts. Excel provides a simple way to essentially start over without deleting your pivot cache. Select the PivotTable Analyze tab and select the Clear dropdown. As you can see in Figure 2-35, this command enables you to either clear your entire pivot table layout or remove any existing filters you might have applied in your pivot table.

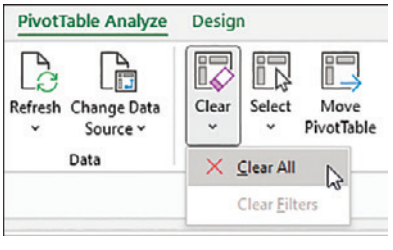

FIGURE 2-35 The Clear command enables you to clear your pivot table fields or remove the applied filters from your pivot table.

Relocating a pivot table

You might find that after you have created a pivot table, you need to move it to another location. It might be in the way of other analyses on the worksheet, or you might simply need to move it to another worksheet. Although there are several ways to move a pivot table, the easiest is Excel's no-frills way: Select Move PivotTable from the PivotTable Analyze tab in the ribbon. This icon activates the Move PivotTable dialog, shown in Figure 2-36. All you have to do here is specify where you want your pivot table moved.

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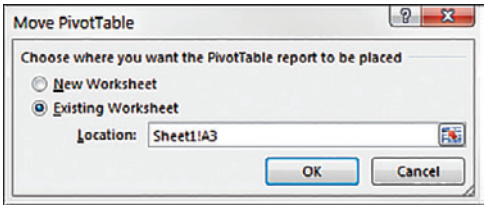
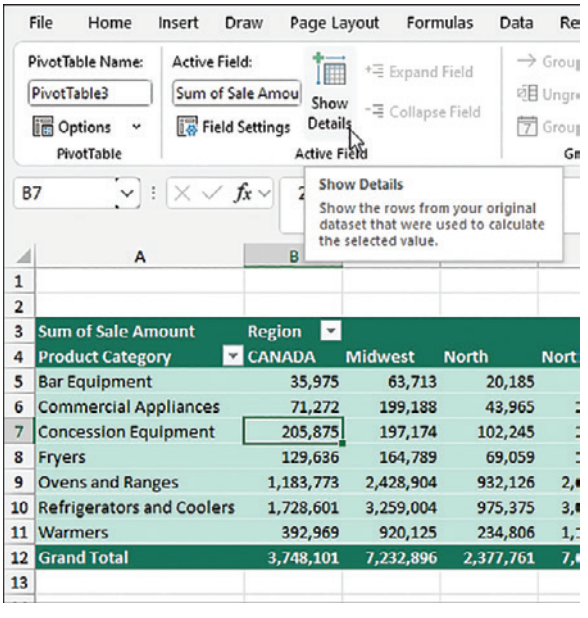


FIGURE 2-36 The Move PivotTable dialog enables you to quickly move your pivot table to another location.

Show Details for any cell in the values area

You've produced a pivot table and sent it to your manager, who takes one look at it and says, "This can't be right! There is no way we sold $205K of Concession Equipment to Canada!"

Any time someone questions one of the numbers in the values area of your pivot table, simply select the cell containing the value. On the PivotTable Tools tab, click Show Details (see Figure 2-37).



	A	B	C	D	E
1					
2					
3	Sum of Sale Amount	Region			
4	Product Category	CANADA	Midwest	North	Nort
5	Bar Equipment	35,975	63,713	20,185	
6	Commercial Appliances	71,272	199,188	43,965	
7	Concession Equipment	205,875	197,174	102,245	
8	Fryers	129,636	164,789	69,059	
9	Ovens and Ranges	1,183,773	2,428,904	932,126	2,
10	Refrigerators and Coolers	1,728,601	3,259,004	975,375	3,
11	Warmers	392,969	920,125	234,806	1,
12	Grand Total	3,748,101	7,232,896	2,377,761	7,
13					

FIGURE 2-37 Click any number in the Values area and then click Show Details.

Excel will insert a new sheet to the left of the current sheet. This sheet will contain a title indicating what cell was active when Show Details was clicked. There will be a blank row 2 and then all of the rows from the original data set that make up the selected number, as shown in Figure 2-38.

Before 2024, you could achieve this Show Details report by double-clicking any cell in the pivot table Values area. In 2024, Microsoft added the Show Details button to the ribbon and improved the result by adding the title.

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	A	B	C	D	E	F
1	Details for Sum of Sale Amount - Product Category: Concession Equipment, Region: CANADA					
2						
3	Region	Market	State	Customer Name	Account Manager	PONumber
4	CANADA	CANADA	NB	ATLANT Corp.	Faxon Mundy	47980
5	CANADA	CANADA	NB	ATLANT Corp.	Faxon Mundy	50203
6	CANADA	CANADA	NB	ATLANT Corp.	Faxon Mundy	53527
7	CANADA	CANADA	NB	ATLANT Corp.	Faxon Mundy	71841

FIGURE 2-38 Excel inserts a new worksheet to the left of the active sheet with all of the rows that make up the selected number.

If you use Show Details on the total number at the intersection of the Grand Total row and the Grand Total column, the Show Details report will be an exact copy of the entire original data set.

You can use Show Details over and over. Each time will create a new worksheet to the left of the active sheet. If you don't need these worksheets, you can press Ctrl+Z to undo; Excel will remove the new sheet.

Next steps

In Chapter 3, you'll learn how to enhance your pivot table reports by customizing your fields, changing field names, changing summary calculations, applying formats to data fields, adding and removing subtotals, and using the Show As setting.

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