Excel Power Pivot

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Overview

Excel Power Pivot is an efficient, powerful tool that comes with Excel as an Add-in. With Power Pivot, you can load hundreds of millions of rows of data from external sources and manage the data effectively with its powerful xVelocity engine in a highly compressed form. This makes it possible to perform the calculations, analyze the data, and arrive at a report to draw conclusions and decisions. Thus, it would be possible for a person with hands-on experience with Excel, to perform the high-end data analysis and decision making in a matter of few minutes.

This training will cover the following:

Power Pivot Features

What makes Power Pivot a strong tool is the set of its features. You will learn the various Power Pivot features in the module − Features.

Power Pivot Data from Various Sources

Power Pivot can collate data from various data sources to perform the required calculations. You will learn how to get data into Power Pivot, in the module − Loading Data into Power Pivot.

Power Pivot Data Model

The power of Power Pivot lies in its database- Data Model. The data is stored in the form of data tables in the Data Model. You can create relationships between the data tables to combine the data from different data tables for analysis and reporting. The module − Understanding Data Model (Power Pivot Database) gives you the details about the Data Model.

Managing Data Model and Relationships

You need to know how you can manage the data tables in the Data Model and the relationships between them. You will get the details of these in the module − Managing Power Pivot Data Model.

Creating Power Pivot Tables and Power Pivot Charts

Power PivotTables and Power Pivot Charts provide you a way to analyze the data for arriving at conclusions and/or decisions.

You will learn how to create Power PivotTables in the modules − Creating a Power PivotTable and Flattened PivotTables.

You will learn how to create Power PivotCharts in the module − Power PivotCharts.

DAX Basics

DAX is the language used in Power Pivot to perform calculations. The formulas in DAX are similar to Excel formulas, with one difference − while the Excel formulas are based on individual cells, DAX formulas are based on columns (fields).

You will understand the basics of DAX in the module − Basics of DAX.

Exploring and Reporting Power Pivot Data

You can explore the Power Pivot Data that is in the Data Model with Power PivotTables and Power Pivot Charts. You will get to learn how you can explore and report data throughout this training.

Hierarchies

You can define data hierarchies in a data table so that it would be easy to handle related data fields together in Power PivotTables. You will learn the details of the creation and usage of Hierarchies in the module − Hierarchies in Power Pivot.

Aesthetic Reports

You can create aesthetic reports of your data analysis with Power Pivot Charts and/or Power Pivot Charts. You have several formatting options available to highlight the significant data in the reports. The reports are interactive in nature, enabling the person looking at the compact report to view any of the required details quickly and easily.

You will learn these details in the module − Aesthetic Reports with Power Pivot Data.

Installing

Power Pivot in Excel provides a Data Model connecting various different data sources based on which the data can be analyzed, visualized, and explored. The easy-to-use interface provided by Power Pivot enables a person with hands-on experience in Excel to effortlessly load data, manage the data as data tables, create relationships among the data tables, and perform the required calculations to arrive at a report.

In this module, you will learn, what makes Power Pivot a strong and sought after tool for analysts and decision makers.

Power Pivot on the Ribbon

The first step to proceed with Power Pivot is to ensure that the POWERPIVOT tab is available on the Ribbon. If you have Excel 2013 or later versions, the POWERPIVOT tab appears on the Ribbon.

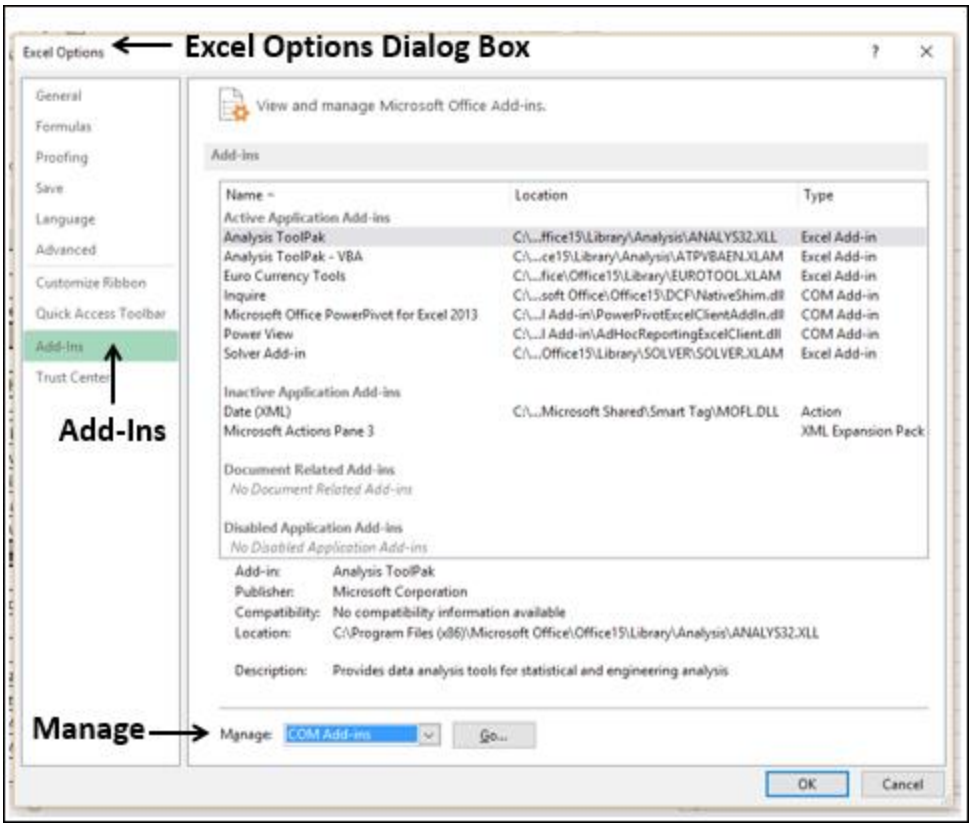
If you have Excel 2010, **POWERPIVOT** tab might not appear on the Ribbon if you have not already enabled the Power Pivot add-in.

Power Pivot Add-in

Power Pivot Add-in is a COM Add-in that needs to be enabled to get the complete features of Power Pivot in Excel. Even when POWERPIVOT tab appears on the ribbon, you need to ensure that the add-in is enabled to access all the features of Power Pivot.

Step 1 − Click the FILE tab on the Ribbon.

Step 2 − Click Options in the dropdown list. The Excel Options dialog box appears.



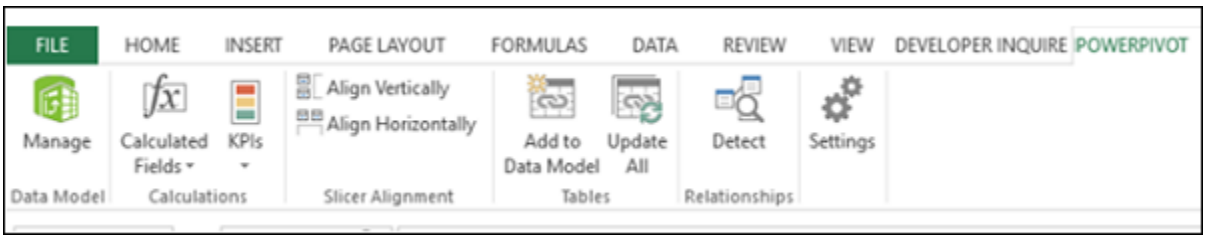
Step 3 − Follow the instructions as follows.

- Click Add-Ins.
- In the Manage box, select COM Add-ins from the dropdown list.
- Click the Go button. The COM Add-Ins dialog box appears.
- Check Power Pivot and click OK.

What is Power Pivot?

Excel Power Pivot is a tool for integrating and manipulating large volumes of data. With Power Pivot, you can easily load, sort and filter data sets that contain millions of rows and perform the required calculations. You can utilize Power Pivot as an ad hoc reporting and analytics solution.

The Power Pivot Ribbon as shown below has various commands, ranging from managing Data Model to creating reports.



The Power Pivot window will have the Ribbon as shown below:

Why is Power Pivot a Strong Tool?

When you invoke Power Pivot, Power Pivot creates data definitions and connections that get stored with your Excel file in a compressed form. When the data at the source is updated, it is refreshed automatically in your Excel file. This facilitates the usage of the data maintained elsewhere but is required for study time-to-time study and arriving at decisions. The source data can be in any form − ranging from a text file or a web page to the different relational databases.

The user-friendly interface of Power Pivot in the PowerPivot window enables you to perform data operations without the knowledge of any database query language. You can then create a report of your analysis within few seconds. The reports are versatile, dynamic and interactive and enable you to further probe into the data to get the insights and arrive at the conclusions / decisions.

The data that you work on in Excel and in the Power Pivot window is stored in an analytical database inside the Excel workbook, and a powerful local engine loads, queries, and updates the data in that database. Since the data is in Excel, it is immediately available to PivotTables, PivotCharts, Power View, and other features in Excel that you use to aggregate and interact with the data. The data presentation and interactivity is provided by Excel and the data and Excel presentation objects are contained within the same workbook file. Power Pivot supports files up to 2GB in size and enables you to work with up to 4GB of data in memory.

Power Features to Excel with Power Pivot

Power Pivot features are free with Excel. Power Pivot has enhanced the Excel performance with power features that include the following:

- Ability to handle large data volumes, compressed into small files, with amazing speed.
- Filter data and rename columns and tables while importing.
- Organize tables into individual tabbed pages in the Power Pivot window as against the Excel tables distributed all over the workbook or multiple tables in the same worksheet.
- Create relationships among the tables, so as to analyze the data in the tables collectively. Before Power Pivot, one had to rely on heavy usage of VLOOKUP function to combine the data into a single table before such analysis. This used to be laborious and error-prone.

- Add power to the simple PivotTable with many added features.
- Provide Data Analysis Expressions (DAX) language to write advanced formulas.
- Add calculated fields and calculated columns to the data tables.
- Create KPIs to use in PivotTables and Power View reports.

You will understand the Power Pivot features in detail in the next module.

Uses of Power Pivot

You can use Power Pivot for the following:

- To perform powerful data analysis and create sophisticated Data Models.
- To mash-up large volumes of data from several different sources quickly.
- To perform information analysis and share the insights interactively.
- To write advanced formulas with the Data Analysis Expressions (DAX) language.
- To create Key Performance Indicators (KPIs).

Data Modelling with Power Pivot

Power Pivot provides advanced data modeling features in Excel. The data in the Power Pivot is managed in the Data Model that is also referenced as Power Pivot database. You can use Power Pivot to help you gain new insights into your data.

You can create relationships between data tables so that you can perform data analysis on the tables collectively. With DAX, you can write advanced formulas. You can create calculated fields and calculated columns in the data tables in the Data Model.

You can define Hierarchies in the data to use everywhere in the workbook, including Power View. You can create KPIs to use in PivotTables and Power View reports to show at a glance whether performance is on or off target for one or more metrics.

Business Intelligence with Power Pivot

Business intelligence (BI) is essentially the set of tools and processes that people use to gather data, turn it into meaningful information, and then make better decisions. The BI capabilities of Power Pivot in Excel enable you to gather data, visualize data, and share information with people in your organization across multiple devices.

You can share your workbook to a SharePoint environment that has Excel Services enabled. On the SharePoint server, Excel Services processes and renders the data in a browser window where others can analyze the data.

Features

The most important and powerful feature of Power Pivot is its database − Data Model. The next significant feature is the xVelocity in-memory analytics engine that makes it possible to work on large multiple databases in a matter of few minutes. There are some more important features that come with the PowerPivot Add-in.

In this module, you will get a brief overview of the features of Power Pivot, which are illustrated in detail later.

Loading Data from External Sources

You can load data into Data Model from external sources in two ways −

- Load data into Excel and then create a Power Pivot Data Model.
- Load data directly into Power Pivot Data Model.

The second way is more efficient because of the efficient way Power Pivot handles the data in memory.

For more details, refer to module − Loading Data into Power Pivot.

Excel Window and Power Pivot Window

When you start working with Power Pivot, two windows will open simultaneously − Excel window and Power Pivot window. It is through PowerPivot window that you can load data into Data Model directly, view the data in Data View and Diagram View, Create relationships between tables, manage the relationships, and create the Power PivotTable and/or PowerPivot Chart reports.

You need not have the data in Excel tables when you are importing data from external sources. If you have data as Excel tables in the workbook, you can add them to Data Model, creating data tables in Data Model that are linked to the Excel tables.

When you create a PivotTable or PivotChart from Power Pivot window, they are created in the Excel window. However, the data is still managed from Data Model.

You can always switch between the Excel window and Power Pivot window anytime, easily.

Data Model

The Data Model is the most powerful feature of Power Pivot. The data that is obtained from various data sources is maintained in Data Model as data tables. You can create relationships between the data tables so that you can combine the data in the tables for analysis and reporting.

You will learn in detail about the Data Model in the module − Understanding Data Model (Power Pivot Database).

Memory Optimization

Power Pivot Data Model uses xVelocity storage, which is highly compressed when data is loaded into memory that makes it possible to store hundreds of millions of rows in memory.

Thus, if you load data directly into Data Model, you will be doing it in the efficient highly compressed form.

Compact File Size

If the data is loaded directly into Data Model, when you save the Excel file, it occupies very less space on the hard disk. You can compare the Excel file sizes, the first one with loading data into Excel and then creating the Data Model and the second with loading data directly into the Data Model skipping the first step. The second one will be up to 10 times smaller than the first one.

Power PivotTables

You can create the Power PivotTables from Power Pivot window. The PivotTables so created are based on the data tables in the Data Model, making it possible to combine data from the related tables for analysis and reporting.

Power PivotCharts

You can create the Power PivotCharts from Power Pivot window. The PivotCharts so created are based on the data tables in the Data Model, making it possible to combine data from the related tables for analysis and reporting. The Power PivotCharts have all the features of Excel PivotCharts and many more such as field buttons.

You can also have combinations of Power PivotTable and Power PivotChart.

DAX Language

The strength of Power Pivot comes from the DAX Language that can be used effectively on the Data Model to perform calculations on the data in the data tables. You can have Calculated Columns and Calculated Fields defined by DAX that can be used in the Power PivotTables and Power PivotCharts.

Loading Data

In this module, we will learn to load data into Power Pivot.

You can load data into Power Pivot in two ways:

- Load data into Excel and add it to the Data Model
- Load data into PowerPivot directly, populating the Data Model, which is the PowerPivot database.

If you want the data for Power Pivot, do it the second way, without Excel even knowing about it. This is because you will be loading the data only once, in highly compressed format. To understand the magnitude of difference, suppose you load data into Excel by first adding it to the Data Model, the file size is said 10 MB.

If you load data into PowerPivot, and hence into Data Model skipping the extra step of Excel, your file size could be as less as 1 MB only.

Data Sources Supported by Power Pivot

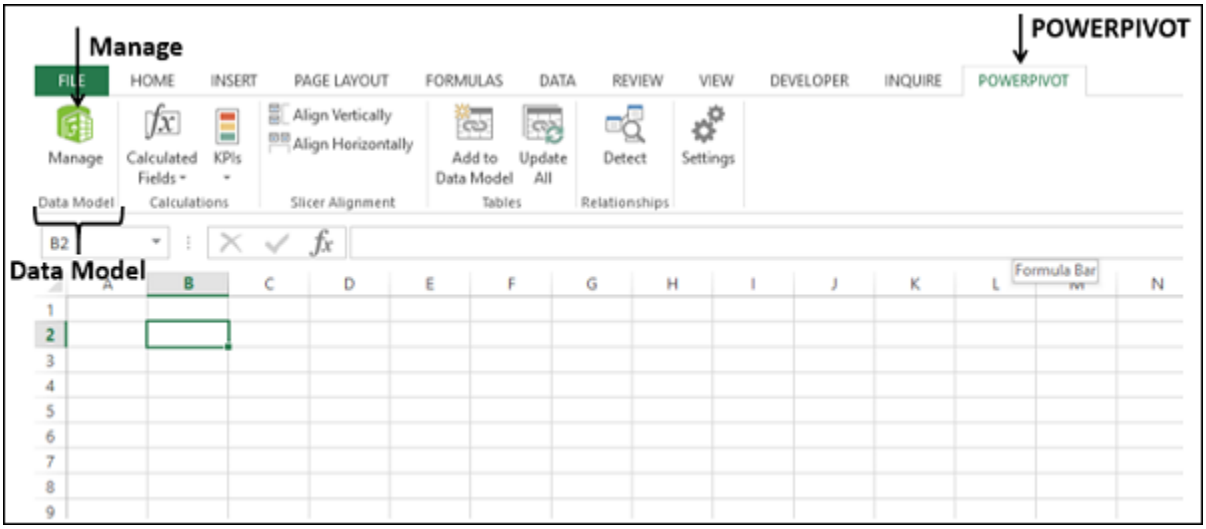
You can either import data into the Power Pivot Data Model from various data sources or establish connections and/or use the existing connections. Power Pivot supports the following data sources −

- SQL Server relational database
- Microsoft Access database
- SQL Server Analysis Services
- SQL Server Reporting Services (SQL 2008 R2)
- ATOM data feeds
- Text files
- Microsoft SQL Azure
- Oracle
- Teradata
- Sybase
- Informix
- IBM DB2
- Object Linking and Embedding Database/Open Database Connectivity
- (OLEDB/ODBC) sources
- Microsoft Excel File
- Text File

Loading Data Directly into PowerPivot

To load data directly into Power Pivot, perform the following:

- Open a new workbook.
- Click on the POWERPIVOT tab on the ribbon.
- Click on Manage in the Data Model group.

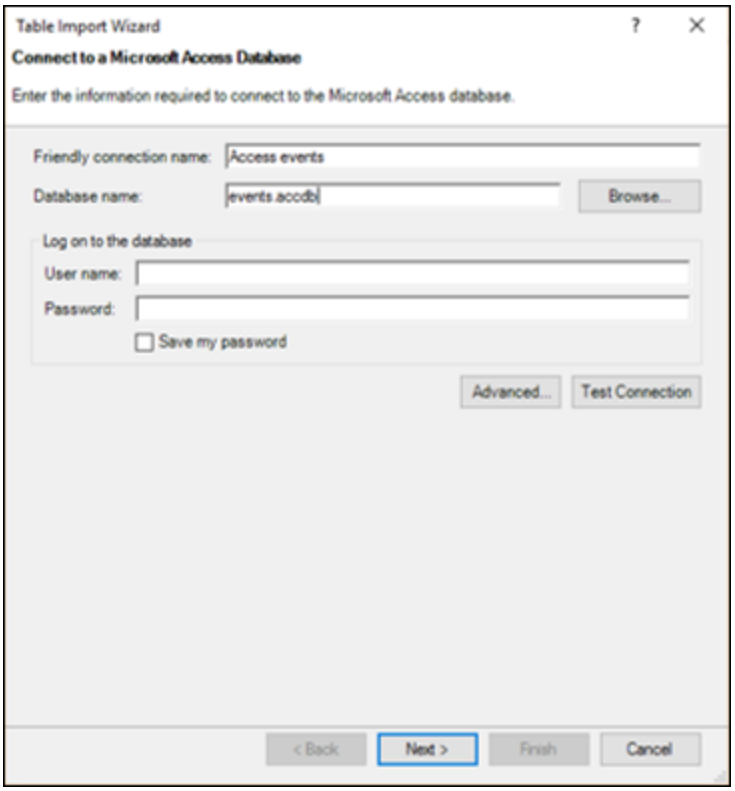


The PowerPivot window opens. Now you have two windows − the Excel workbook window and the PowerPivot for Excel window that is connected to your workbook.

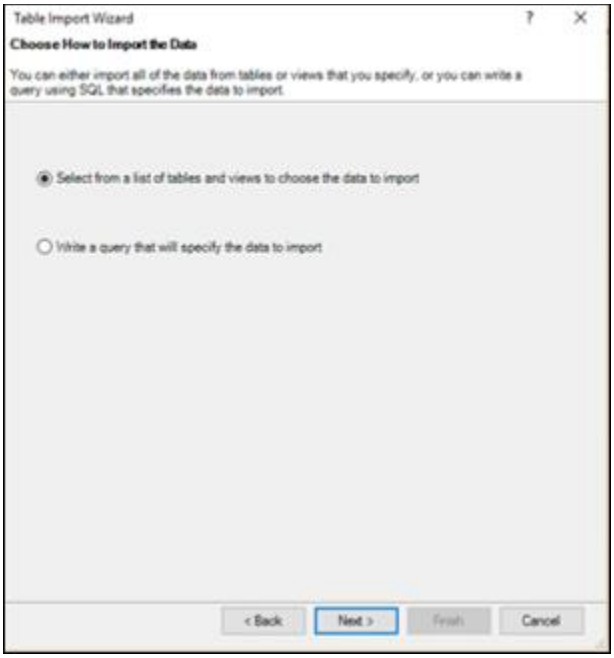
- Click the **Home** tab in the PowerPivot window.
- Click **From Database** in the Get External Data group.
- Select **From Access**.

The Table Import Wizard appears.

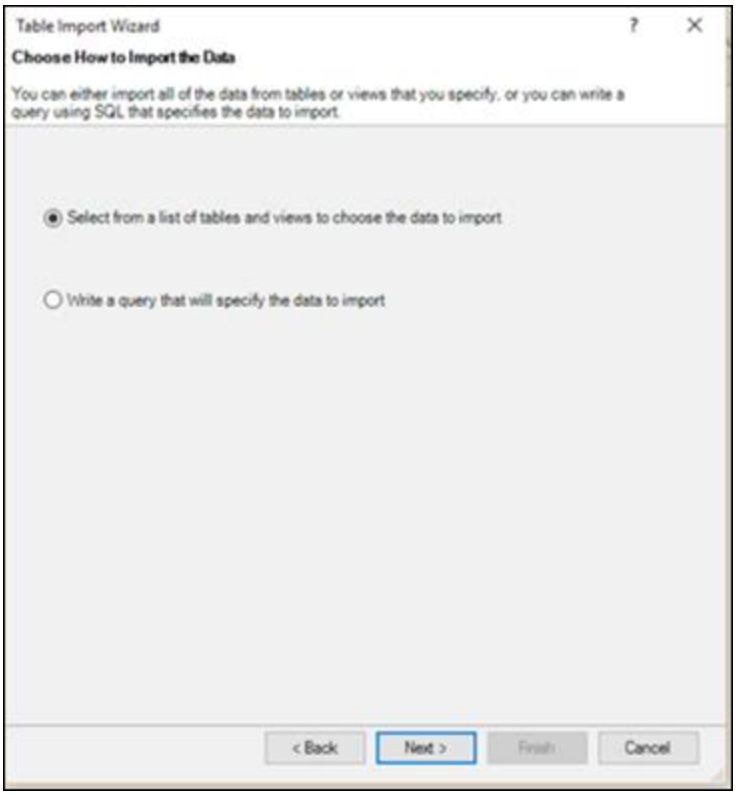
- Browse to the Access database file.
- Provide Friendly connection name.
- If the database is password protected, fill in those details also.



Click the **Next** → button. The Table Import Wizard displays the options for choosing how to import data.

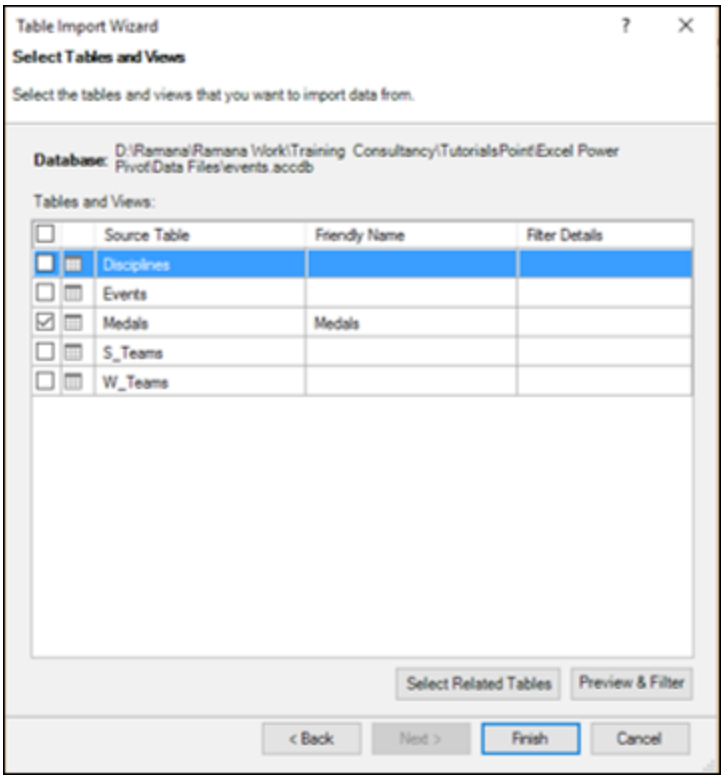


Click Select from a list of tables and views to choose the data to import.



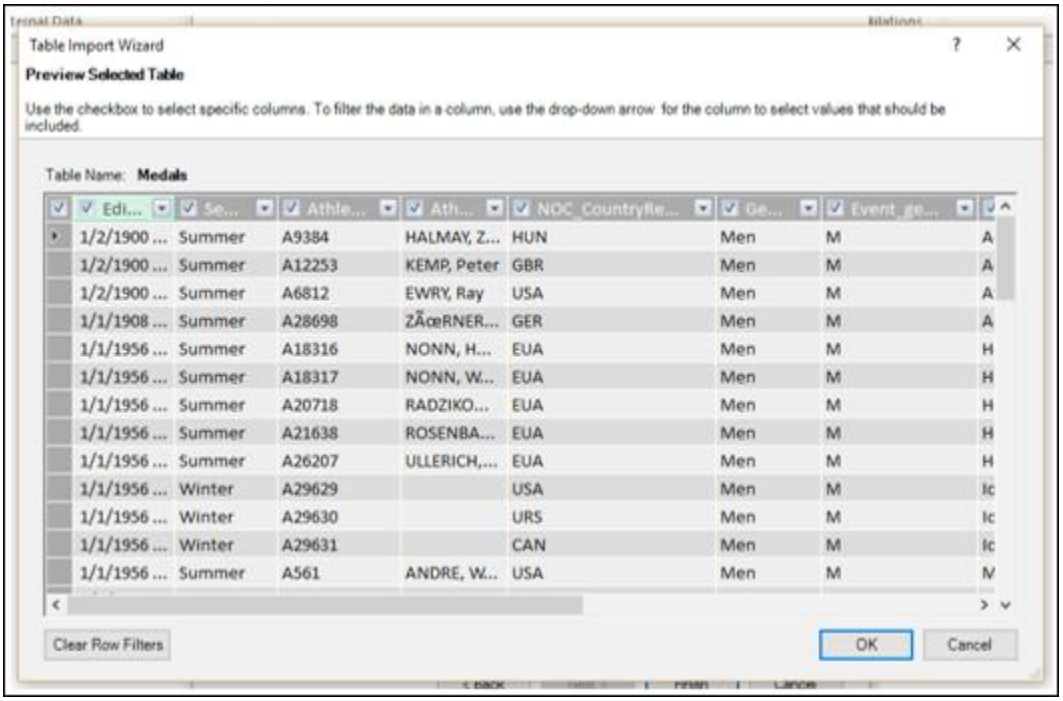
Click the **Next** → button. The Table Import Wizard displays the tables and views in the Access database that you have selected.

Check the box Medals.



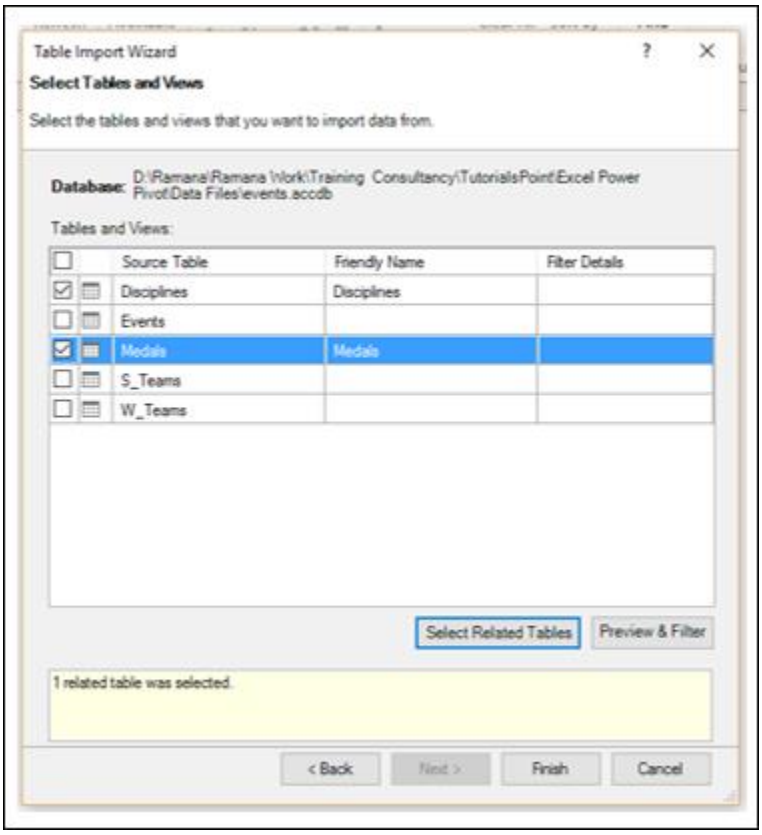
As you can observe, you can select the tables by checking the boxes, preview and filter the tables before adding to Pivot Table and/or select the related tables.

Click the **Preview & Filter** button.



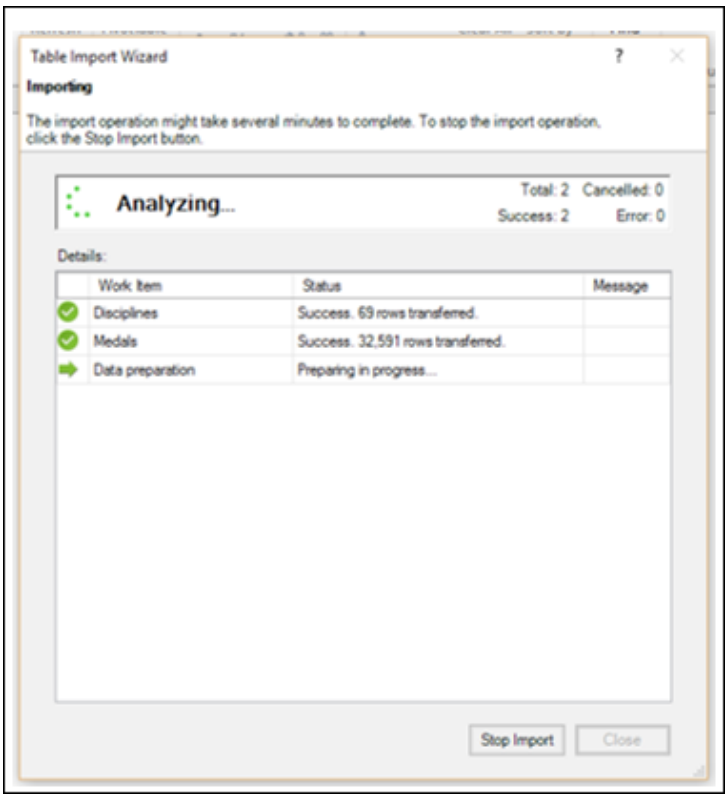
As you can see, you can select specific columns by checking the boxes in the column labels, filter the columns by clicking the dropdown arrow in the column label to select the values to be included.

- Click OK.
- Click the **Select Related Tables** button.
- Power Pivot checks what other tables are related to the selected Medals table, if a relation exists.

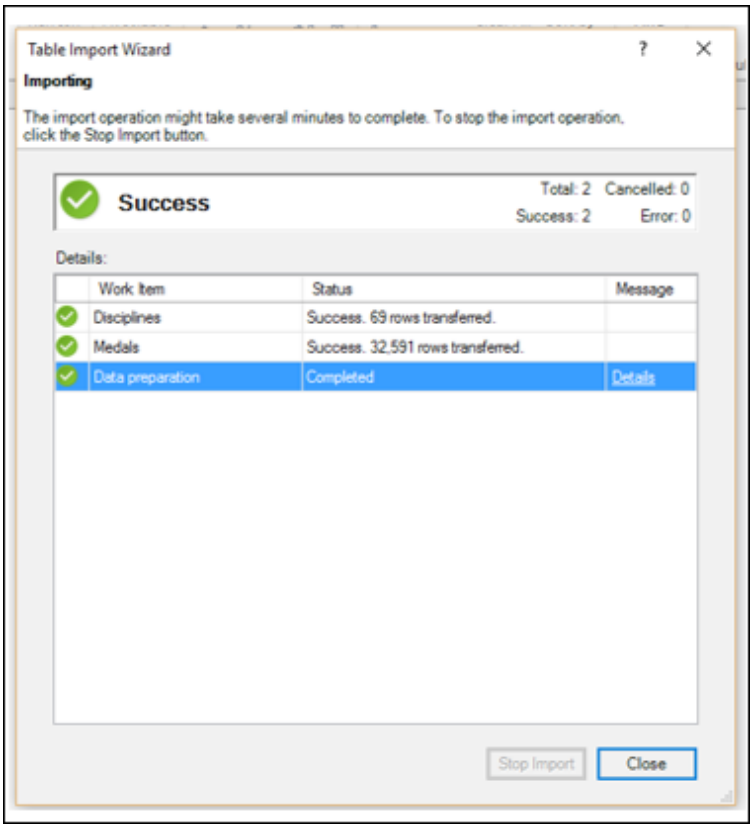


You can see that Power Pivot found that the table Disciplines are related to the table Medals and selected it. Click Finish.

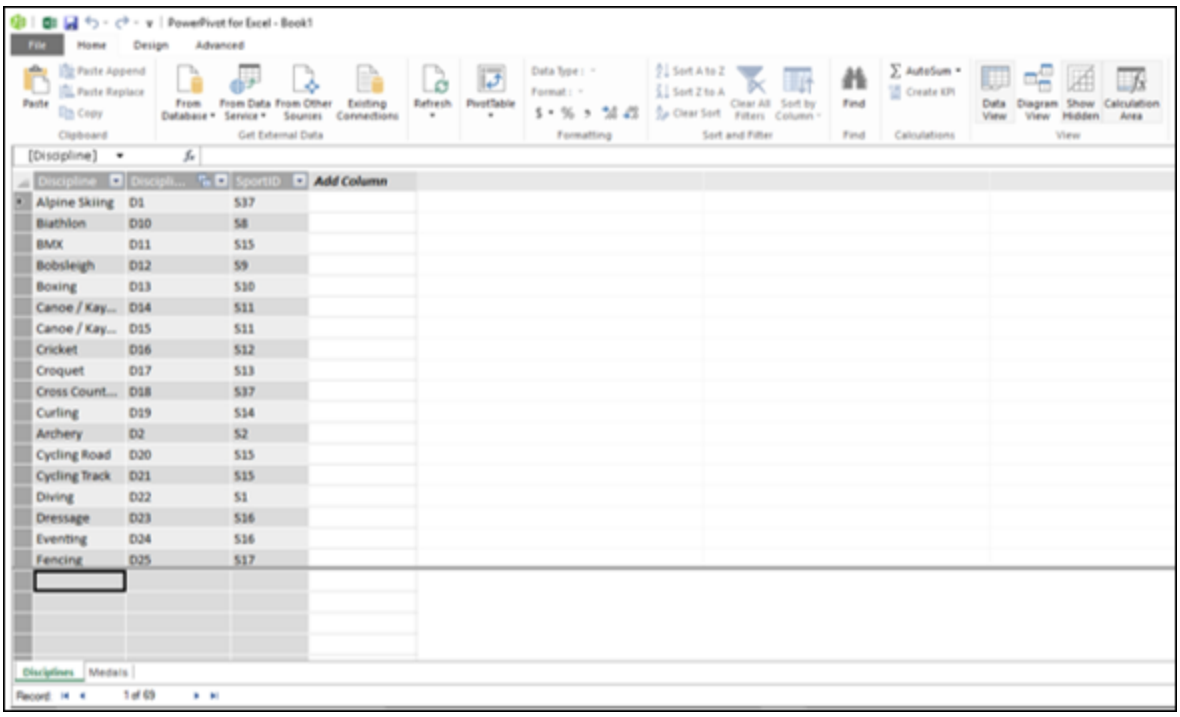
Table Import Wizard displays − **Importing** and shows the status of the import. This will take a few minutes and you can stop the import by clicking the **Stop Import** button.



Once the data is imported, the Table Import Wizard displays – **Success** and shows the results of the import as shown in the screenshot below. Click Close.



Power Pivot displays the two imported tables in two tabs.



You can scroll through the records (rows of the table) using the **Record** arrows below the tabs.

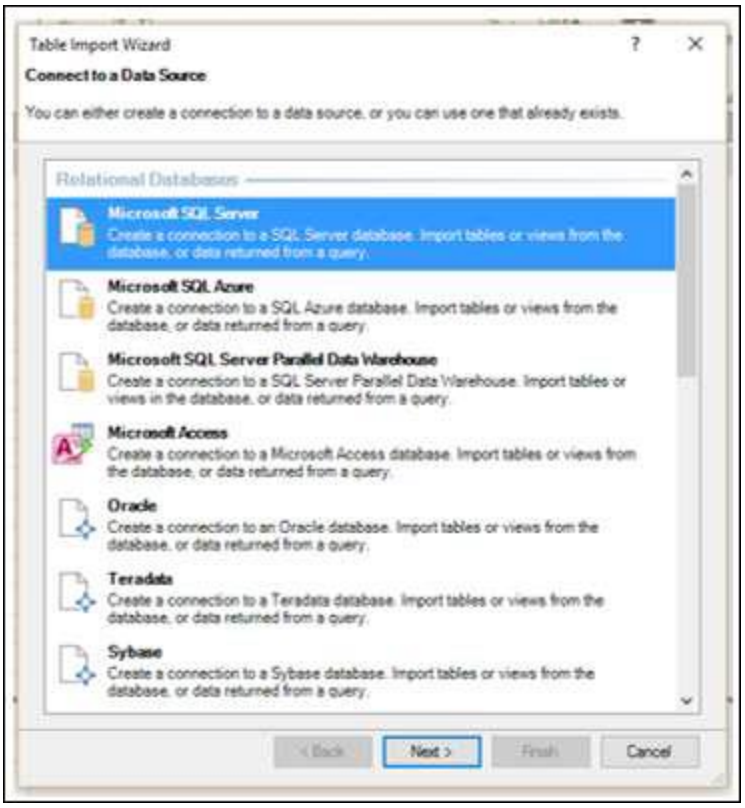
Table Import Wizard

In the previous section, you have learnt how to import data from Access through the Table Import Wizard.

Note that the Table Import Wizard options change as per the data source that is selected to connect to. You might want to know what data sources you can choose from.

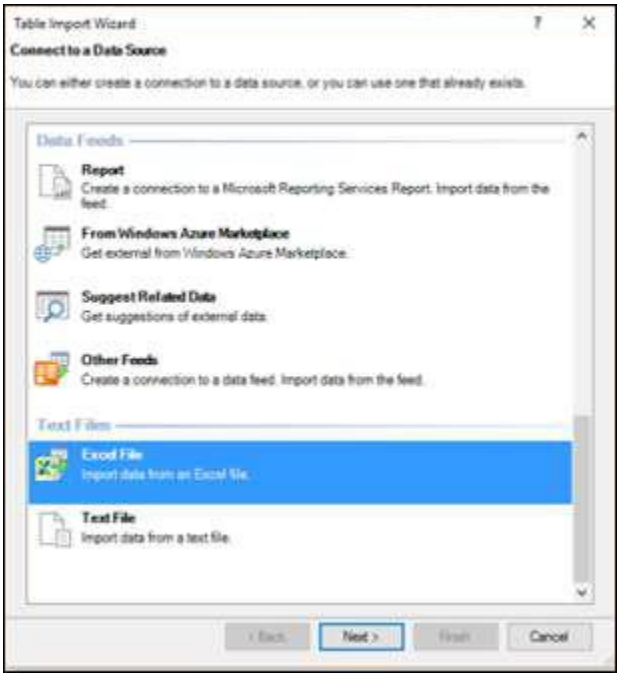
Click **From Other Sources** in the Power Pivot window.

The Table Import Wizard – **Connect to a Data Source** appears. You can either create a connection to a data source or you can use one that already exists.

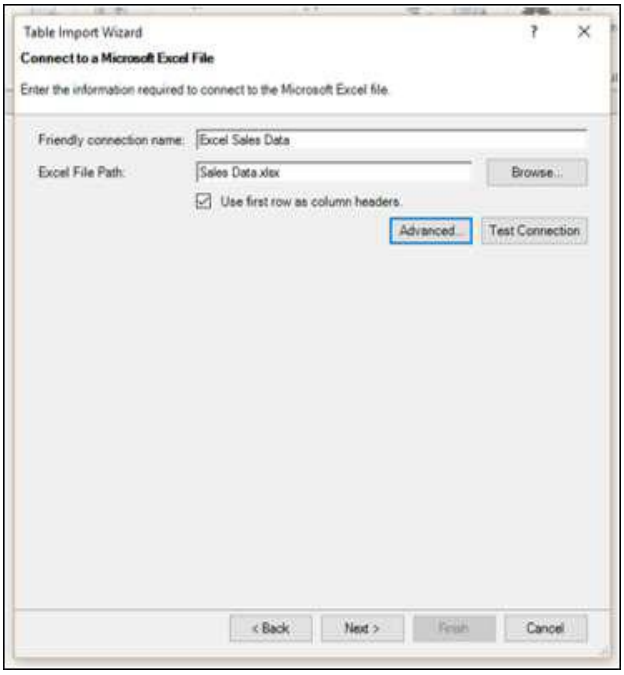


You can scroll through the list of connections in the Import Table Wizard to know the compatible data connections to Power Pivot.

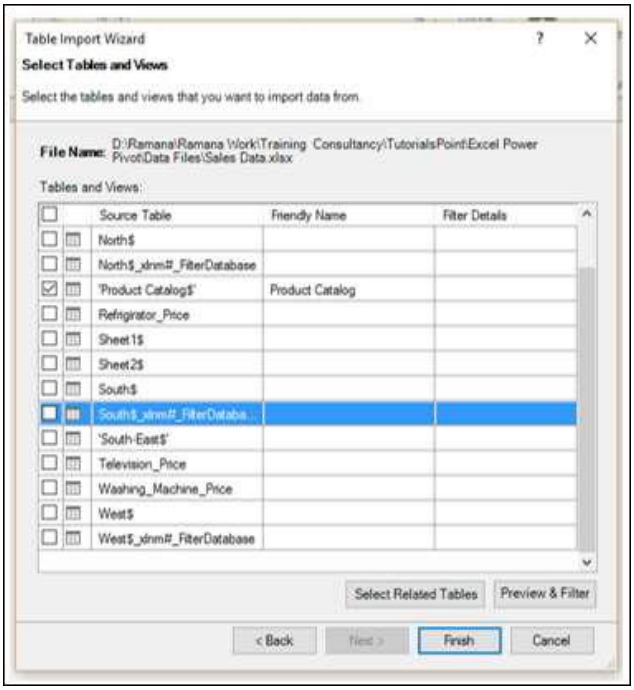
- Scroll down to the Text Files.
- Select **Excel File**.



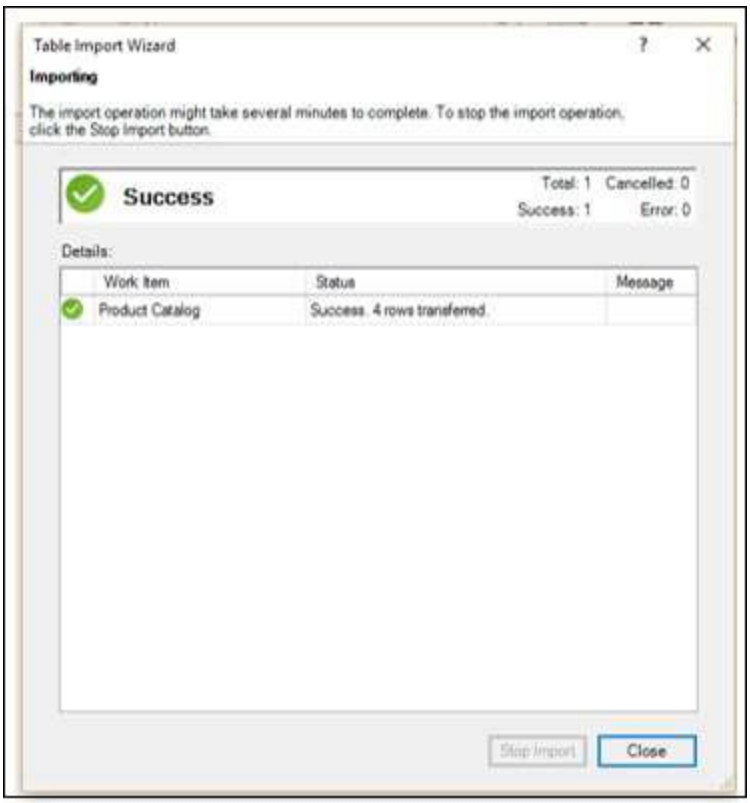
- Click the **Next** → button. The Table Import Wizard displays – Connect to a Microsoft Excel File.
- Browse to the Excel file in the Excel File Path box.
- Check the box – **Use first row as column headers**.



- Click the **Next** → button. The Table Import Wizard displays − **Select Tables and Views**.
- Check the box **Product Catalog$**. Click the **Finish** button.



You will see the following **Success** message. Click Close.



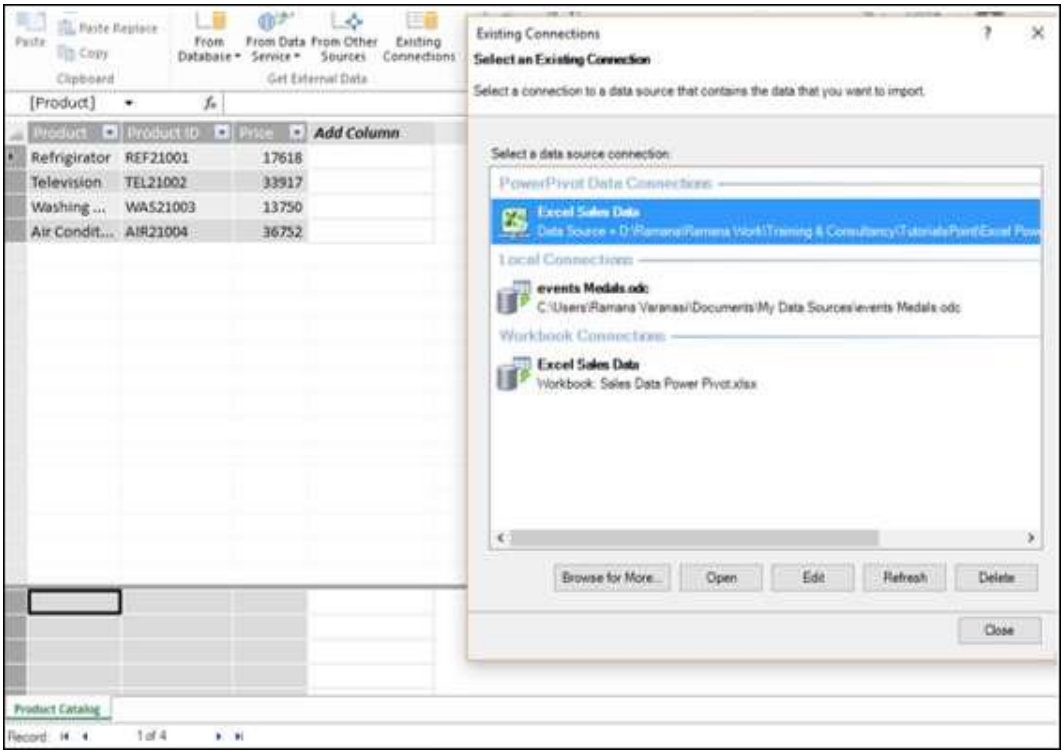
You have imported one table, and you have also, created a connection to the Excel file that contains several other tables.

Opening Existing Connections

Once you have established a connection to a data source, you can open it later.

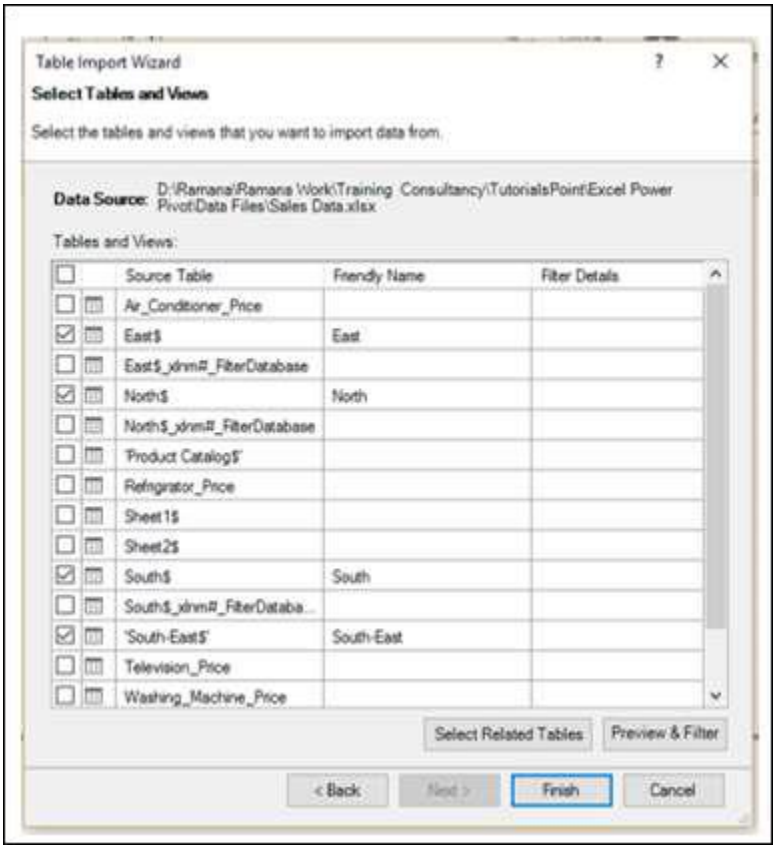
Click Existing Connections in the PowerPivot window.

The Existing Connections dialog box appears. Select Excel Sales Data from the list.

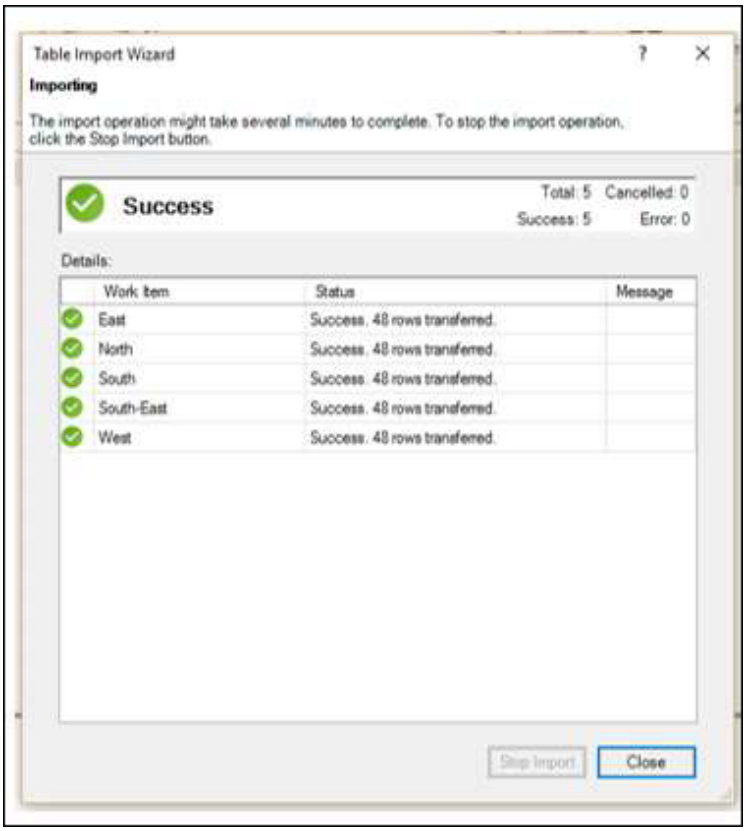


Click the Open button. The Table Import Wizard appears displaying the tables and views.

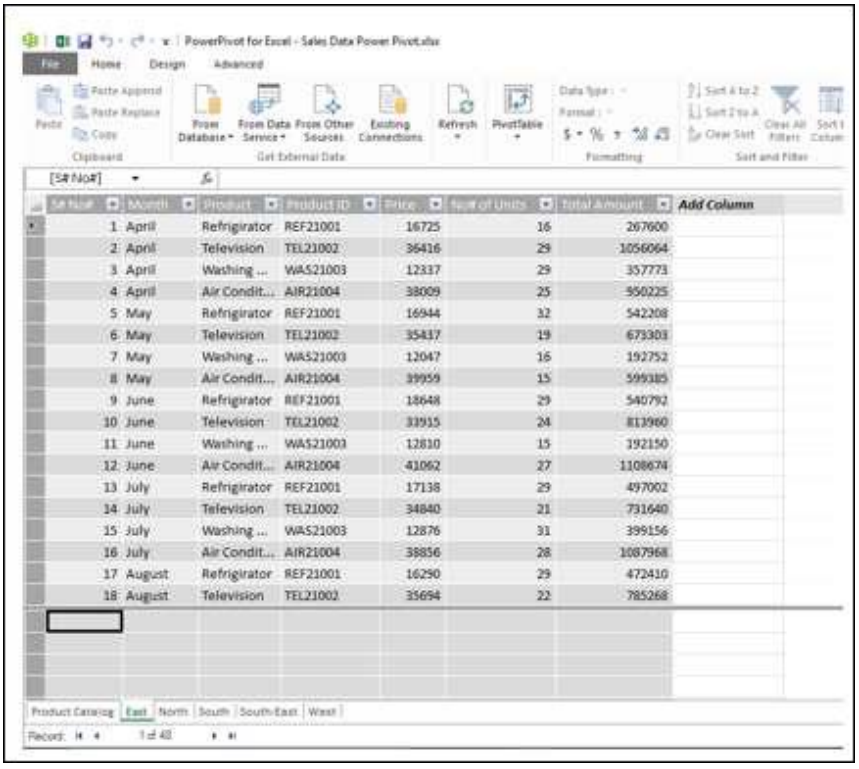
Select the tables that you want to import and click **Finish**.



The selected five tables will be imported. Click **Close**.



You can see that the five tables are added to the Power Pivot, each in a new tab.

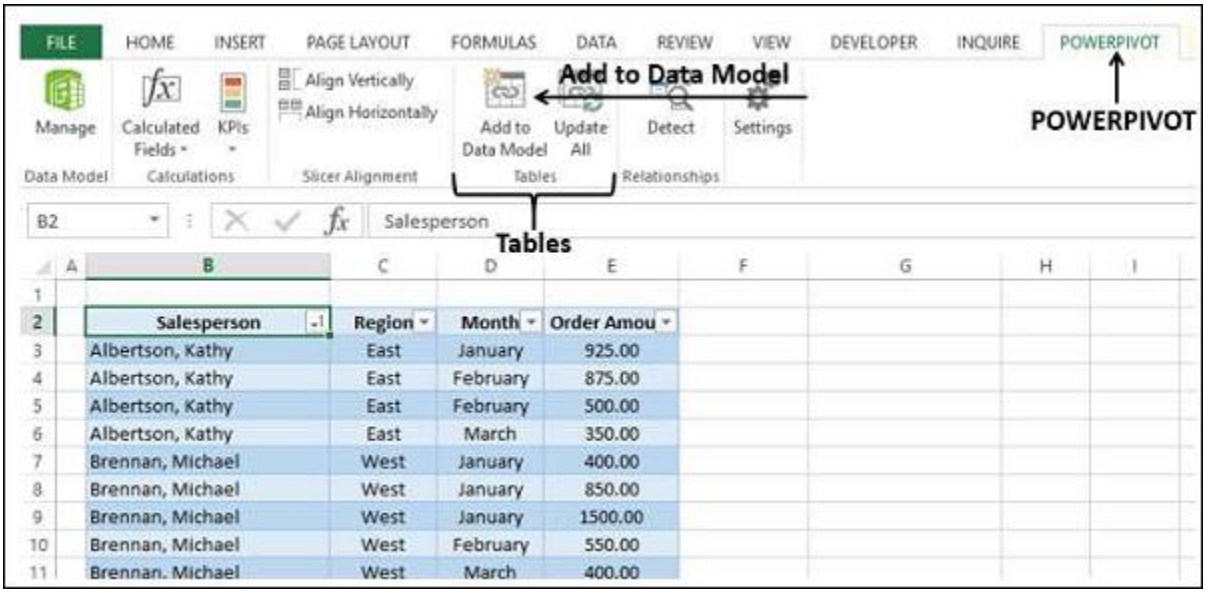


Creating Linked Tables

Linked tables are a live link between the table in Excel and the table in the Data Model. Updates to the table in Excel automatically update the data in the data table in the model.

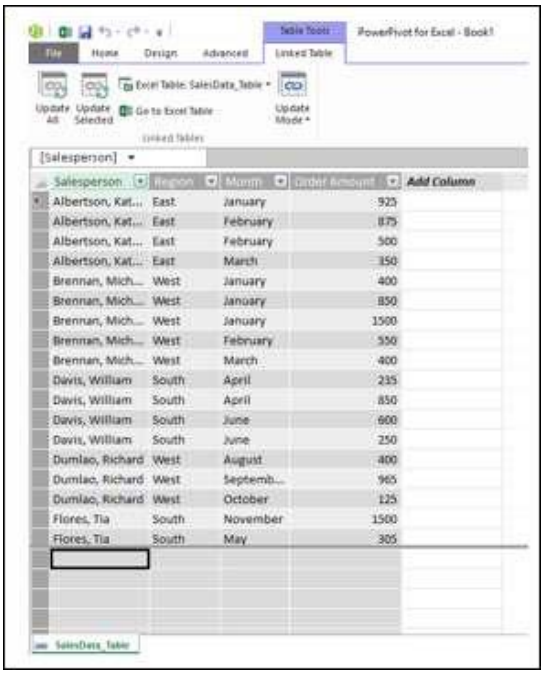
You can link the Excel table into Power Pivot in a few steps as follows:

- Create an Excel table with the data.
- Click the POWERPIVOT tab on the Ribbon.
- Click **Add to Data Model** in the Tables group.



	A	B	C	D	E	F	G	H	I
1									
2		Salesperson	Region	Month	Order Amou				
3		Albertson, Kathy	East	January	925.00				
4		Albertson, Kathy	East	February	875.00				
5		Albertson, Kathy	East	February	500.00				
6		Albertson, Kathy	East	March	350.00				
7		Brennan, Michael	West	January	400.00				
8		Brennan, Michael	West	January	850.00				
9		Brennan, Michael	West	January	1500.00				
10		Brennan, Michael	West	February	550.00				
11		Brennan, Michael	West	March	400.00				

The Excel table is linked to the corresponding Data Table in PowerPivot.



You can see that the Table Tools with the tab - Linked Table is added to the Power Pivot window. If you click **Go to Excel Table**, you will switch to the Excel worksheet. If you click **Manage**, you will switch back to the linked table in the Power Pivot window.

You can update the linked table either automatically or manually.

Note that you can link an Excel table only if it is present in the workbook with the Power Pivot. If you have Excel tables in a separate workbook, then you have to load them as explained in the next section.

Loading from Excel Files

If you want to load the data from Excel workbooks, keep the following in mind −

- Power Pivot considers the other Excel workbook as a database and only worksheets are imported.
- Power Pivot loads each worksheet as a table.
- Power Pivot cannot recognize single tables. Hence, Power Pivot cannot recognize if there are multiple tables on a worksheet.
- Power Pivot cannot recognize any additional information other than the table on a worksheet.

Hence, keep each table in a separate worksheet.

Once your data in the workbook is ready, you can import the data as follows:

- Click **From Other Sources** in the Get External Data group in the Power Pivot window.
- Proceed as given in the section − Table Import Wizard.

The following are the differences between linked Excel tables and imported Excel tables −

- Linked tables need to be in the same Excel workbook in which the Power Pivot database is stored. If the data already exists in other Excel workbooks, there is no point in using this feature.
- The Excel import feature allows you to load data from different Excel workbooks.
- Loading data from an Excel workbook does not create a link between the two files. Power Pivot creates only a copy of the data, while importing.
- When the original Excel file is updated, data in the Power Pivot will not be refreshed. You need to either set the update mode to automatic or update the data manually, in the Linked Table tab of the Power Pivot window.

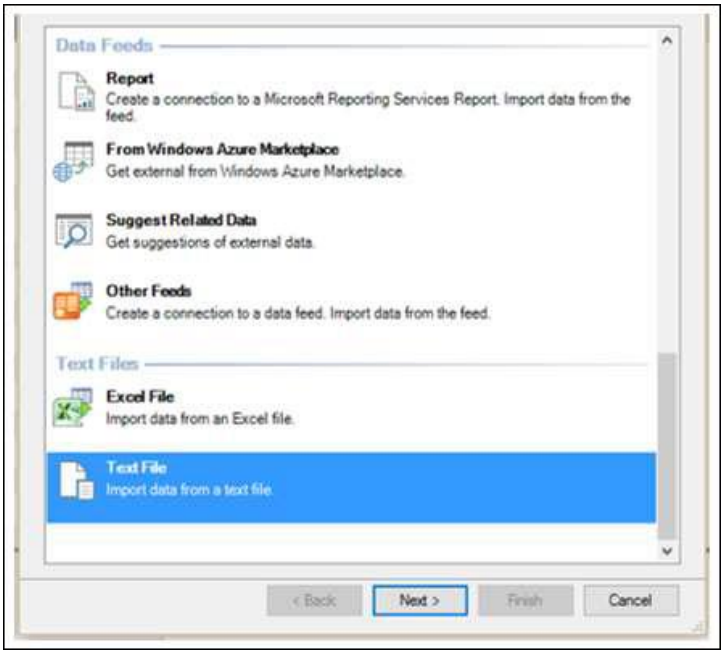
Loading from Text Files

One of the popular data representation styles is with the format known as comma separated values (csv). Each data row /record is represented by a text line, wherein the columns /fields are separated by commas. Many databases provide the option of saving to a csv format file.

If you want to load a csv file into Power Pivot, you have to use the Text File option. Suppose you have the following text file with csv format −

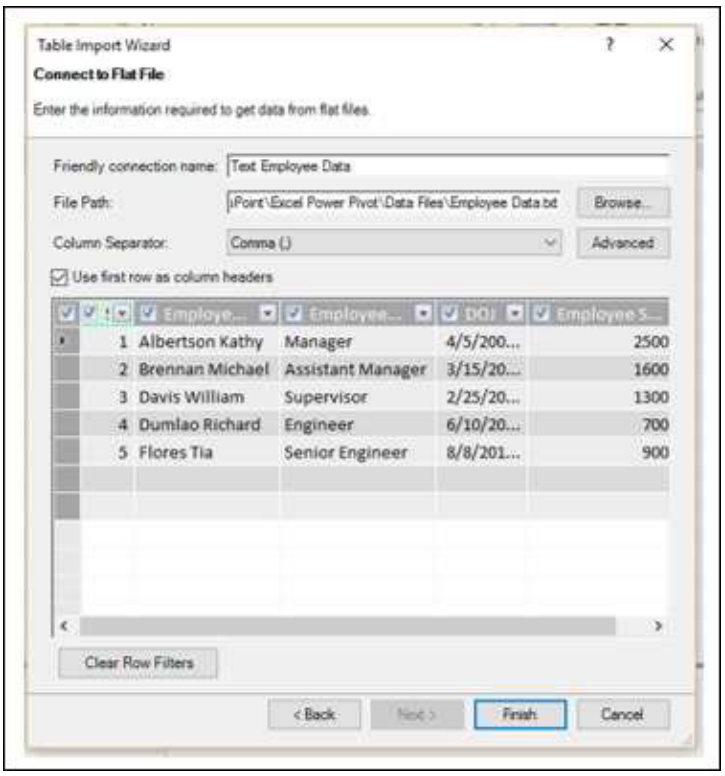
```
S. No., Employee Name, Employee Designation, DOJ, Employee Salary
1, Albertson Kathy, Manager, 4/5/2006, 2500000
2, Brennan Michael, Assistant Manager, 3/15/2010, 1600000
3, Davis William, Supervisor, 2/25/2014, 1300000
4, Dumlao Richard, Engineer, 6/10/2010, 700000
5, Flores Tia, Senior Engineer, 8/8/2013, 900000
```

- Click the PowerPivot tab.
- Click the Home tab in the PowerPivot window.
- Click **From Other Sources** in the Get External Data group. The Table Import Wizard appears.
- Scroll down to Text Files.



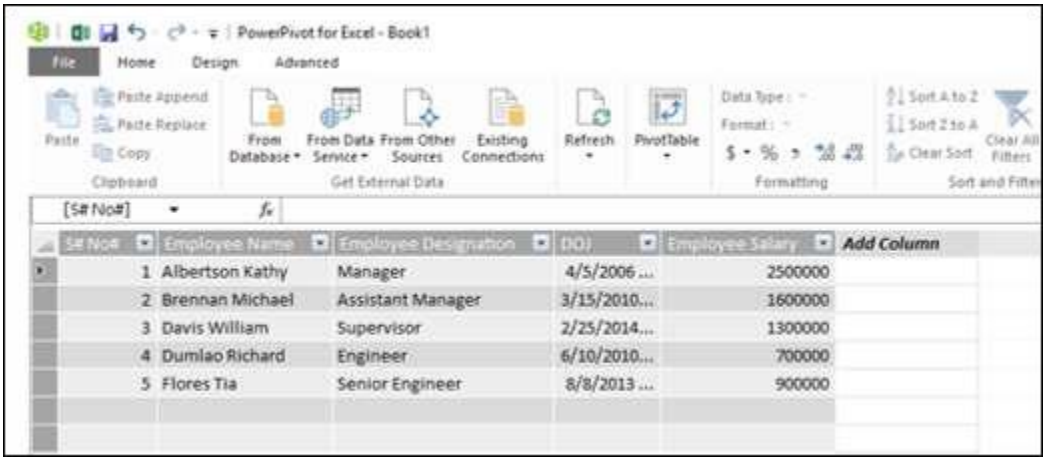
- Click Text File.

- Click the **Next** → button. Table Import Wizard appears with the display − Connect to Flat File.
- Browse to the text file in the File Path box. The csv files usually have the first line representing column headers.
- Check the box Use first row as column headers, if the first line has headers.
- In the Column Separator box, default is Comma (,), but in case your text file has any other operator such as Tab, Semicolon, Space, Colon or Vertical Bar, then choose that operator.



As you can observe, there is a preview of your data table. Click Finish.

Power Pivot creates the data table in the Data Model.



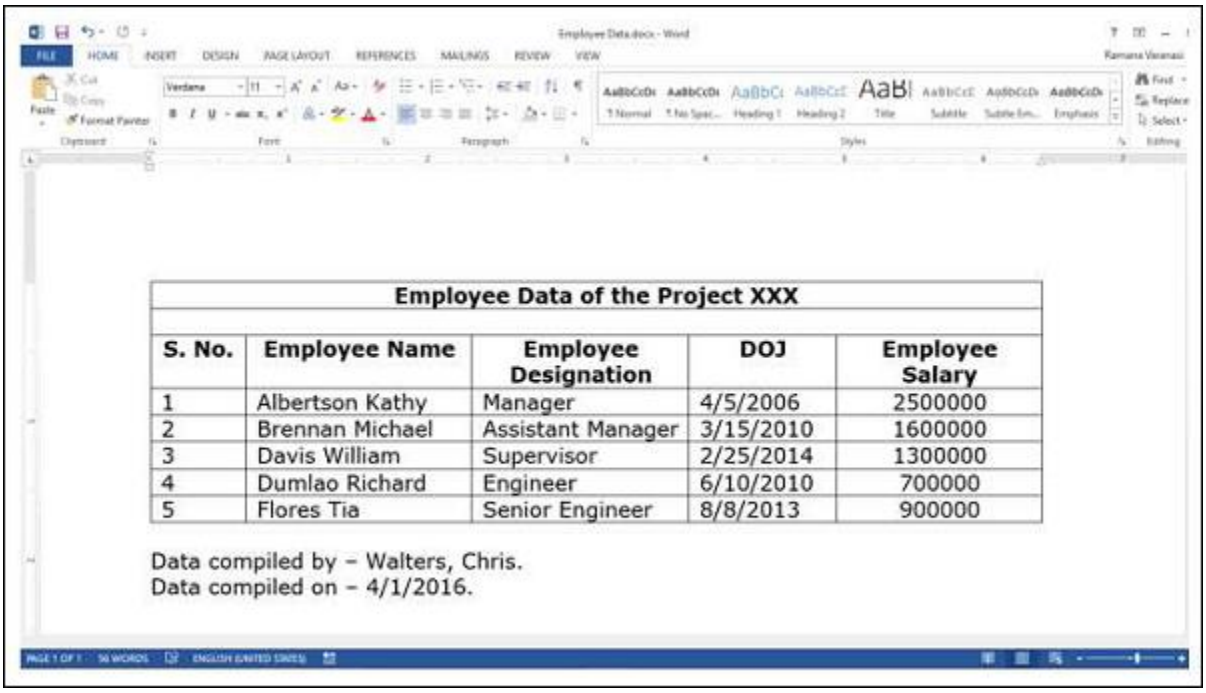
Loading from the Clipboard

Suppose, you have data in an application that is not recognized by Power Pivot as a data source. To load this data into Power Pivot, you have two options −

- Copy the data to an Excel file and use the Excel file as data source for Power Pivot.
- Copy the data, so that it will be on the clipboard, and paste it into Power Pivot.

You have already learnt the first option in an earlier section. And this is preferable to the second option, as you will find at the end of this section. However, you should know how to copy data from clipboard into Power Pivot.

Suppose you have data in a word document as follows:



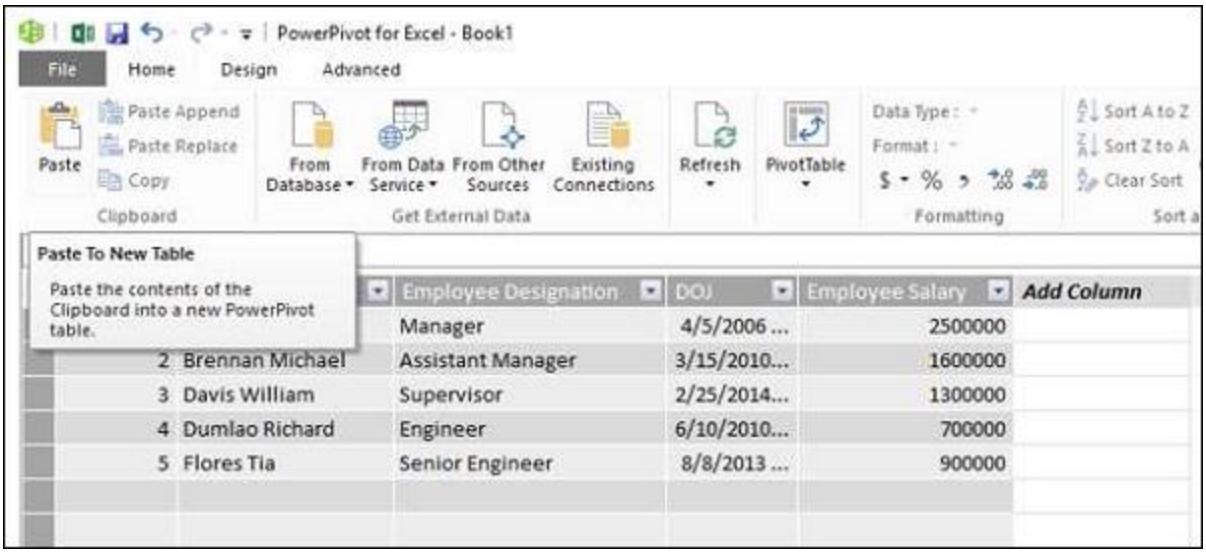
Employee Data of the Project XXX

S. No.	Employee Name	Employee Designation	DOJ	Employee Salary
1	Albertson Kathy	Manager	4/5/2006	2500000
2	Brennan Michael	Assistant Manager	3/15/2010	1600000
3	Davis William	Supervisor	2/25/2014	1300000
4	Dumlao Richard	Engineer	6/10/2010	700000
5	Flores Tia	Senior Engineer	8/8/2013	900000

Data compiled by – Walters, Chris.
Data compiled on – 4/1/2016.

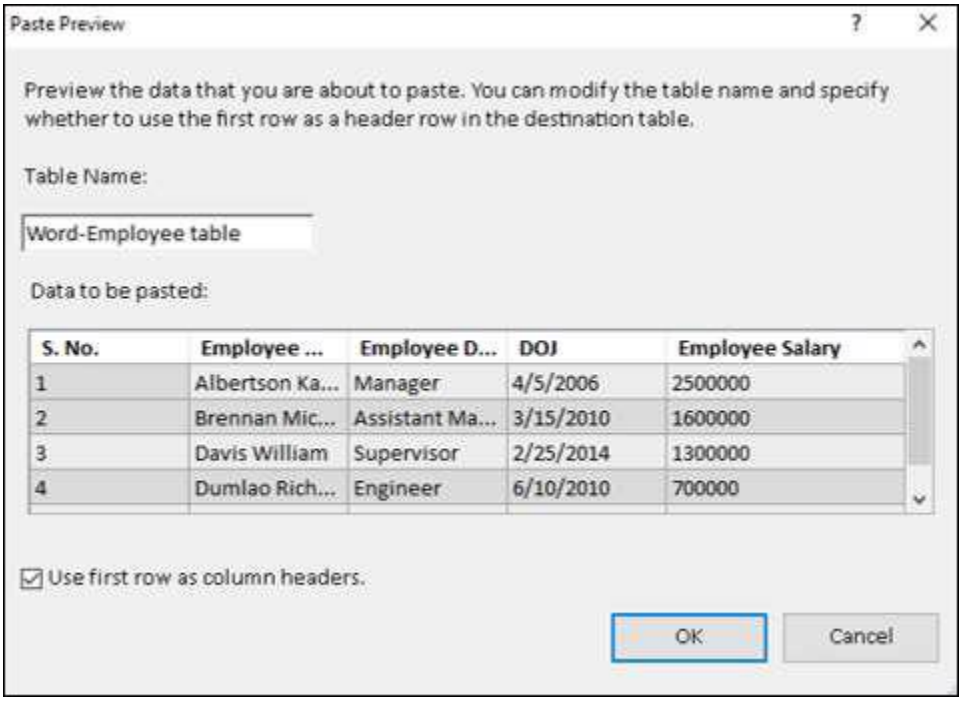
Word is not a data source for Power Pivot. Therefore, perform the following:

- Select the table in the Word document.
- Copy and Paste it in the PowerPivot window.

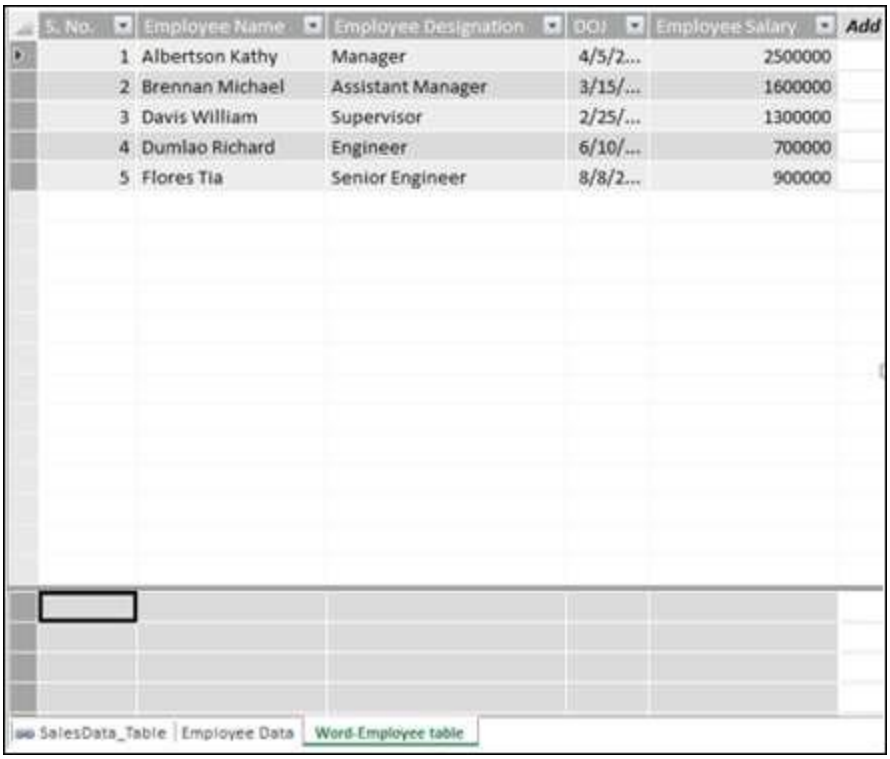


The **Paste Preview** dialog box appears.

- Give the name as **Word-Employee table**.
- Check the box **Use first row as column headers** and click OK.

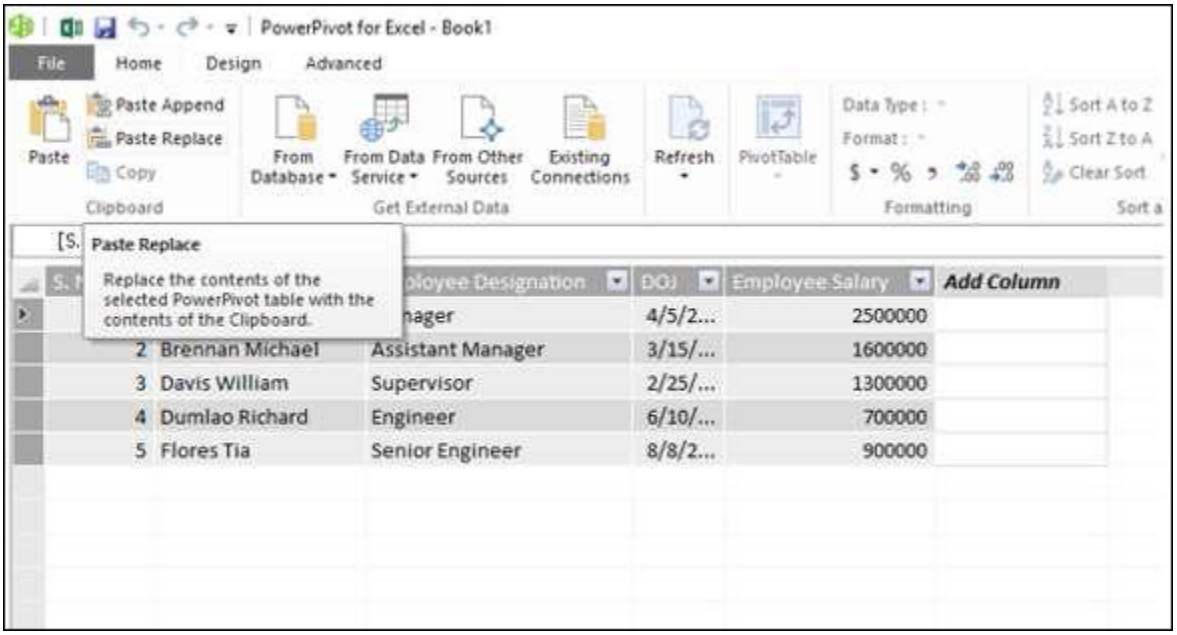


The data copied into the clipboard will be pasted into a new data table in Power Pivot, with the tab − Word-Employee table.

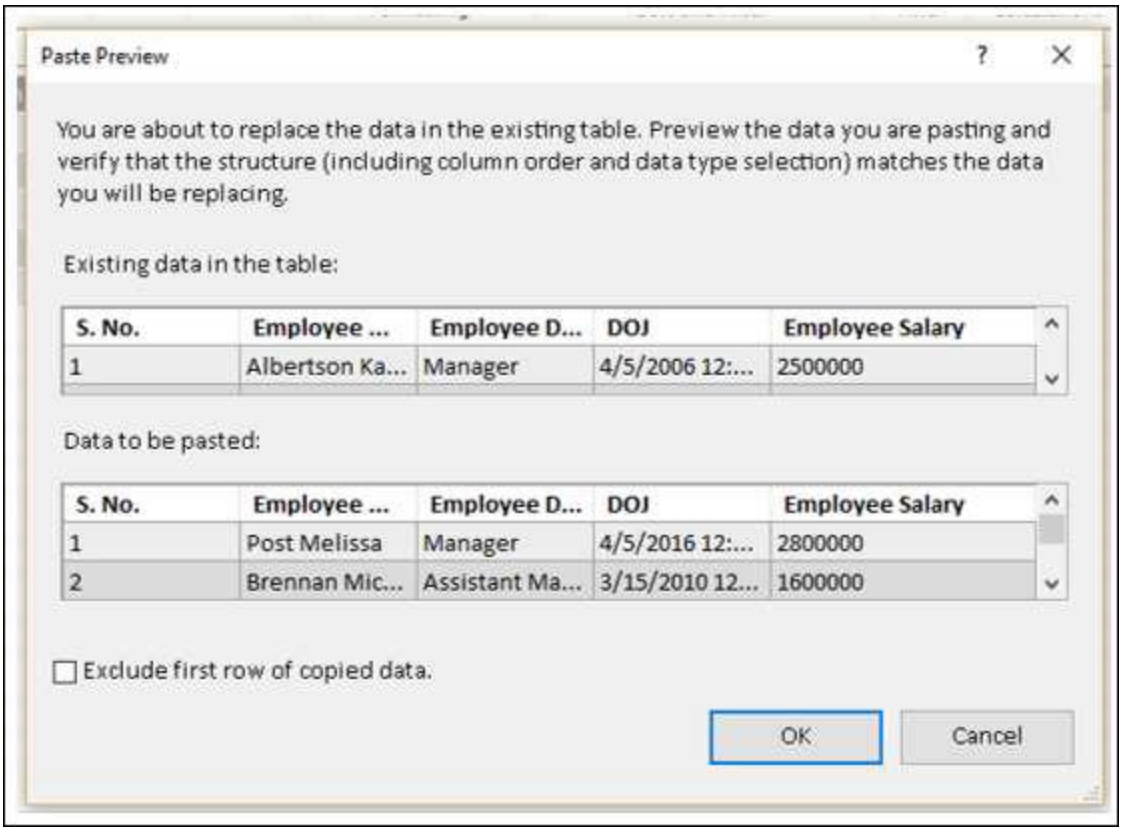


Suppose, you want to replace this table with new content.

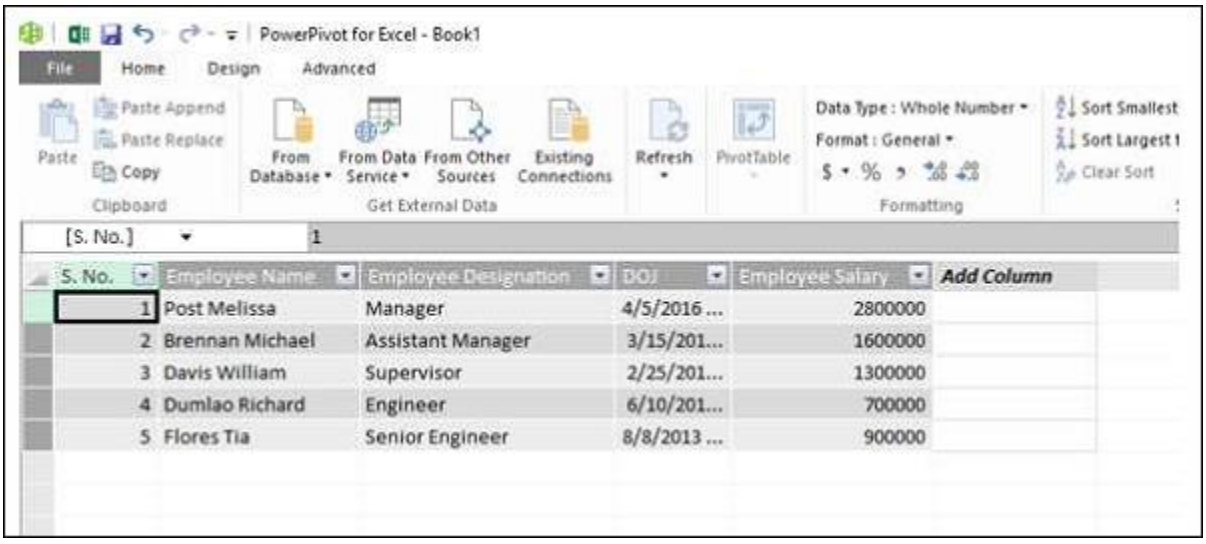
- Copy the table from Word.
- Click Paste Replace.



The Paste Preview dialog box appears. Verify the contents that you are using for replace.

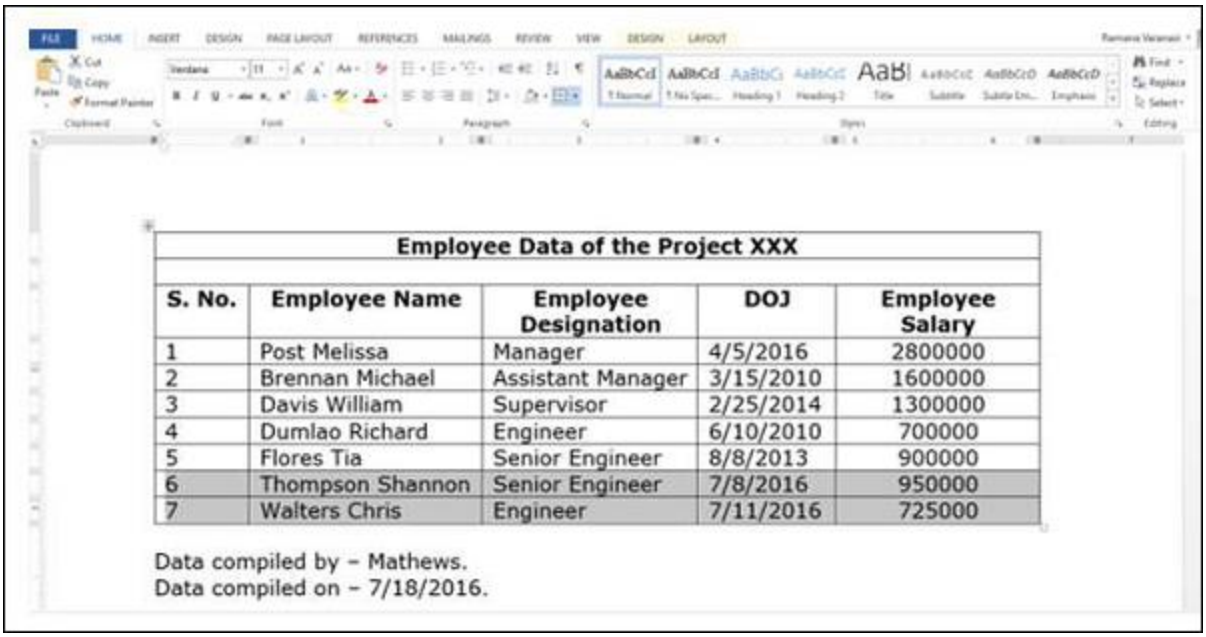


Click OK.



As you can observe, the contents of the data table in Power Pivot are replaced by the contents in the clipboard.

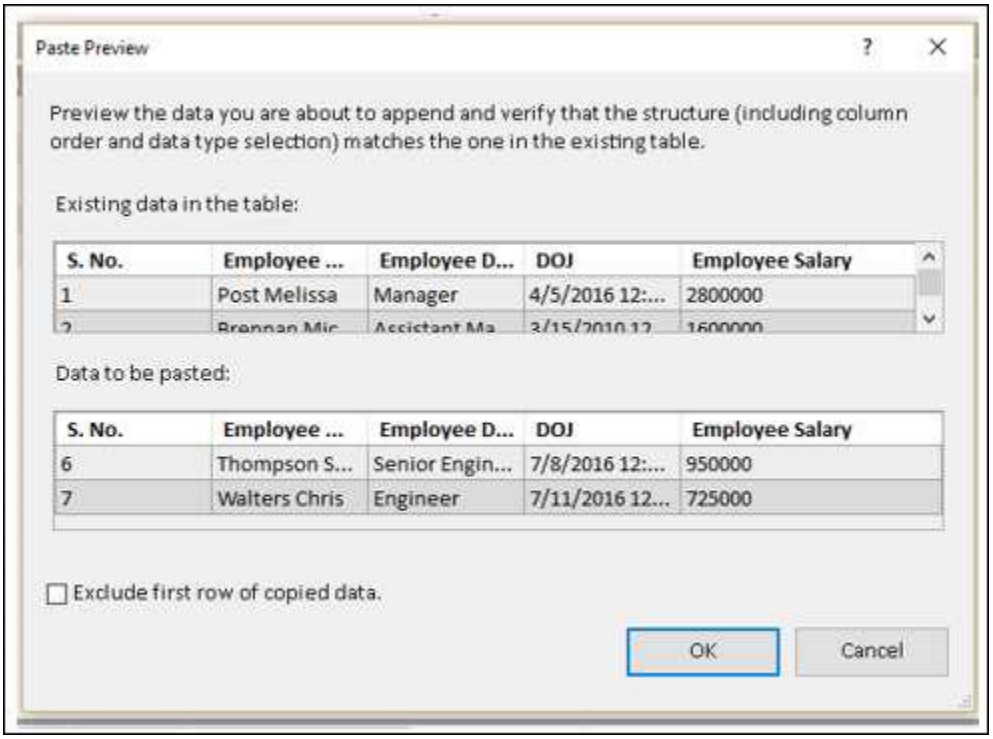
Suppose you want to add two new rows of data to a data table. In the table in the Word document, you have the two news rows.



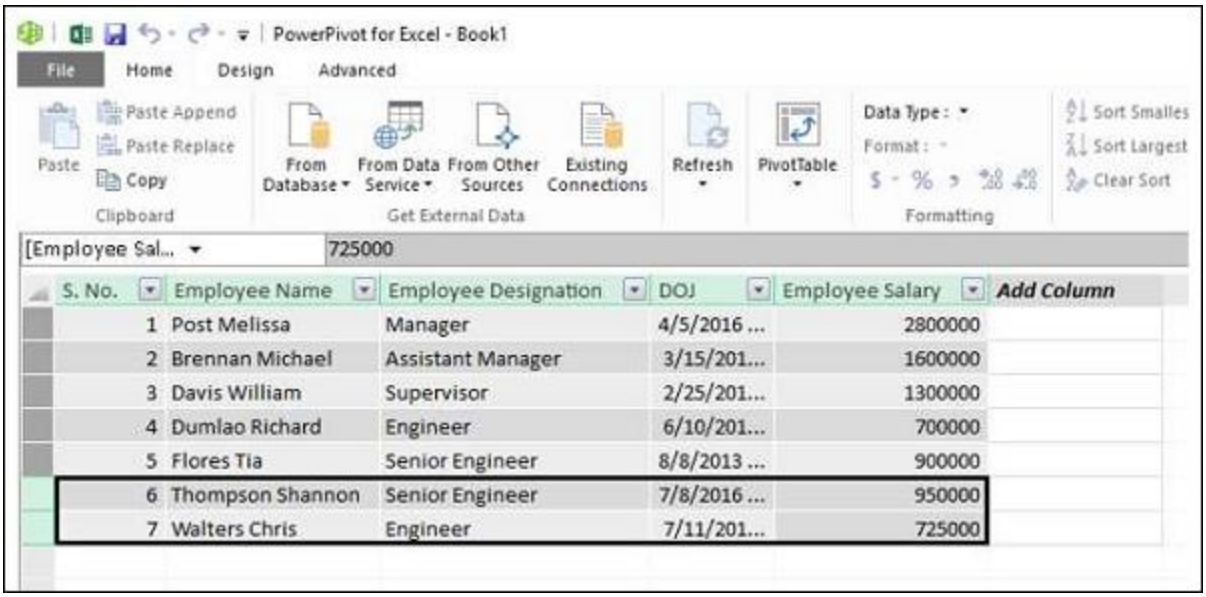
Employee Data of the Project XXX				
S. No.	**Employee Name**	**Employee Designation**	**DOJ**	**Employee Salary**
1	Post Melissa	Manager	4/5/2016	2800000
2	Brennan Michael	Assistant Manager	3/15/2010	1600000
3	Davis William	Supervisor	2/25/2014	1300000
4	Dumlao Richard	Engineer	6/10/2010	700000
5	Flores Tia	Senior Engineer	8/8/2013	900000
6	Thompson Shannon	Senior Engineer	7/8/2016	950000
7	Walters Chris	Engineer	7/11/2016	725000

Data compiled by – Mathews.
Data compiled on – 7/18/2016.

- Select the two new rows.
- Click Copy.
- Click **Paste Append** in the Power Pivot window. The Paste Preview dialog box appears.
- Verify the contents that you are using to append.



Click OK to proceed.



As you can observe, the contents of the data table in Power Pivot are appended with the contents in the clipboard.

In the beginning of this section, we have said that copying data to an excel file and using linked table is better than copying from clipboard.

This is because of the following reasons −

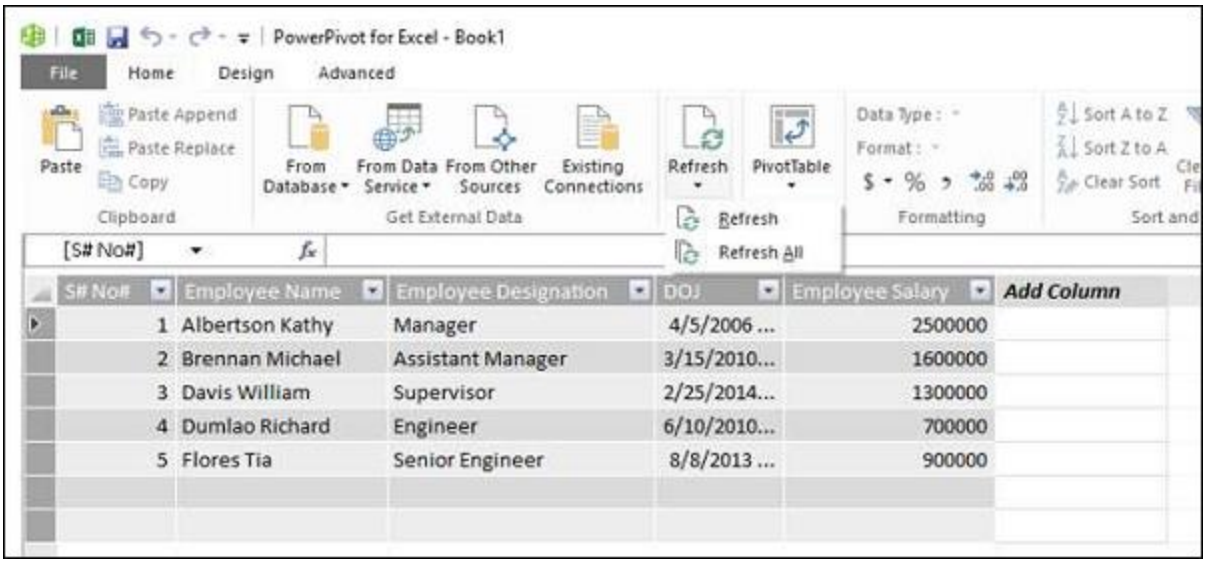
- If you use linked table, you know the source of the data. On the other hand, you will not know the source of the data later or if it is used by a different person.
- You have tracking information in the Word file, such as when the data is replaced and when the data is appended. However, there is no way of copying that information to Power Pivot. If you copy the data first to an excel file, you can preserve that information for later use.
- While copying from clipboard, if you want to add some comments, you cannot do so. If you copy to Excel file first, you can insert comments in your Excel table that will be linked to the Power Pivot.
- There is no way to refresh the data copied from clipboard. If the data is from a linked table, you can always ensure that the data is updated.

Refreshing Data in Power Pivot

You can refresh the data imported from the external data sources at any point of time.

If you want to refresh only one data table in the Power Pivot, do the following:

- Click the tab of the data table.
- Click Refresh.
- Select Refresh from the dropdown list.



If you want to refresh all the data tables in the Power Pivot, do the following:

- Click the Refresh button.
- Select Refresh All from the dropdown list.

Data Model

A Data Model is a new approach introduced in Excel 2013 for integrating data from multiple tables, effectively building a relational data source inside an Excel workbook. Within Excel, Data Model is used transparently, providing tabular data used in PivotTables and PivotCharts. In Excel, you can access the tables and their corresponding values through the PivotTable / PivotChart Field lists that contain the table names and corresponding fields.

The main use of Data Model in Excel is its usage by Power Pivot. Data Model can be considered as the Power Pivot database, and all the power features of Power Pivot are managed with the Data Model. All data operations with Power Pivot are explicit in nature and can be visualized in the Data Model.

In this module, you will understand the Data Model in detail.

Excel and Data Model

There will be only one Data Model in an Excel workbook. When you work with Excel, Data Model usage is implicit. You cannot directly access the Data Model. You can only see the multiple tables in the Data Model in the Fields list of PivotTable or PivotChart and use them. Creating the Data Model and adding data is also done implicitly in Excel, while you are getting external data into Excel.

If you want to look at the Data Model, you can do so as follows:

- Click the POWERPIVOT tab on the Ribbon.
- Click Manage.

Data Model, if exists in the workbook, will be displayed as tables, each one with a tab.

Note − If you add an Excel table to Data Model, you will not transform the Excel table into a data table. A copy of the Excel table is added as a data table in the Data Model and a link is created between the two. Hence, if changes are done in the Excel table, the data table also is updated. However, from the storage point of view, there are two tables.

Power Pivot and Data Model

Data Model is inherently the database for Power Pivot. Even when you create the Data Model from Excel, it builds the Power Pivot database only. Creating the Data Model and/or adding data is done explicitly in Power Pivot.

In fact, you can manage the Data Model from Power Pivot window. You can add data to Data Model, import data from different data sources, view the Data Model, create relationships between the tables, create calculated fields and calculated columns, etc.

Creating a Data Model

You can either add tables to the Data Model from Excel or you can directly import data into Power Pivot, thus creating the Power Pivot Data Model tables. You can view the Data Model by clicking Manage in the Power Pivot window.

You will understand how to add tables from Excel to the Data Model in the module – Loading Data through Excel. You will understand how to load data into Data Model in the module – Loading Data into Power Pivot.

Tables in Data Model

Tables in Data Model can be defined as a set of tables holding relationships across them. The relationships enable combining related data from different tables for analysis and reporting purposes.

The tables in the Data Model are called Data Tables.

A table in the Data Model is considered as a set of records (a record is a row) made up of fields (a field is a column). You cannot edit individual items in a data table. However, you can append rows or add calculated columns to the data table.

Excel Tables and Data Tables

Excel tables are just a collection of separate tables. There can be multiple tables on a worksheet. Each table can be accessed separately, but it is not possible to access data from more than one Excel table at the same time. This is the reason that when you create a PivotTable, it is based on only one table. If you need to use the data from two Excel tables collectively, you need to first merge them into a single Excel table.

A data table on the other hand coexists with other data tables with relationships, facilitating the combination of data from multiple tables. Data tables get created when you import data into Power Pivot. You can also add Excel tables to the Data Model while you are creating a Pivot Table getting external data or from multiple tables.

The data tables in the Data Model can be viewed in two ways −

- Data View.
- Diagram View.

Data View of Data Model

In the data view of the Data Model, each data table exists on a separate tab. The data table rows are the records and columns represent the fields. The tabs contain the table names and the column headers are the fields in that table. You can do calculations in the data view using the Data Analysis Expressions (DAX) language.

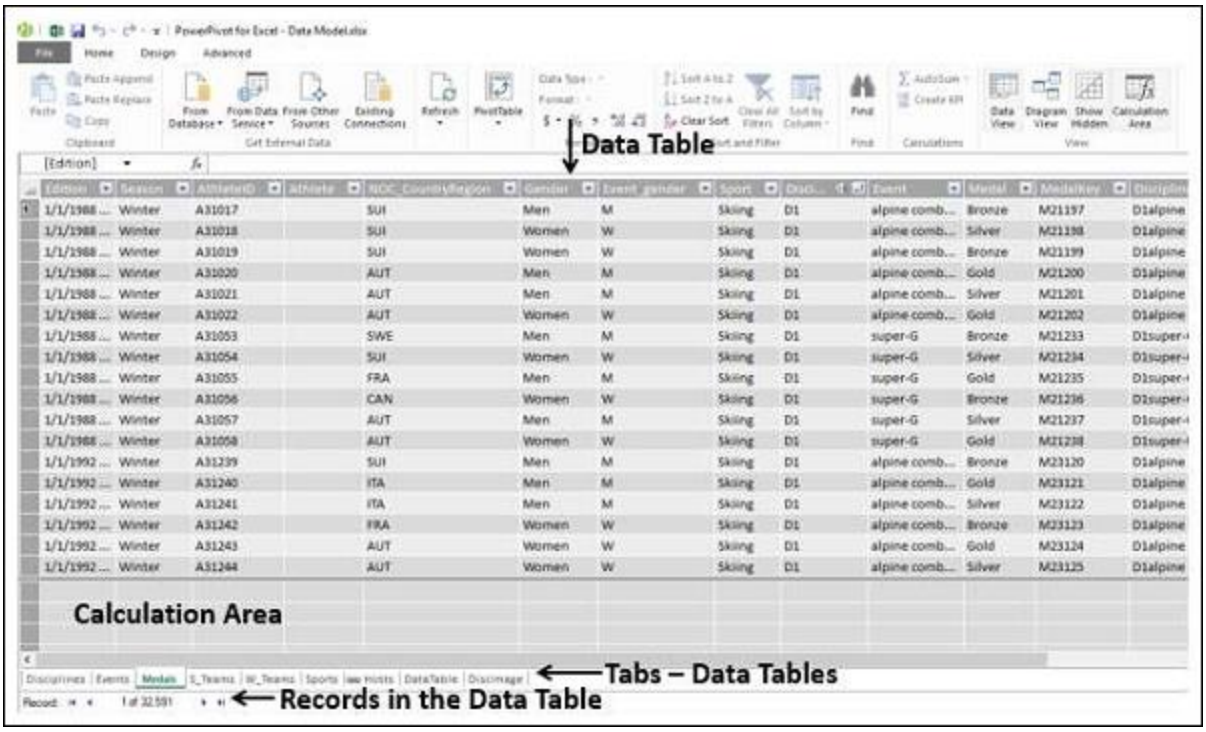
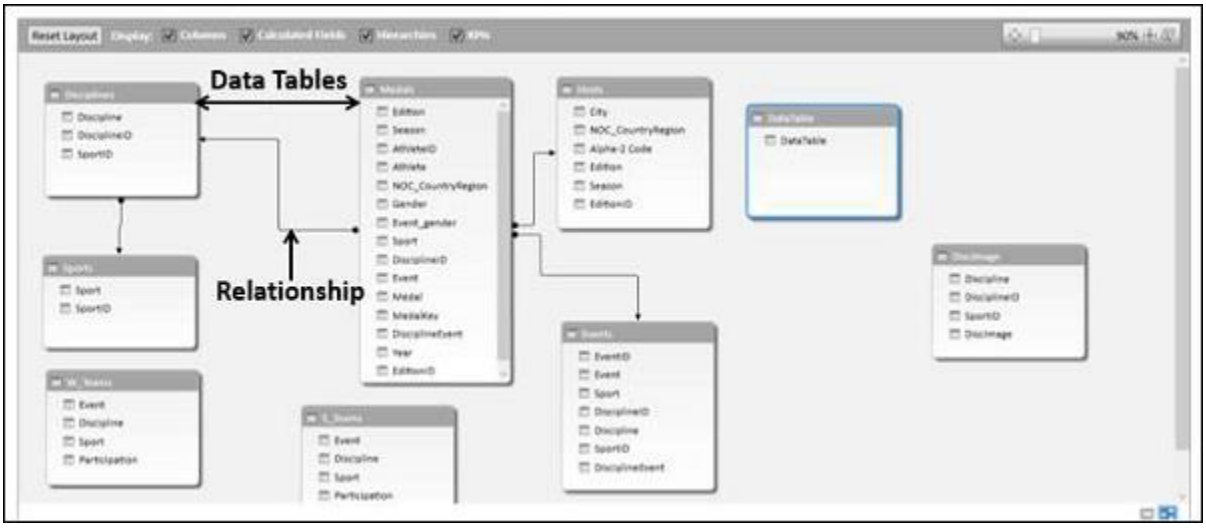


Diagram View of Data Model

In the diagram view of the Data Model, all the data tables are represented by boxes with the table names and contain the fields in the table. You can arrange the tables in the diagram view by just dragging them. You can adjust the size of a data table so that all the fields in the table are displayed.



Relationships in Data Model

You can view the relationships in the diagram view. If two tables have a relationship defined between them, an arrow connecting the source table to the target table appears. If you want to know which fields are used in the relationship, just double click the arrow. The arrow and the two fields in the two tables are highlighted.

Table relationships will be created automatically if you import related tables that have primary and foreign key relationships. Excel can use the imported relationship information as the basis for table relationships in the Data Model.

You can also explicitly create relationships in either of the two views −

- **Data View** − Using Create Relationship dialog box.
- **Diagram View** − By clicking and dragging to connect the two tables.

Create Relationship Dialog Box

In a relationship, four entities are involved −

- **Table** − The data table from which the relationship starts.
- **Column** − The field in the Table that is also present in the related table.
- **Related Table** − The data table where the relationship ends.
- **Related Column** − The field in the related table that is same as the field represented by Column in Table. Note that the values of Related Column should be unique.

In the diagram view, you can create the relationship by clicking on the field in the table and dragging to the related table.

You will learn more about relationships in the module - Managing Data Tables and Relationships with Power Pivot.

Managing Data Model

The major use of Power Pivot is its ability to manage the data tables and the relationships among them, to facilitate analysis of the data from several tables. You can add an excel table to the Data Model while you are creating a PivotTable or directly from the PowerPivot Ribbon.

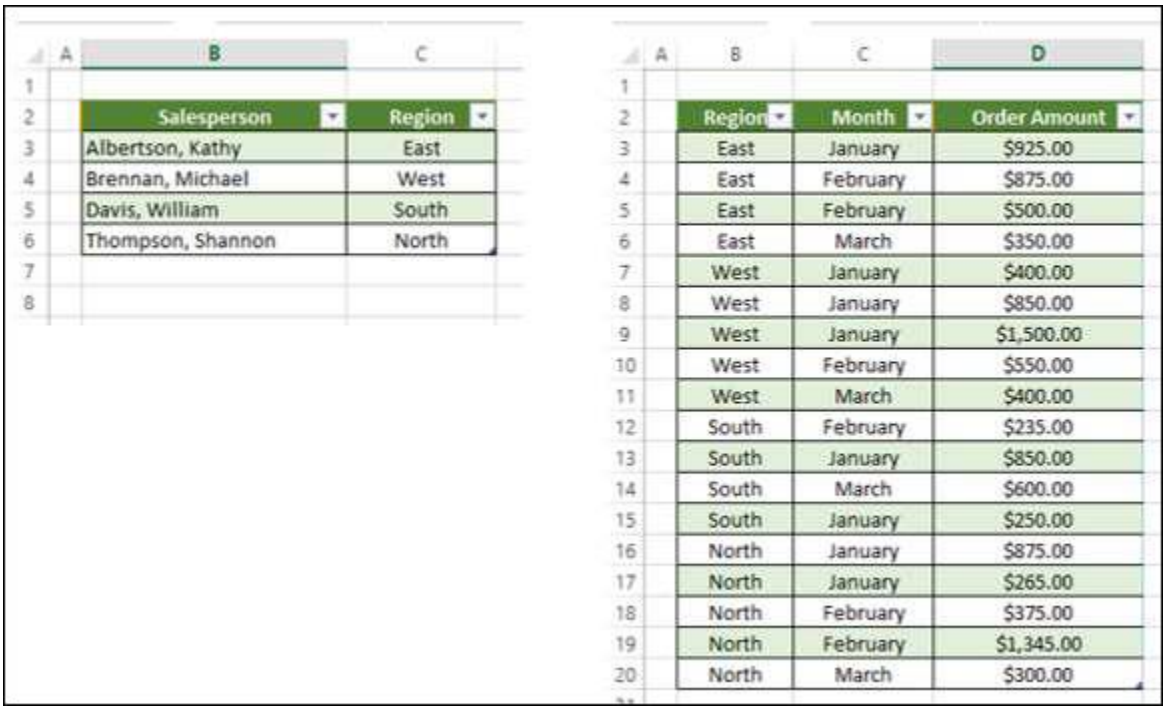
You can analyze data from across multiple tables only when relationships exist among them. With Power Pivot, you can create relationships from the Data View or Diagram View. Moreover, if you had chosen to add a table to the Power Pivot, you need to add a relationship as well.

Adding Excel Tables to Data Model with PivotTable

When you create a PivotTable in Excel, it is based only on a single table / range. In case you want to add more tables to the PivotTable, you can do so with the Data Model.

Suppose you have two worksheets in your workbook −

- One containing the data of salespersons and the regions they represent, in a table- Salesperson.
- Another containing the data of sales, region and month wise, in a table – Sales.



Salesperson	Region
Albertson, Kathy	East
Brennan, Michael	West
Davis, William	South
Thompson, Shannon	North

Region	Month	Order Amount
East	January	$925.00
East	February	$875.00
East	February	$500.00
East	March	$350.00
West	January	$400.00
West	January	$850.00
West	January	$1,500.00
West	February	$550.00
West	March	$400.00
South	February	$235.00
South	January	$850.00
South	March	$600.00
South	January	$250.00
North	January	$875.00
North	January	$265.00
North	February	$375.00
North	February	$1,345.00
North	March	$300.00

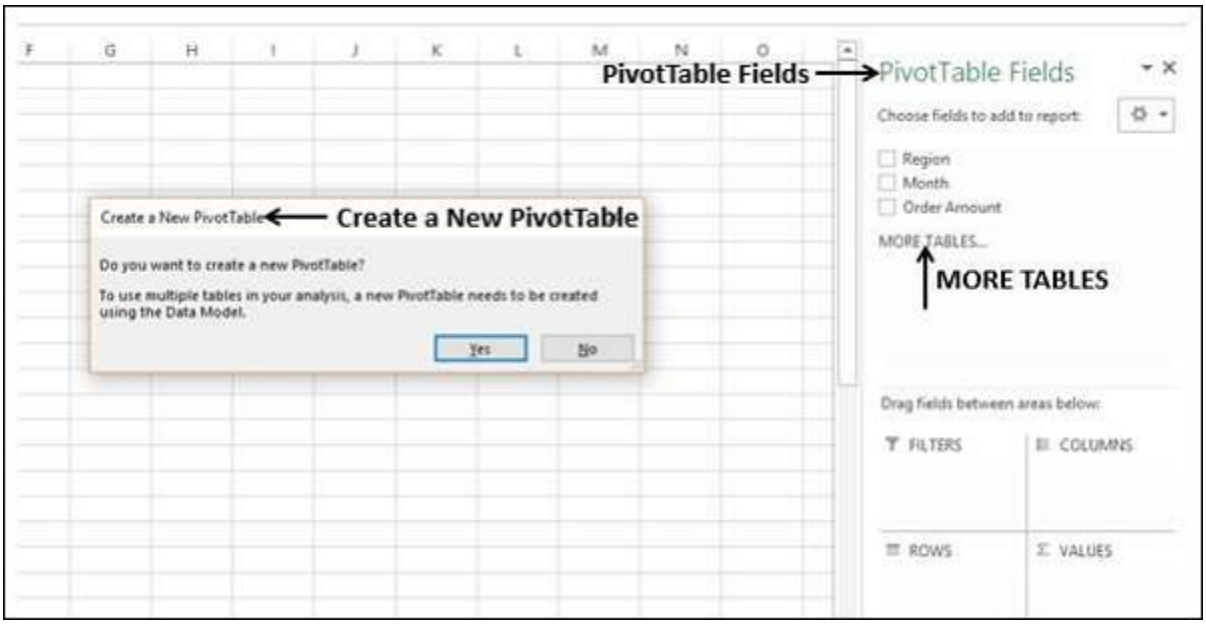
You can summarize the sales – salesperson-wise as given below.

- Click the table – Sales.
- Click the INSERT tab on the Ribbon.
- Select PivotTable in the Tables group.

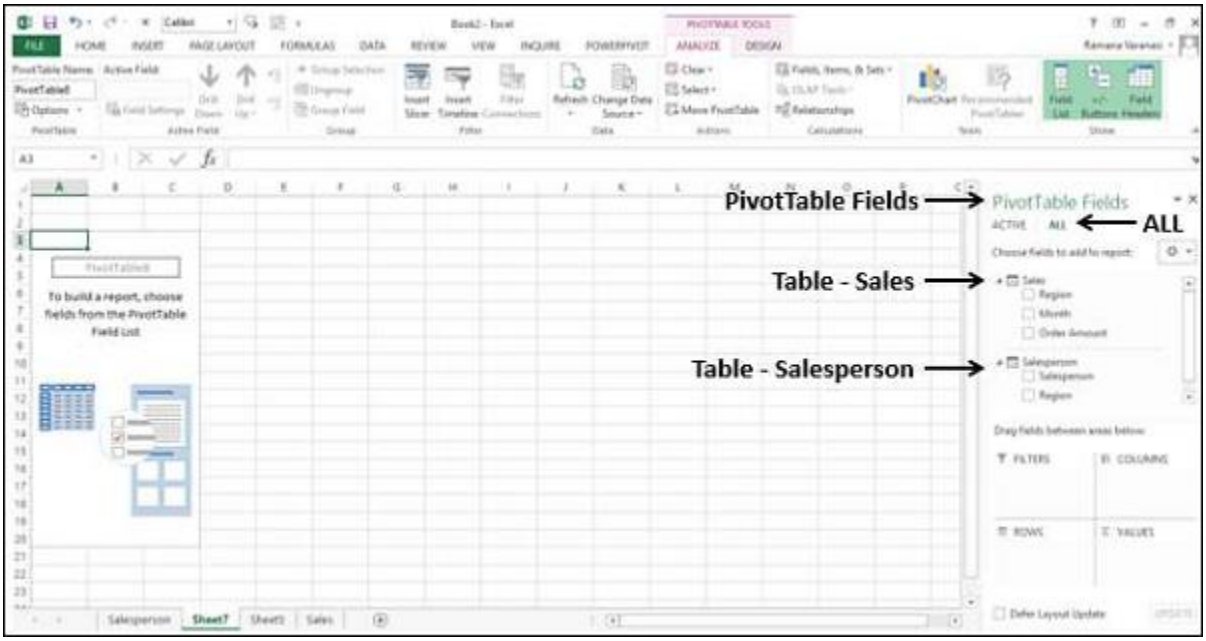
An empty PivotTable with the fields from the Sales table – Region, Month and Order Amount will be created. As you can observe, there is a **MORE TABLES** command below the PivotTable Fields list.

- Click on MORE TABLES.

The **Create a New PivotTable** message box appears. The message displayed is- To use multiple tables in your analysis, a new PivotTable needs to be created using the Data Model. Click Yes

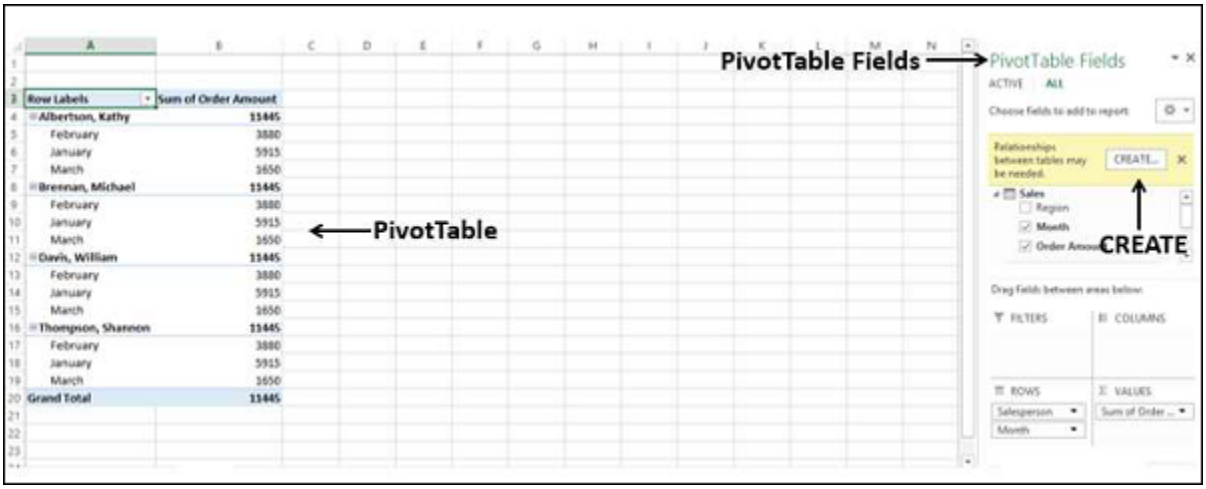


A New PivotTable will be created as shown below:



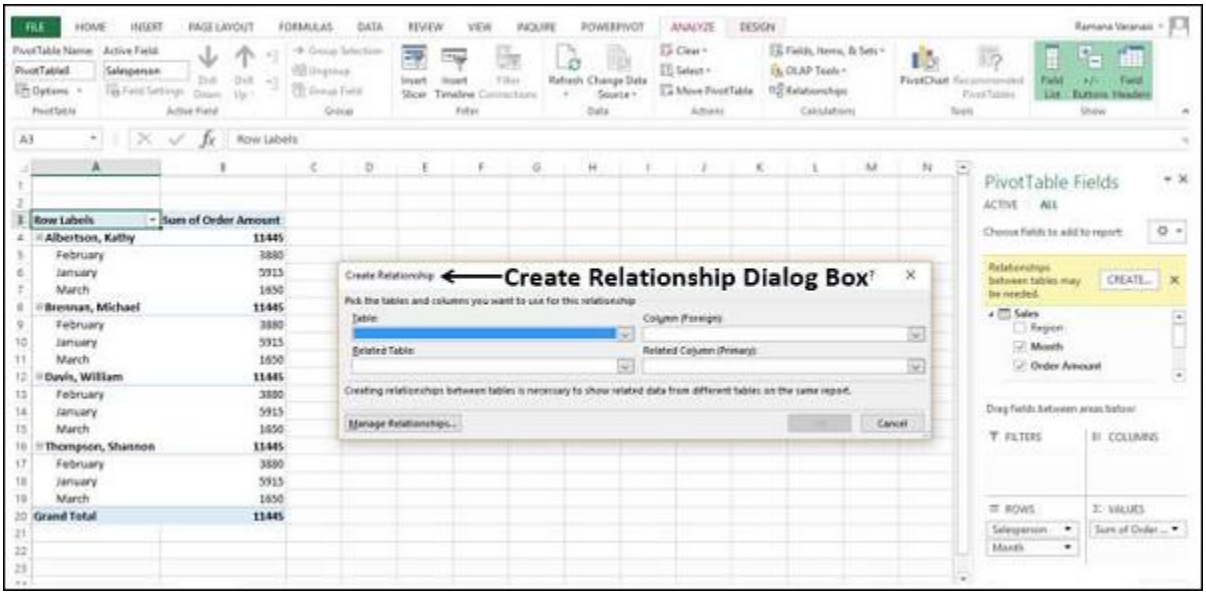
Under PivotTable Fields, you can observe that there are two tabs – **ACTIVE** and **ALL**.

- Click the ALL tab.
- Two tables- Sales and Salesperson, with the corresponding fields appear in the PivotTable Fields list.
- Click the field Salesperson in the Salesperson table and drag it to ROWS area.
- Click the field Month in the Sales table and drag it to ROWS area.
- Click the field Order Amount in the Sales table and drag it to ∑ VALUES area.



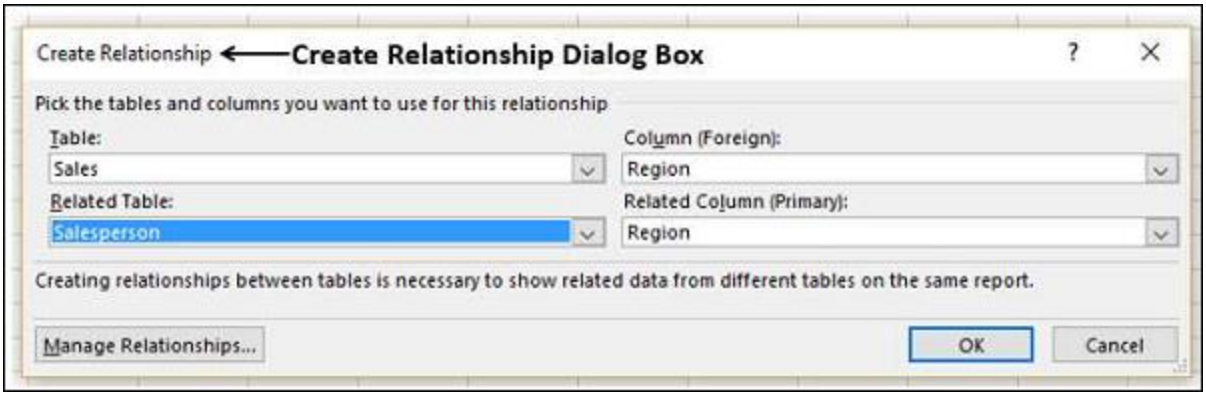
The PivotTable is created. A message appears in the PivotTable Fields – **Relationships between tables may be needed**.

Click the CREATE button next to the message. The **Create Relationship** dialog box appears.



- Under **Table**, select Sales.
- Under **Column (Foreign)** box, select Region.

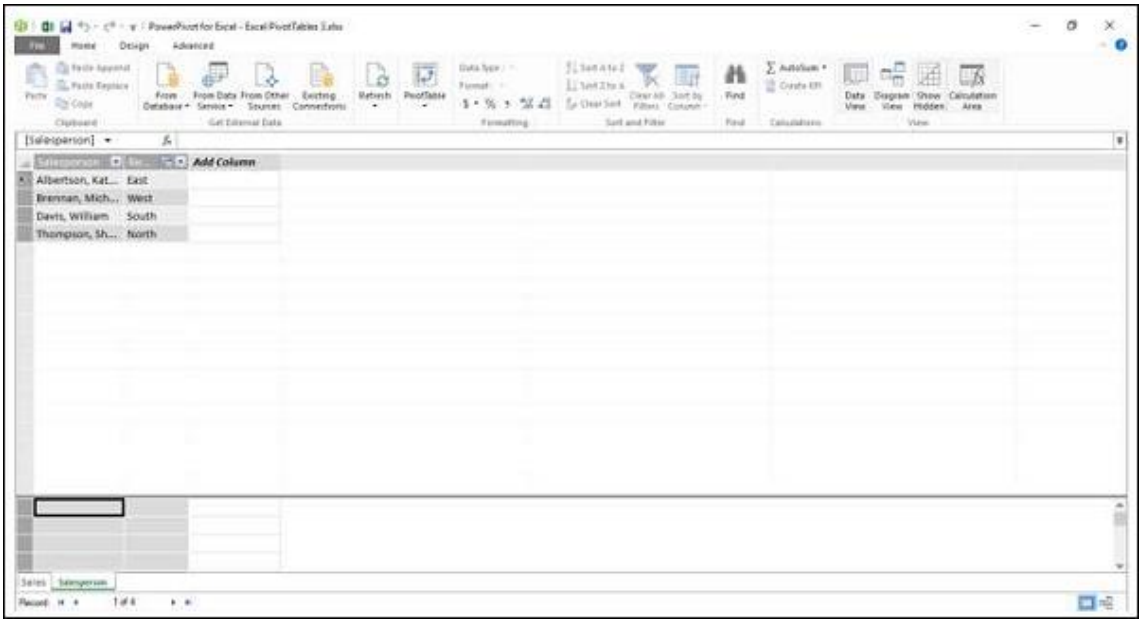
- Under **Related Table**, select Salesperson.
- Under **Related Column (Primary)** box, select Region.
- Click OK.



Your PivotTable from the two tables on two worksheets is ready.

Further, as Excel stated while adding the second table to the PivotTable, the PivotTable got created with Data Model. To verify, do the following:

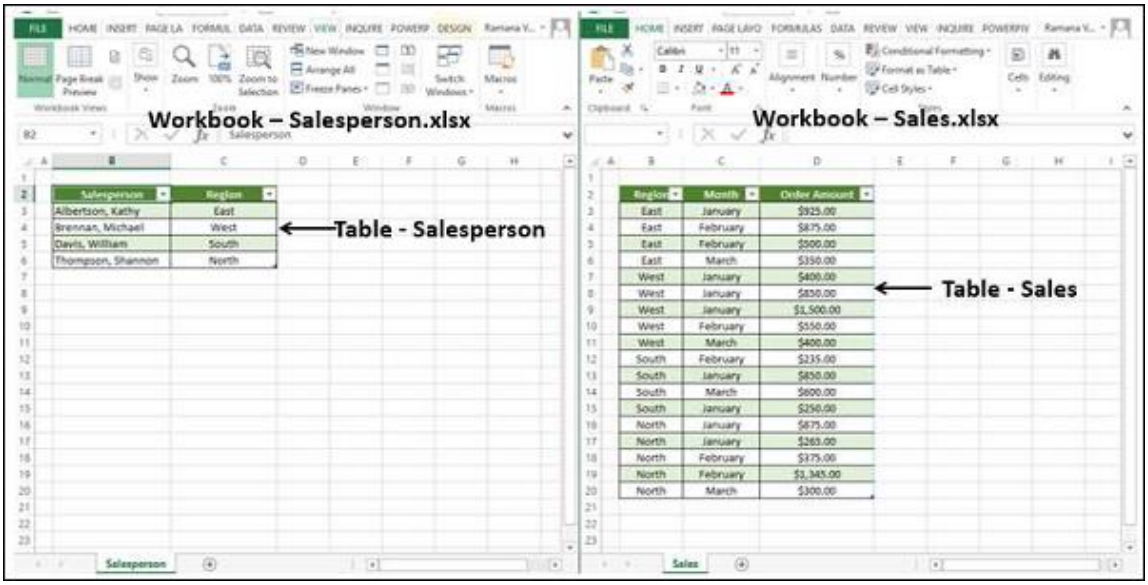
- Click the POWERPIVOT tab on the Ribbon.
- Click **Manage** in the Data Model group. The Data View of the Power Pivot appears.



You can observe that the two Excel tables that you used in creating the PivotTable are converted to data tables in the Data Model.

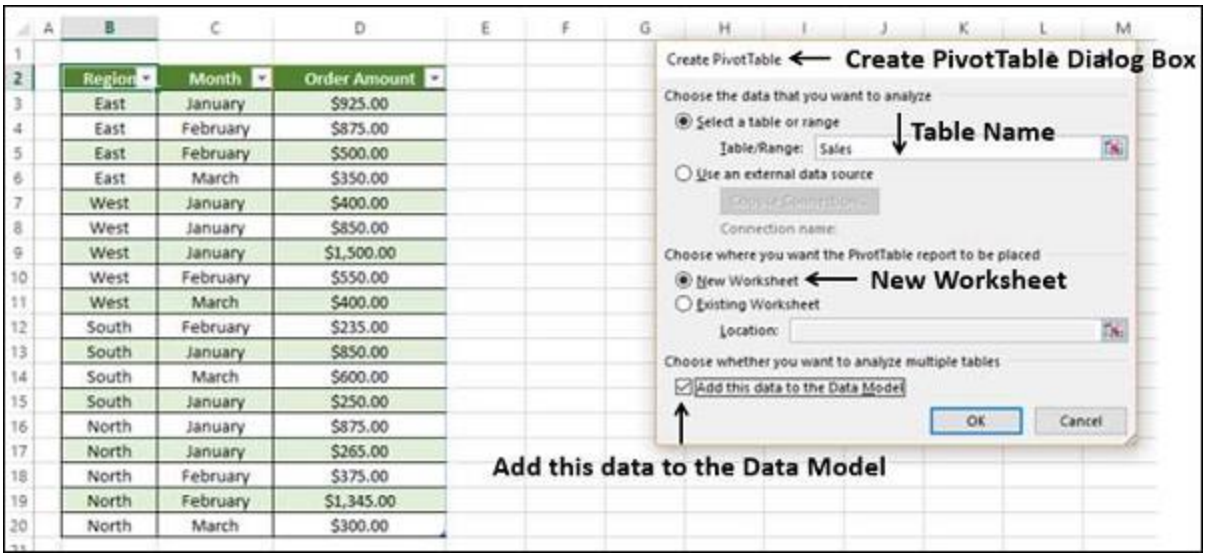
Adding Excel Tables from a Different Workbook to Data Model

Suppose the two tables – Salesperson and Sales are in two different workbooks.



You can add the Excel table from a different workbook to the Data Model as follows:

- Click the Sales table.
- Click the INSERT tab.
- Click PivotTable in the Tables group. The **Create PivotTable** dialog box appears.



- In the Table/Range box, type Sales.
- Click on New Worksheet.
- Check the box Add this data to the Data Model.
- Click OK.

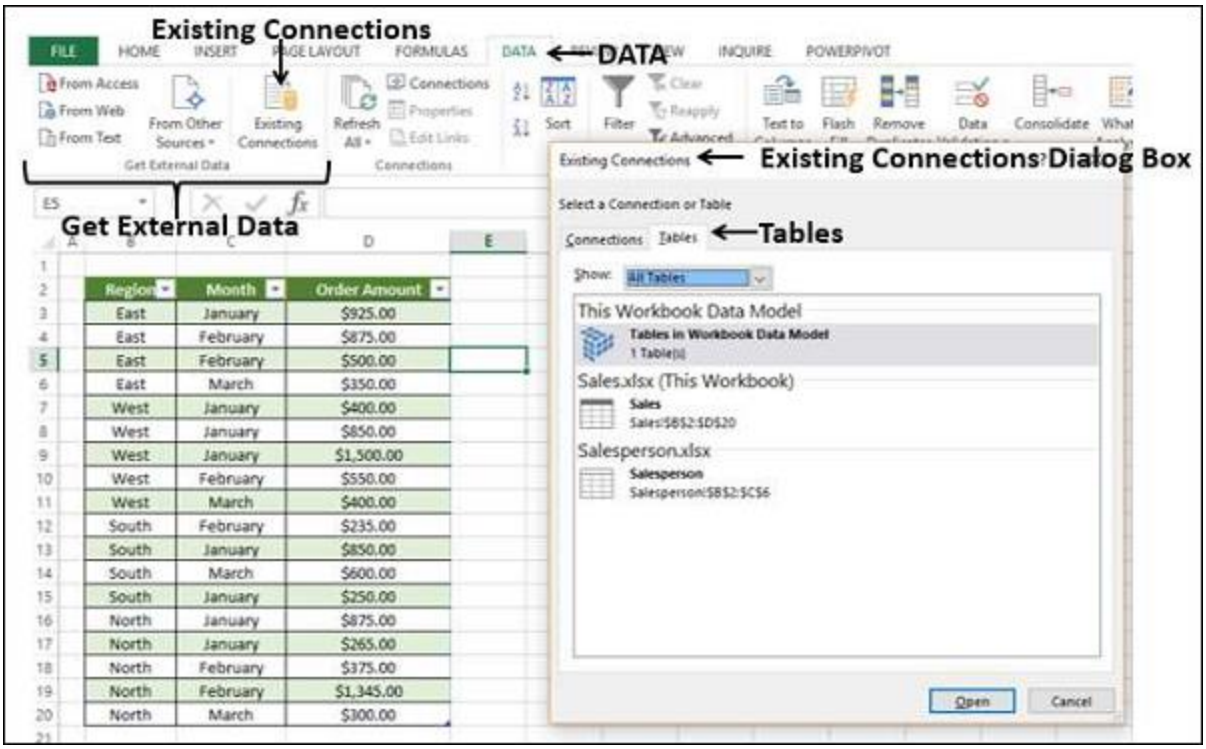
You will get an empty PivotTable on a new worksheet with only the fields corresponding to the Sales table.

You have added the Sales table data to the Data Model. Next, you have to get the Salesperson table data also into Data Model as follows:

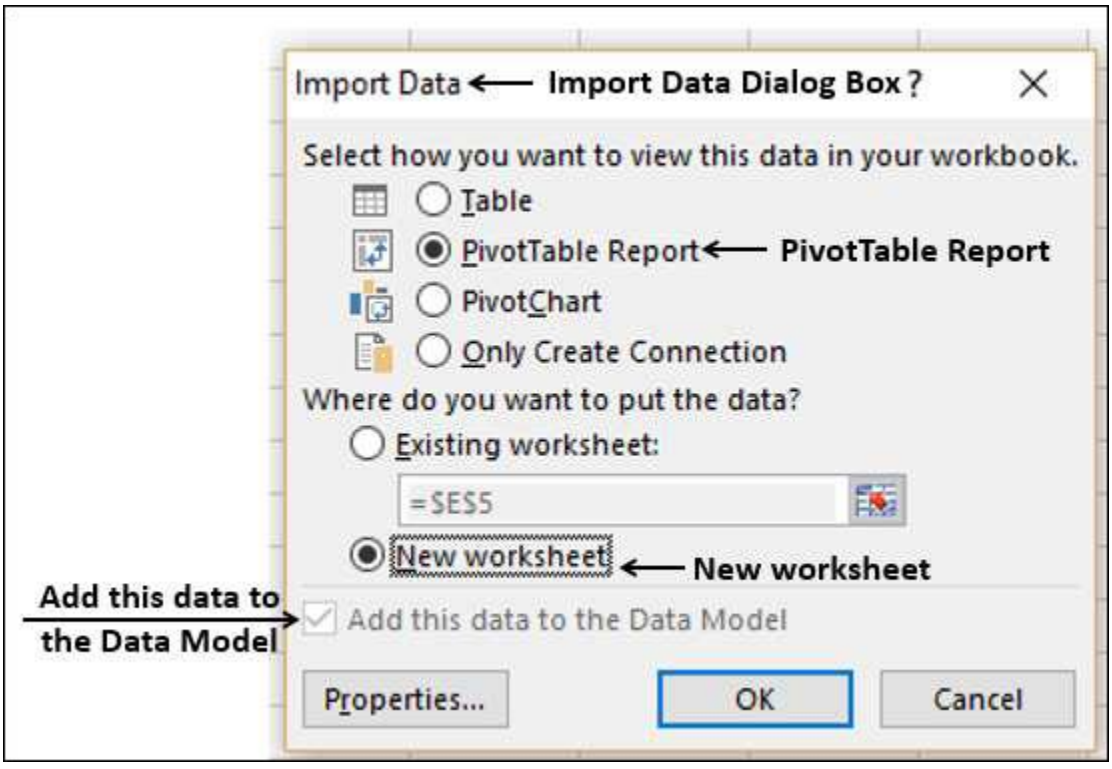
- Click on the worksheet containing Sales table.
- Click the DATA tab on the Ribbon.
- Click Existing Connections in the Get External Data group. The Existing Connections dialog box appears.
- Click on the Tables tab.

Under **This Workbook Data Model, 1 table** is displayed (This is the Sales table that you added earlier). You also find the two workbooks displaying the tables in them.

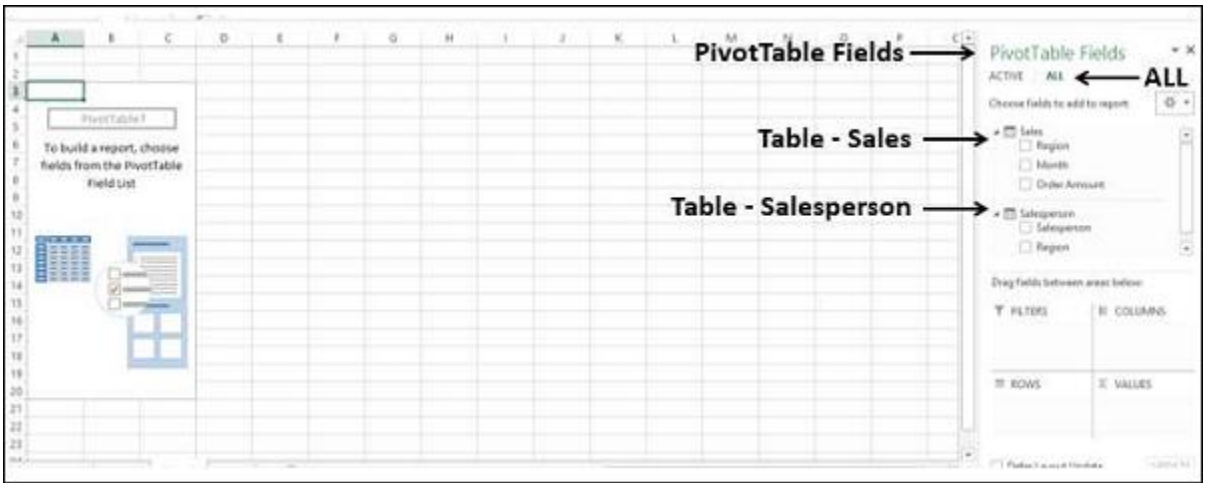
- Click Salesperson under Salesperson.xlsx.
- Click Open. The **Import Data** dialog box appears.
- Click on PivotTable Report.
- Click on New worksheet.



You can see that the box – **Add this data to the Data Model** is checked and inactive. Click OK.



The PivotTable will be created.



As you can observe the two tables are in the Data Model. You might have to create a relationship between the two tables as in the previous section.

Adding Excel Tables to Data Model from the PowerPivot Ribbon

Another way of adding Excel tables to Data Model is doing **so from the PowerPivot Ribbon**.

Suppose you have two worksheets in your workbook −

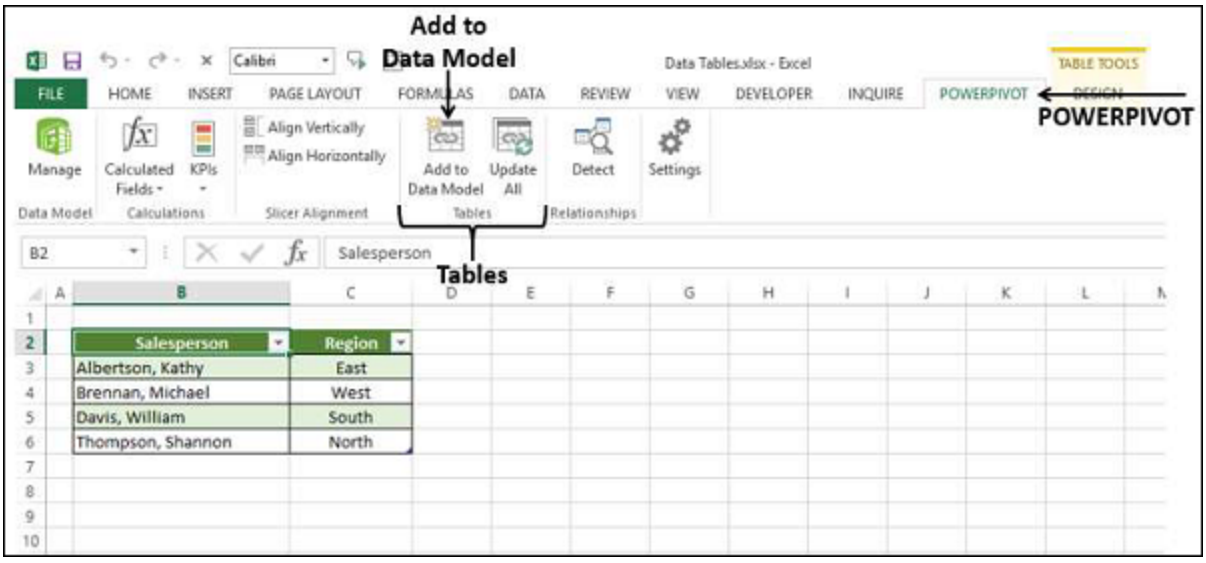
- One containing the data of salespersons and the regions they represent, in a table – Salesperson.
- Another containing the data of sales, region and month wise, in a table – Sales.

Salesperson	Region
Albertson, Kathy	East
Brennan, Michael	West
Davis, William	South
Thompson, Shannon	North

Region	Month	Order Amount
East	January	$925.00
East	February	$875.00
East	February	$500.00
East	March	$350.00
West	January	$400.00
West	January	$850.00
West	January	$1,500.00
West	February	$550.00
West	March	$400.00
South	February	$235.00
South	January	$850.00
South	March	$600.00
South	January	$250.00
North	January	$875.00
North	January	$265.00
North	February	$375.00
North	February	$1,345.00
North	March	$300.00

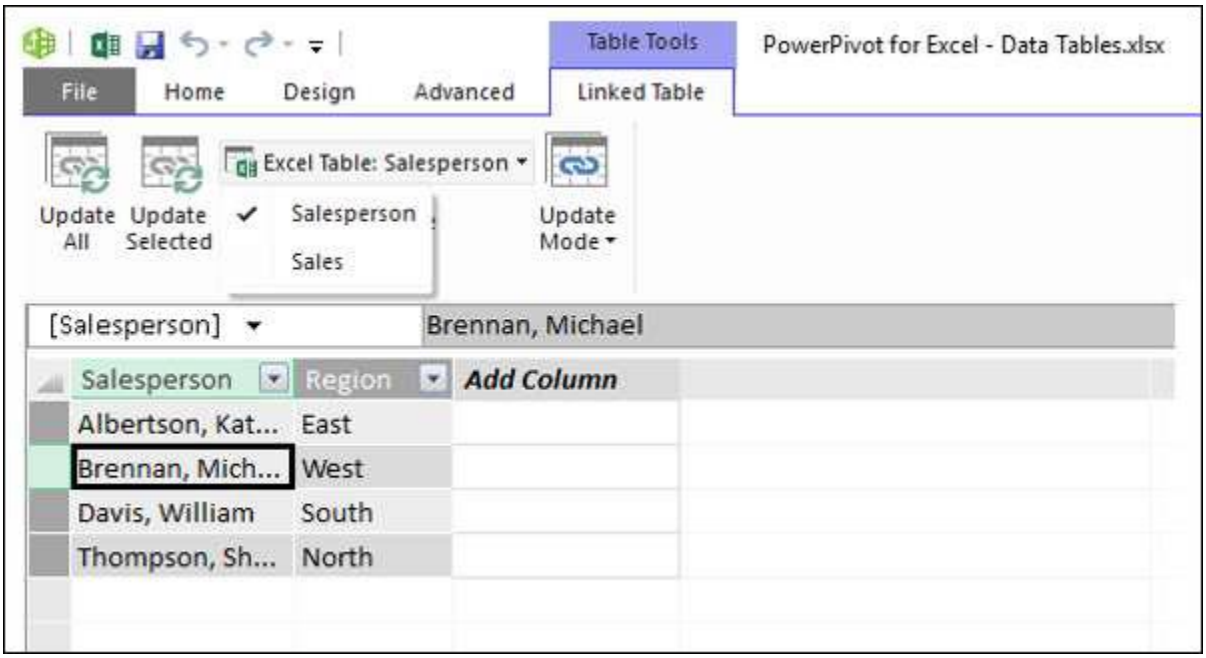
You can add these Excel tables to the Data Model first, before doing any analysis.

- Click on the Excel table - Sales.
- Click the POWERPIVOT tab on the Ribbon.
- Click Add to Data Model in the Tables group.



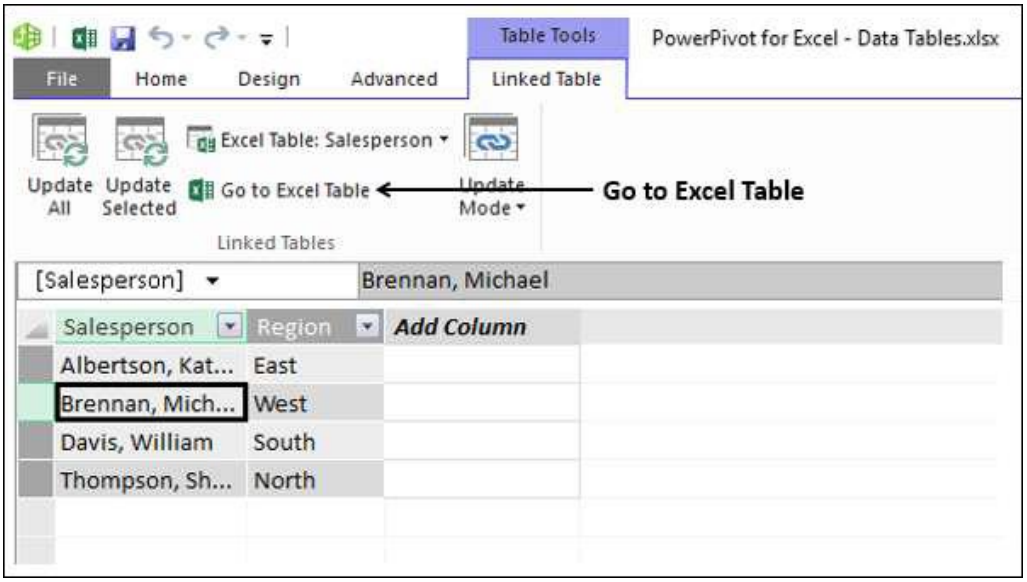
Power Pivot window appears, with the data table Salesperson added to it. Further a tab – Linked Table appears on the Ribbon in the Power Pivot window.

- Click on the Linked Table tab on the Ribbon.
- Click on Excel Table: Salesperson.



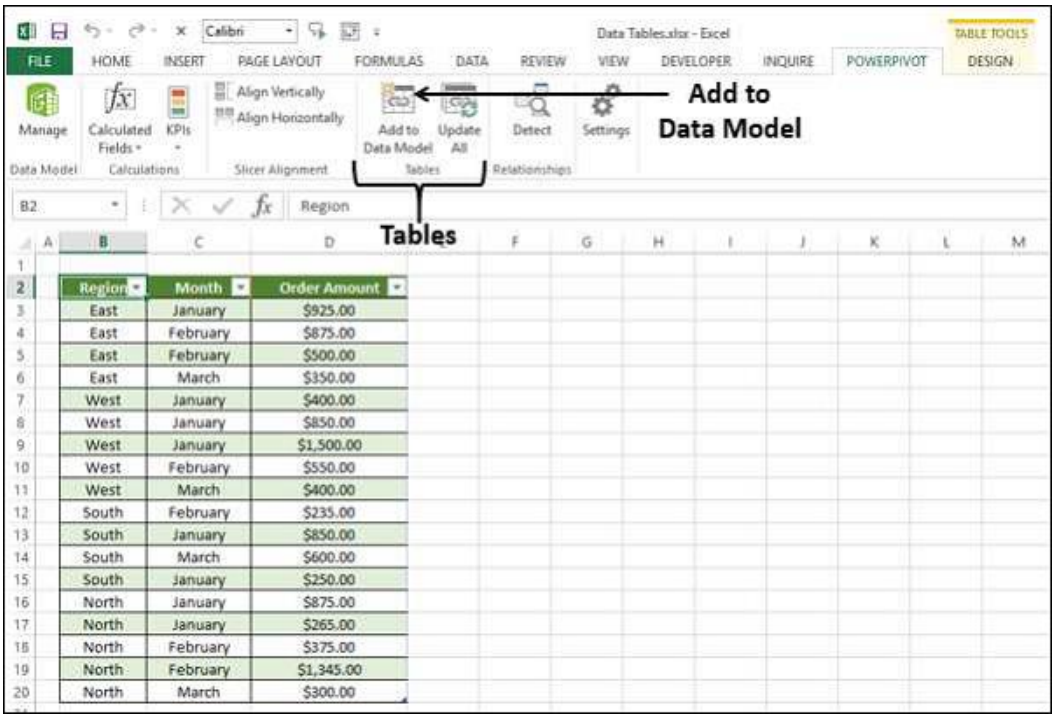
You can find that the names of the two tables present in your workbook are displayed and the name Salesperson is ticked. This means the data table Salesperson is linked to the Excel table Salesperson.

Click **Go to Excel Table**.

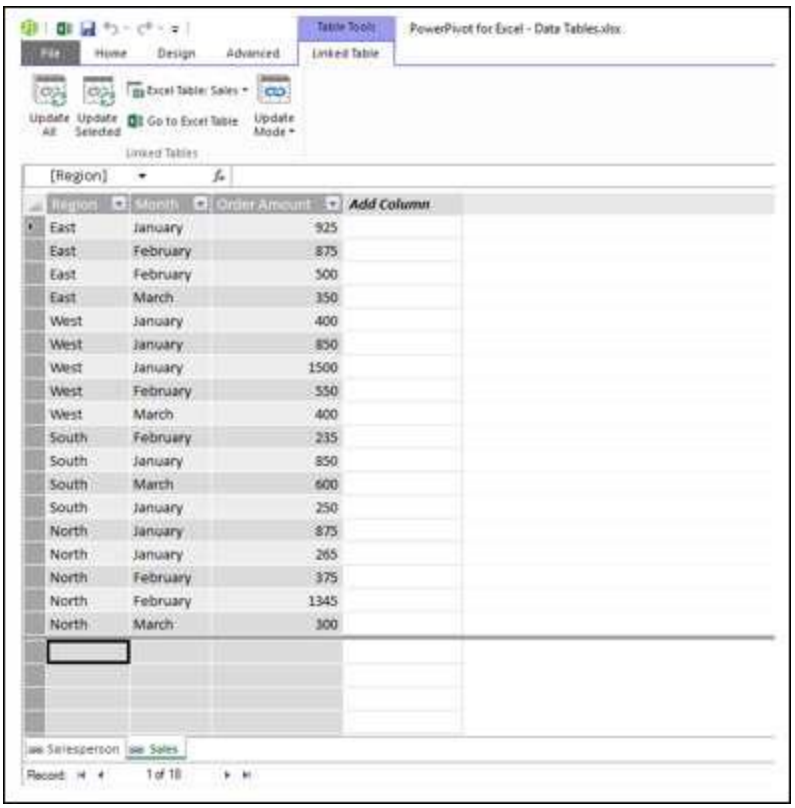


Excel window with worksheet containing Salesperson table appears.

- Click the Sales worksheet tab.
- Click the Sales table.
- Click Add to Data Model in the Tables group on the Ribbon.



The Excel table Sales is also added to the Data Model.



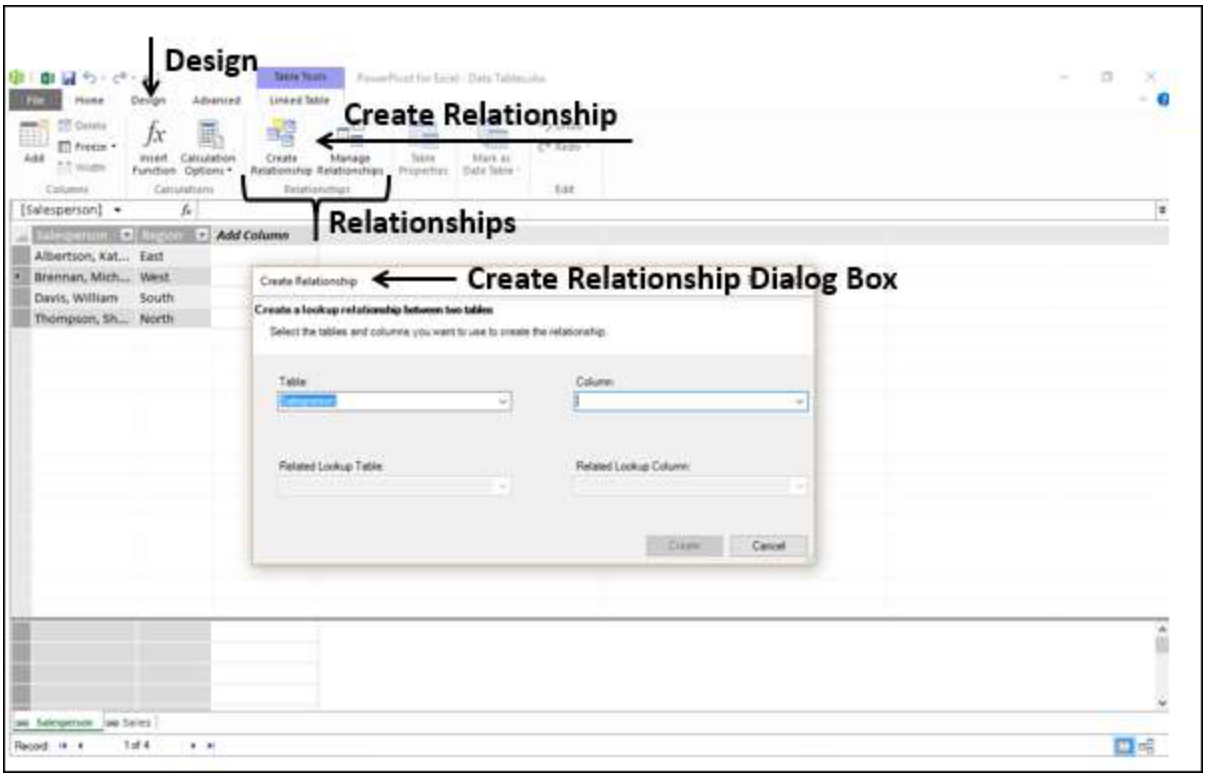
If you want to do analysis based on these two tables, as you are aware, you need to create a relationship between the two data tables. In Power Pivot, you can do this in two ways −

- From Data View
- From Diagram View

Creating Relationships from Data View

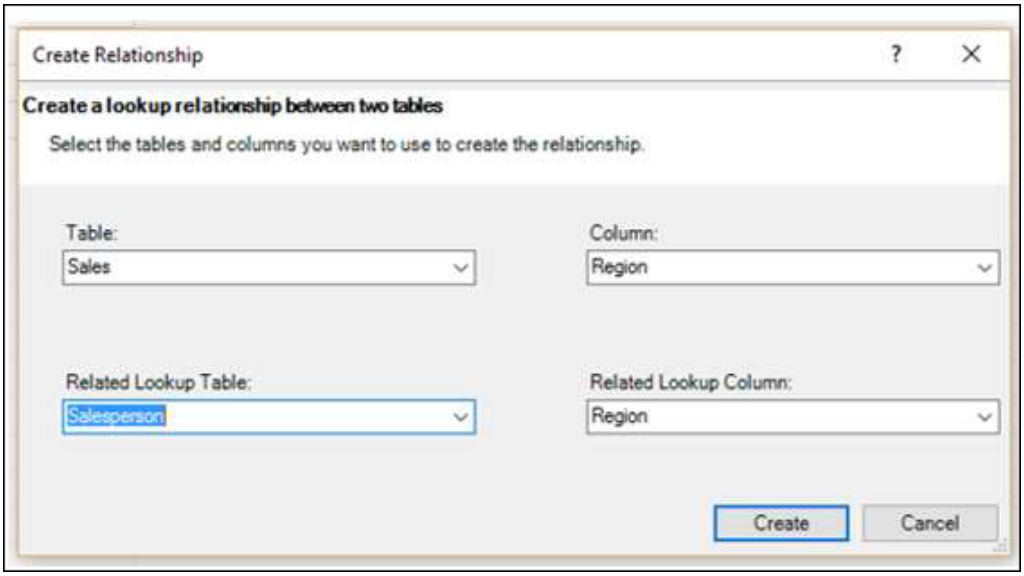
As you know that in Data View, you can view the data tables with records as rows and fields as columns.

- Click on the Design tab in the Power Pivot window.
- Click on Create Relationship in the Relationships group. The **Create Relationship** dialog box appears.



- Click on Sales in the Table box. This is the table from where the relationship starts. As you are aware, Column should be the field that is present in the related table Salesperson that contains unique values.
- Click on Region in the Column box.
- Click on Salesperson in the Related Linked Table box.

The Related Linked Column gets automatically populated with Region.

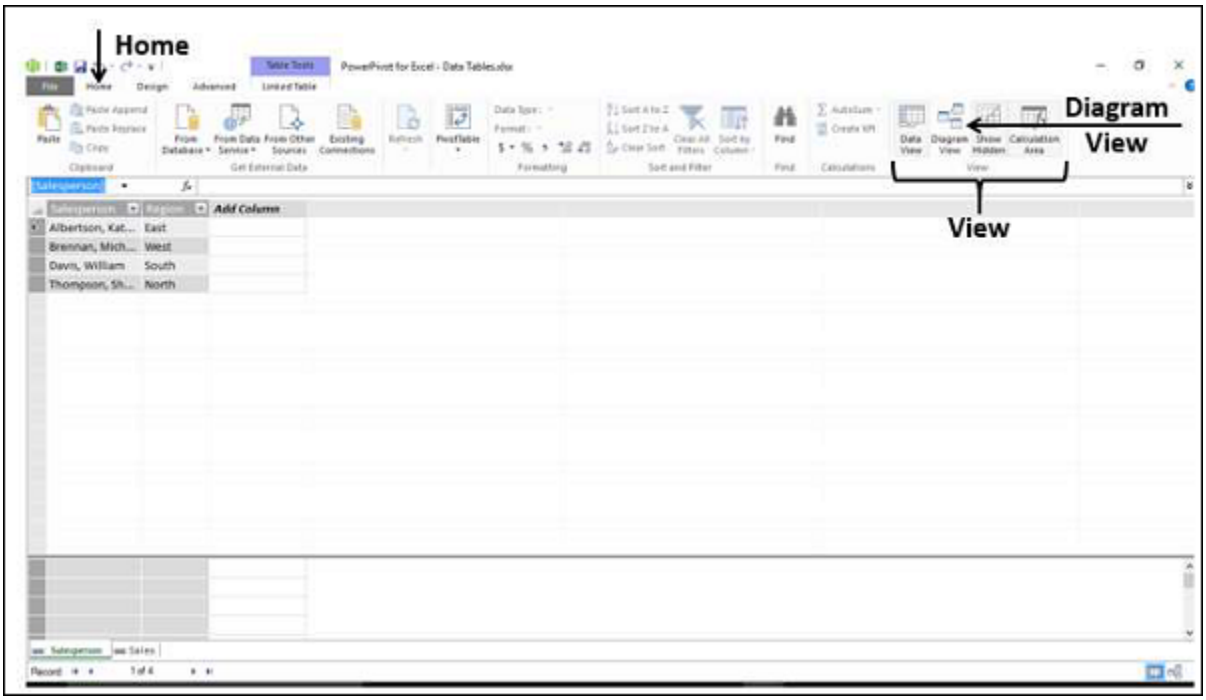


Click the Create button. The relationship is created.

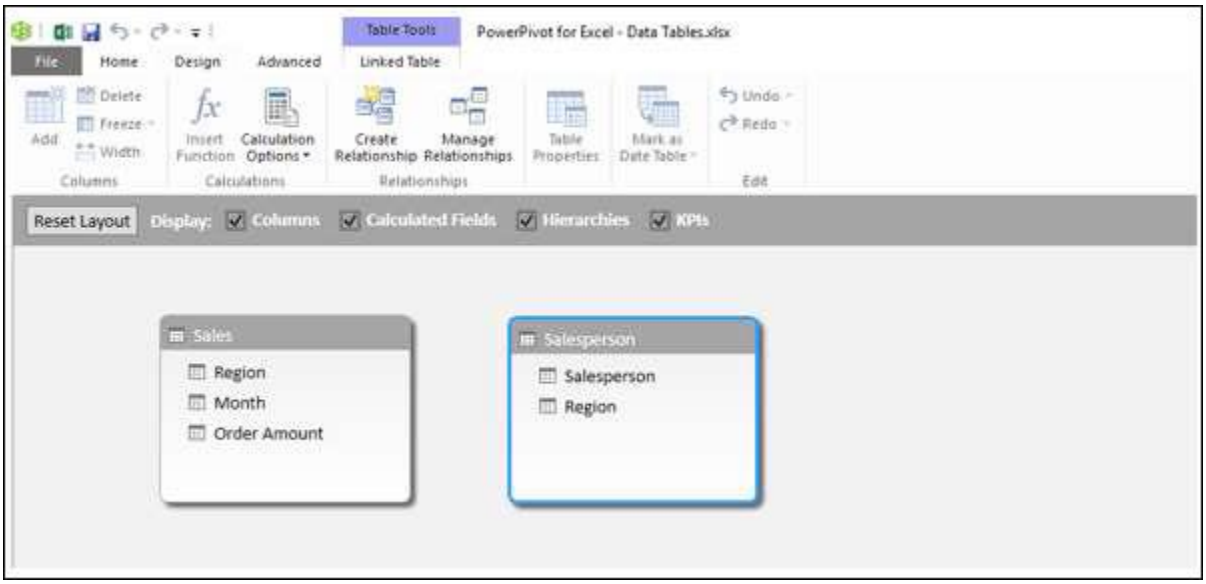
Creating Relationships from Diagram View

Creating Relationships from Diagram View is relatively easier. Follow the given steps.

- Click the Home tab in the Power Pivot window.
- Click Diagram View in the View group.

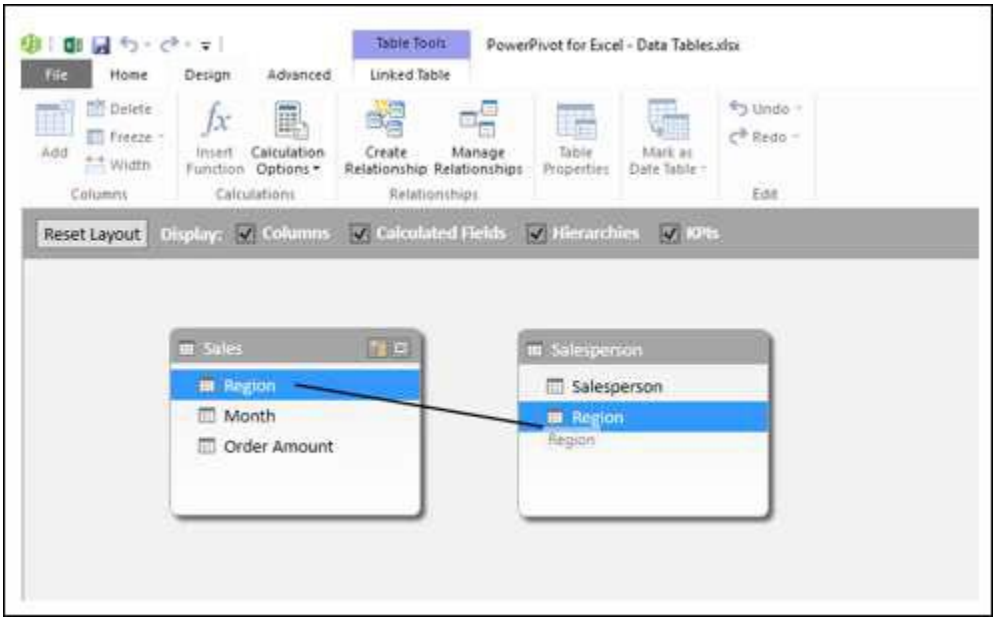


The Diagram View of the Data Model appears in the Power Pivot window.

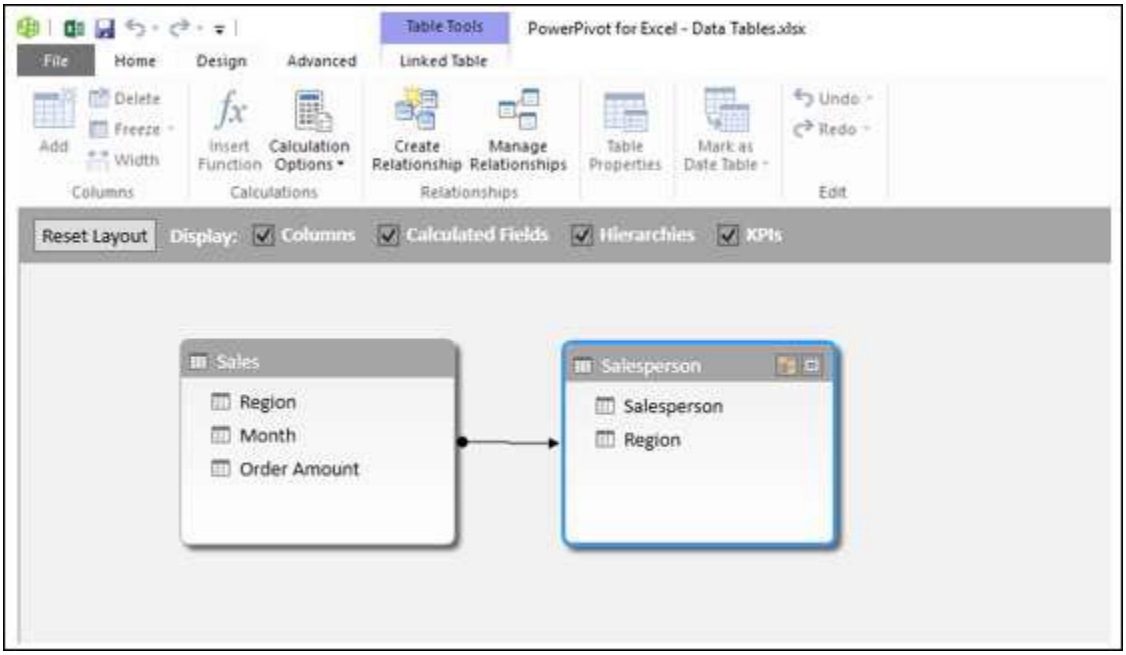


- Click on Region in Sales table. Region in Sales table is highlighted.

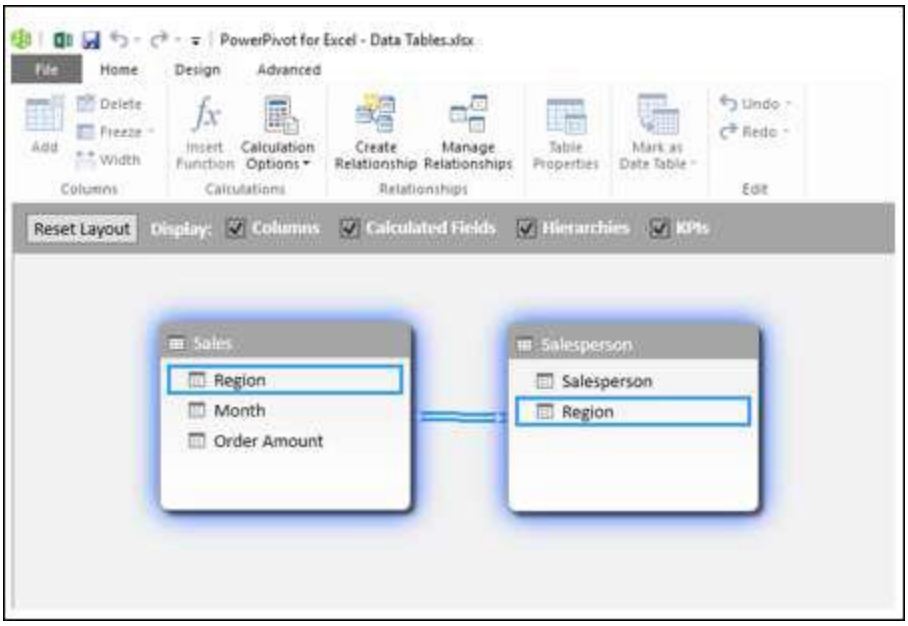
- Drag to Region in Salesperson table. Region in Salesperson table is also highlighted. A line appears in the direction you dragged.
- A line appears from the table Sales to the table Salesperson indicating the relationship.



As you can see, a line appears from the Sales table to the Salesperson table, indicating the relationship and the direction.



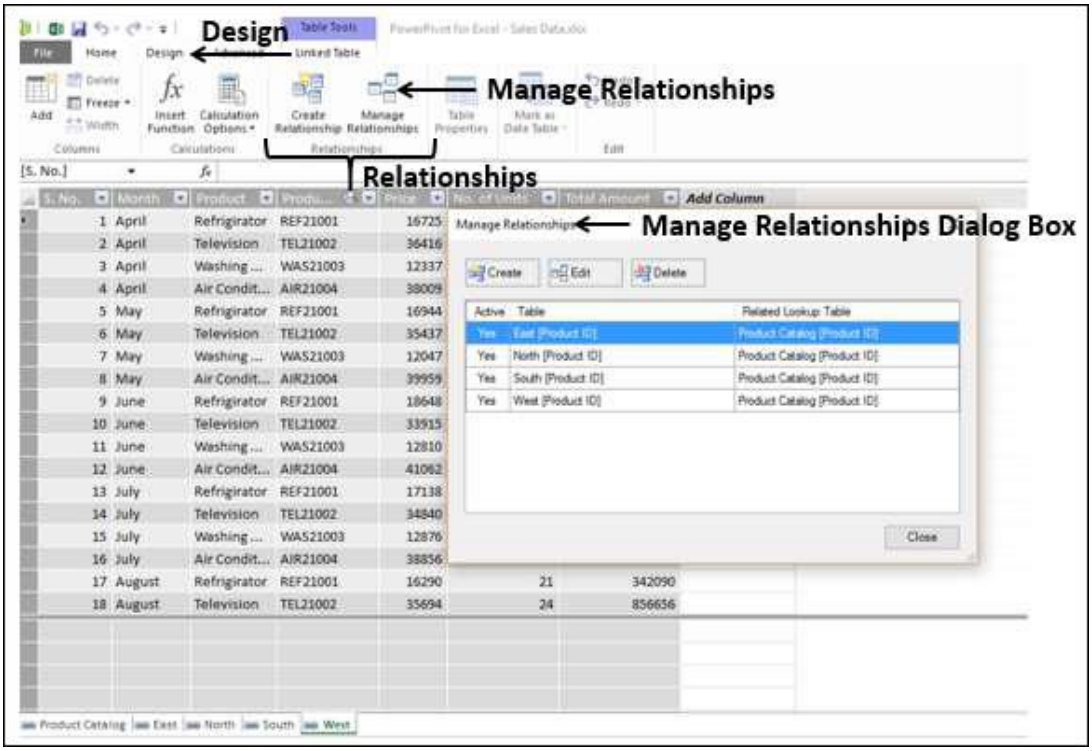
If you want to know the field that is a part of a relationship, click on the relationship line. The line and the field in both the tables are highlighted.



Managing Relationships

You can edit or delete an existing relationship in Data Model.

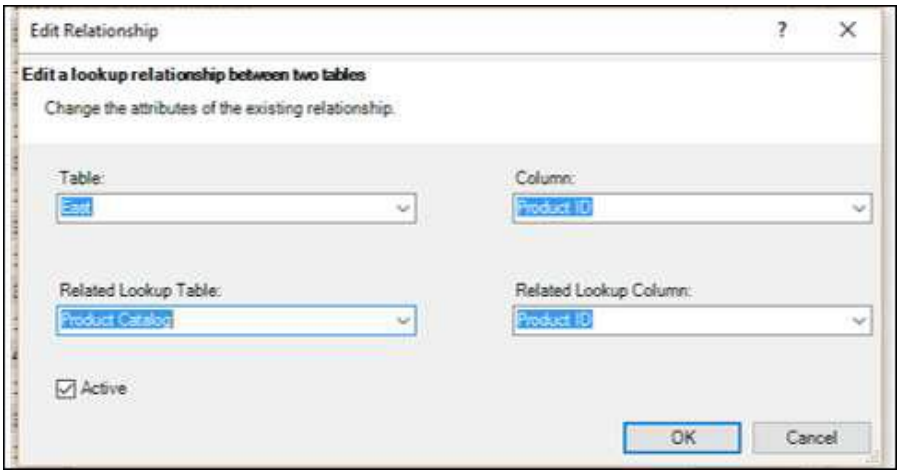
- Click the Design tab in the Power Pivot window.
- Click Manage Relationships in the Relationships group. The Manage Relationships dialog box appears.



All the relationships that exist in the Data Model are displayed.

To edit a relationship

- Click on a Relationship.
- Click the **Edit** button. The **Edit Relationship** dialog box appears.



- Make the required changes in the relationship.
- Click OK. The changes get reflected in the relationship.

To delete a relationship

- Click on a Relationship.
- Click on the Delete button. A warning message appears showing how the tables that are affected by deleting the relationship would affect the reports.
- Click OK if you are sure you want to delete. The selected relationship is deleted.

Refreshing Power Pivot Data

Suppose you modify the data in the Excel table. You can add / change / delete the data in the Excel table.

To refresh the PowerPivot data, do the following:

- Click the Linked Table tab in the Power Pivot window.
- Click Update All.

The data table is updated with the modifications made in the Excel table.

As you can observe, you cannot modify data in the data tables directly. Hence, it is better to maintain your data in Excel tables that are linked to the data tables when you add them to the Data Model. This facilitates updating the data in data tables as and when you update the data in Excel tables.

PowerPivot Table Creation

Power PivotTable is based on the Power Pivot database, which is called the Data Model. You have already learnt the powerful features of the Data Model. The power of Power Pivot is in its ability to summarize data from the Data Model in the Power PivotTable. As you are aware, the Data Model can handle huge data spanning millions of rows and coming from diverse inputs. This enables Power PivotTable to summarize the data from anywhere in a matter of few minutes.

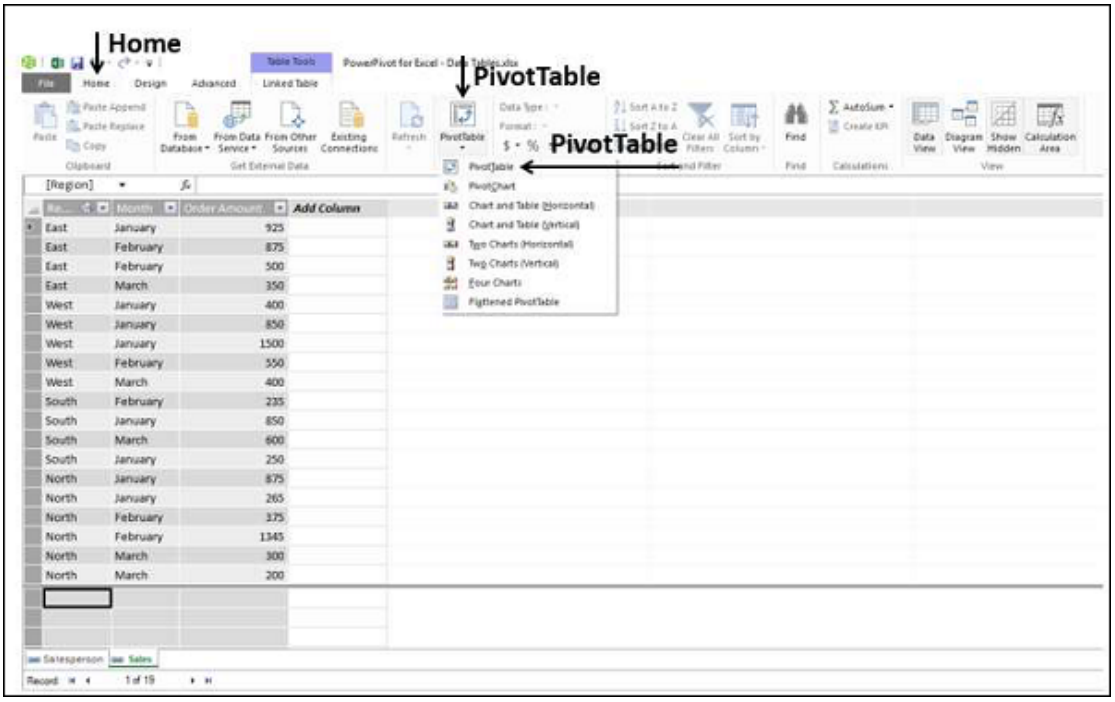
Power PivotTable resembles PivotTable in its layout, with the following differences −

- PivotTable is based on Excel tables, whereas Power PivotTable is based on data tables that are part of Data Model.
- PivotTable is based on a single Excel table or data range, whereas Power PivotTable can be based on multiple data tables, provided they are added to Data Model.
- PivotTable is created from Excel window, whereas Power PivotTable is created from PowerPivot window.

Creating a Power PivotTable

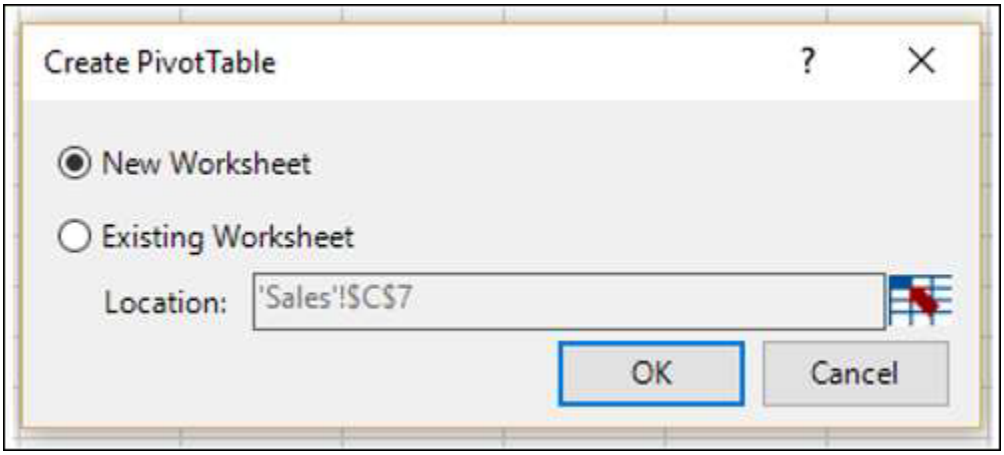
Suppose you have two data tables − Salesperson and Sales in the Data Model. To create a PowerPivot Table from these two data tables, proceed as follows:

- Click the Home tab on the Ribbon in PowerPivot window.
- Click PivotTable on the Ribbon.
- Select PivotTable from the dropdown list.

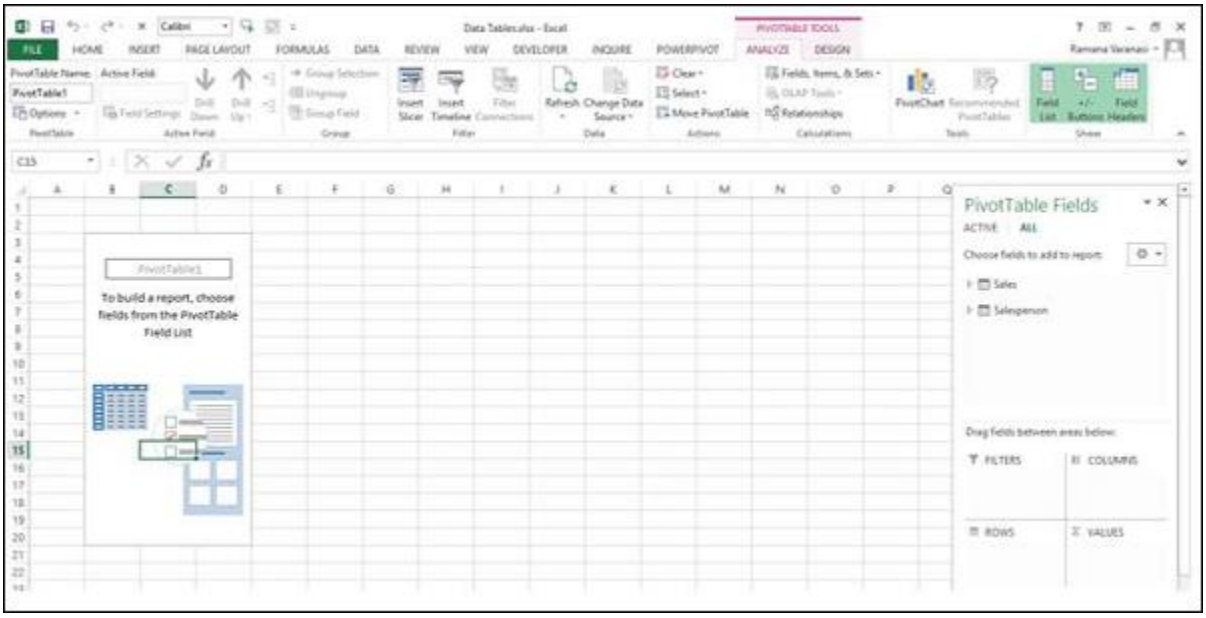


Create PivotTable dialog box appears. As you can observe, this is a simple dialog box, without any queries on data. This is because, Power PivotTable is always based on Data Model, i.e. the data tables with the relationships defined among them.

Select New Worksheet and click OK.



A new worksheet is created in Excel window and an empty PivotTable appears.

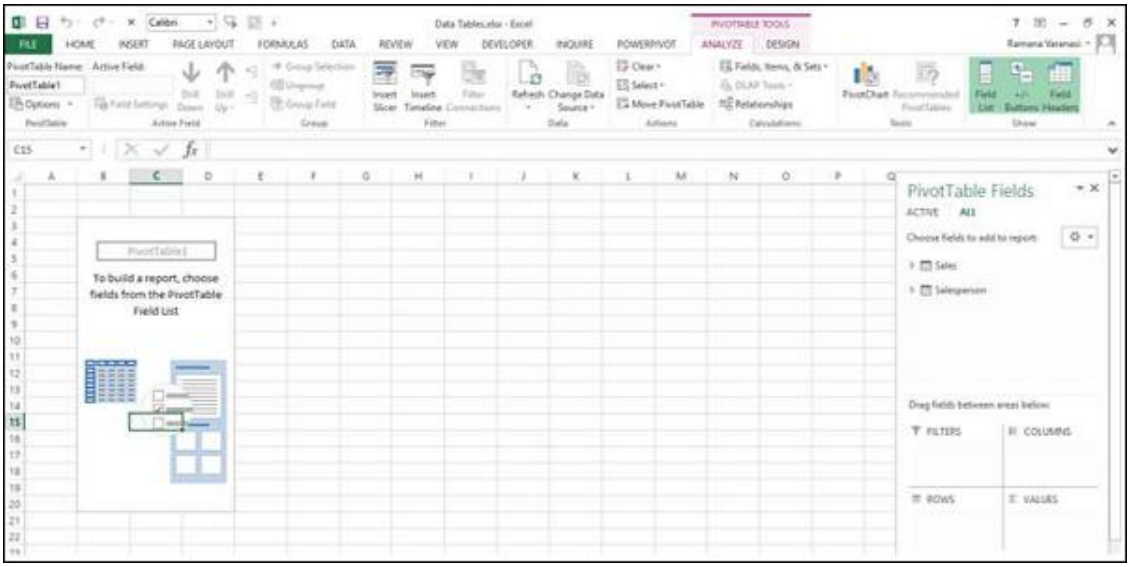


As you can observe, the layout of the Power PivotTable is similar to that of PivotTable. The **PIVOTTABLE TOOLS** appear on the Ribbon, with **ANALYZE** and **DESIGN** tabs, identical to PivotTable.

The PivotTable Fields List appears on the right side of the worksheet. Here, you will find some differences from PivotTable.

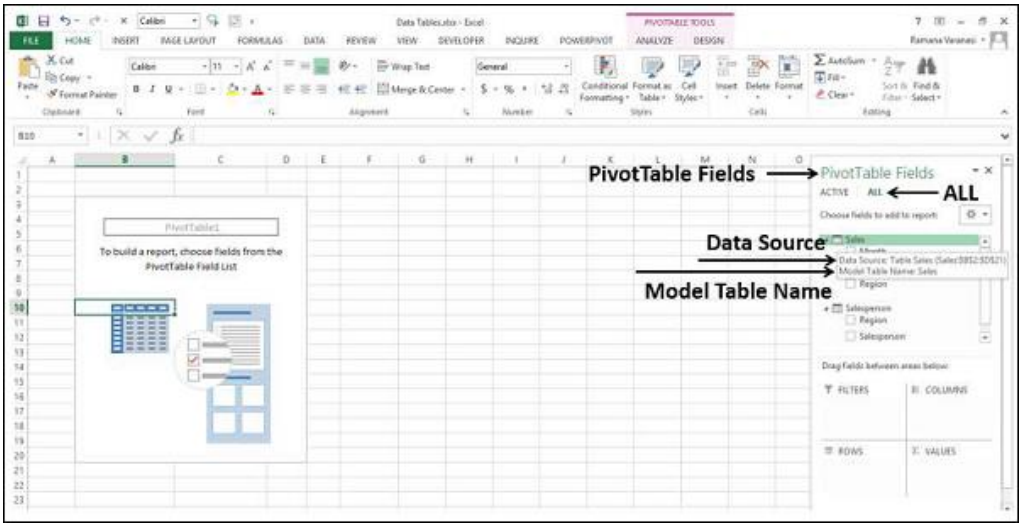
Power PivotTable Fields

The PivotTable Fields list has two tabs − ACTIVE and ALL that appear below the title and above the fields list. The **ALL** tab is highlighted.

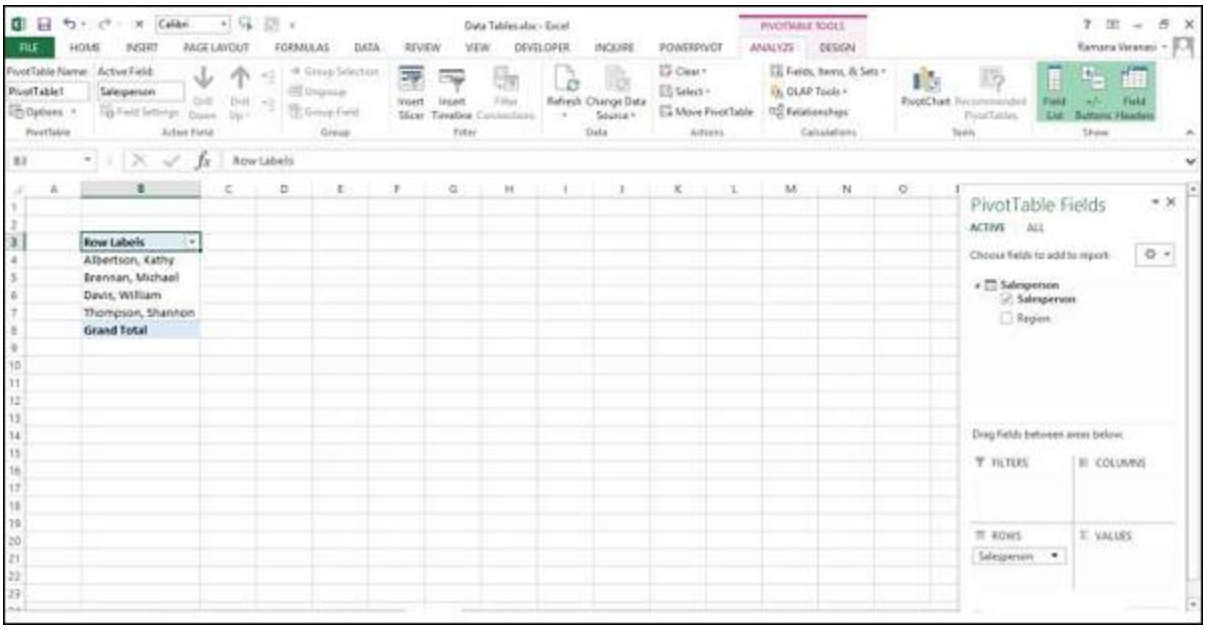


Note that the **ALL** tab displays all the data tables in the Data Model and ACTIVE tab displays all the data tables that are chosen for the Power PivotTable at hand. As the Power PivotTable is empty, it means that no data table is selected yet; hence by default, ALL tab is selected and the two tables that are currently in the Data Model are displayed. At this point, if you click the **ACTIVE** tab, the Fields list would be empty.

- Click on the table names in the PivotTable Fields list under ALL. The corresponding fields with check boxes will appear.
- Each table name will have the symbol  on the left side.
- If you place the cursor on this symbol, the Data Source and the Model Table Name of that data table will be displayed.

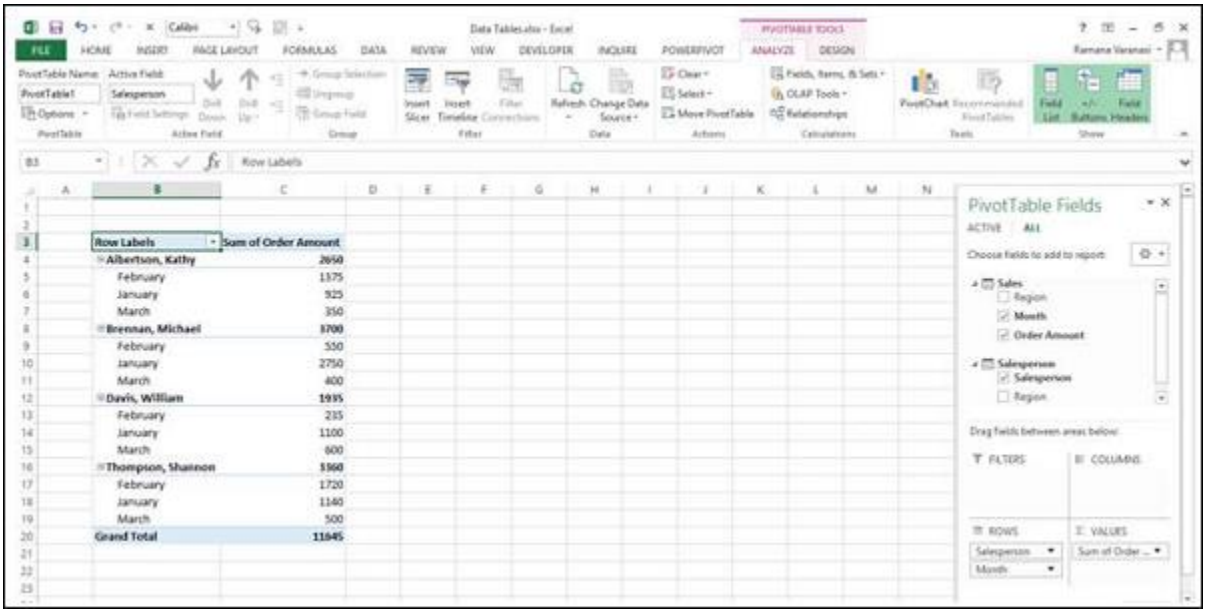


- Drag Salesperson from Salesperson table to the ROWS area.
- Click the **ACTIVE** tab.

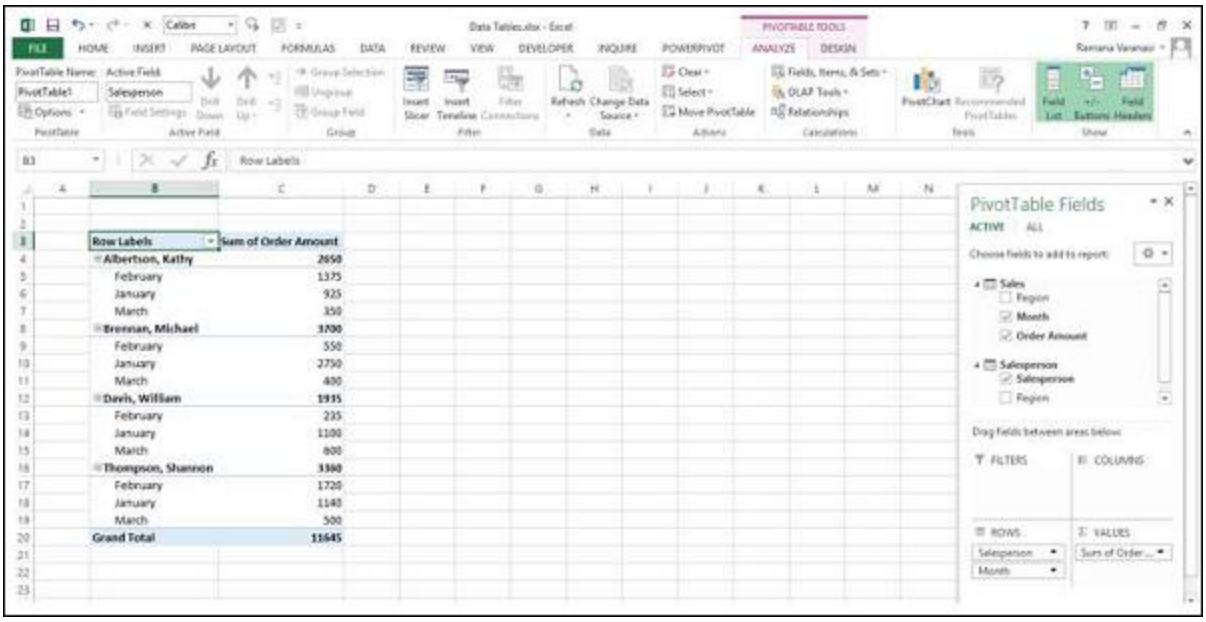


As you can observe, the field Salesperson appears in the PivotTable and the table Salesperson appears under the **ACTIVE** tab as expected.

- Click the **ALL** tab.
- Click on Month and Order Amount in the Sales table.

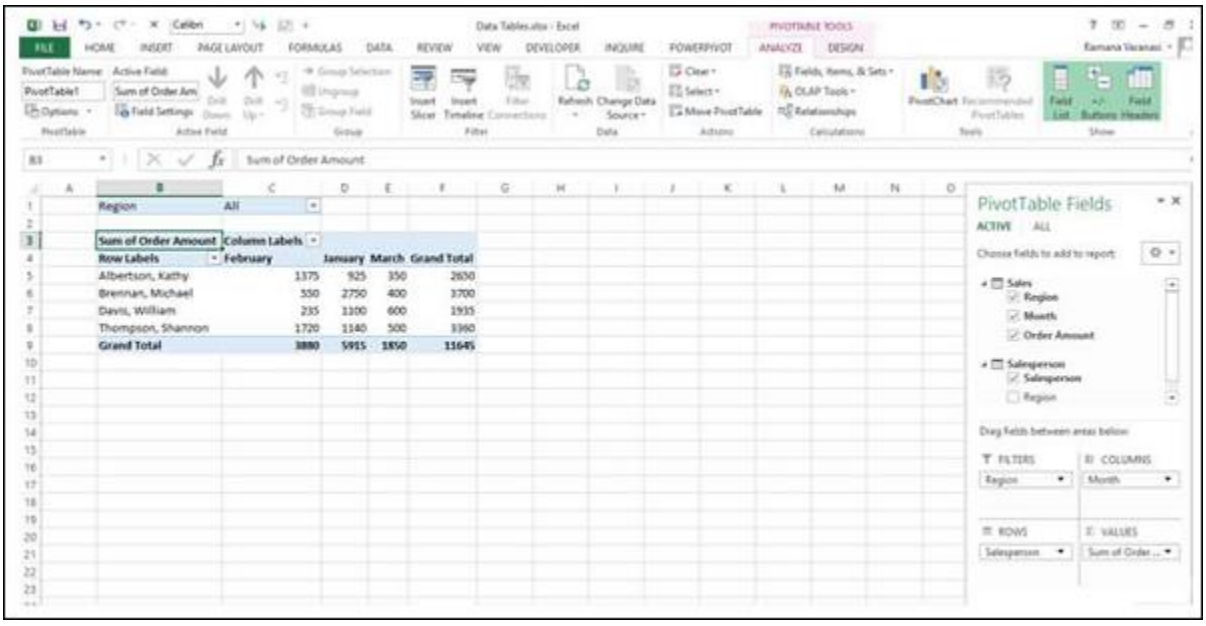


Again, click the ACTIVE tab. Both the tables − Sales and Salesperson appear under the **ACTIVE** tab.



Row Labels	Sum of Order Amount
Albertson, Kathy	2650
February	1375
January	925
March	350
Brennan, Michael	3700
February	550
January	2750
March	400
Davis, William	1935
February	235
January	1100
March	600
Thompson, Shannon	3360
February	1720
January	1140
March	500
Grand Total	11645

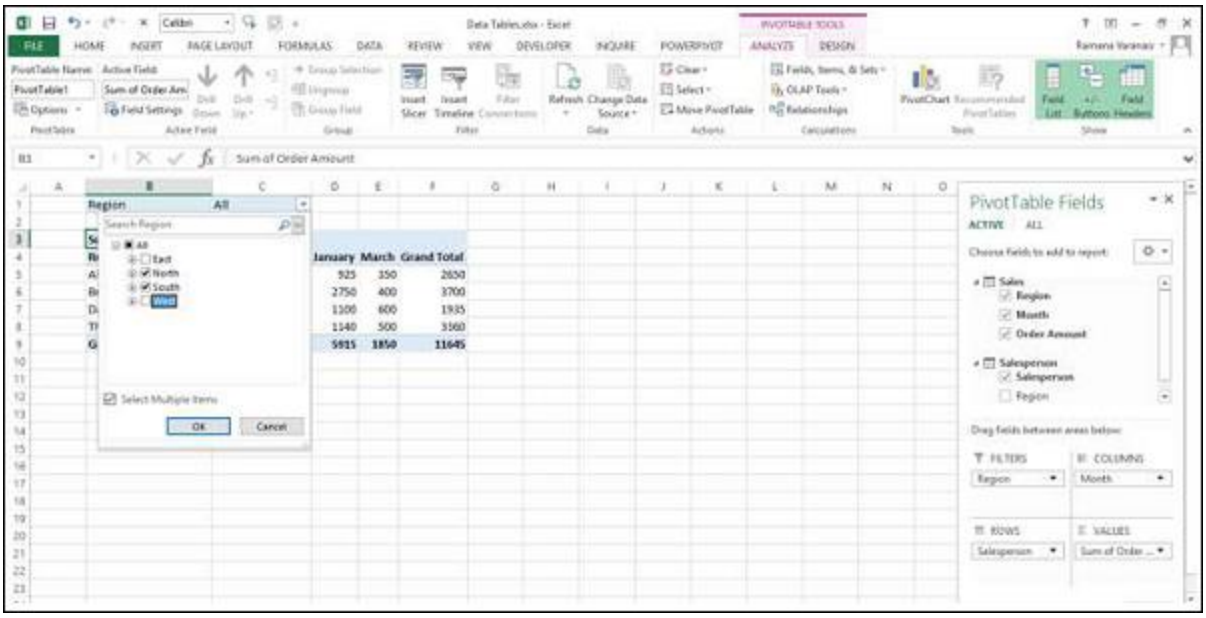
- Drag Month to COLUMNS area.
- Drag Region to FILTERS area.



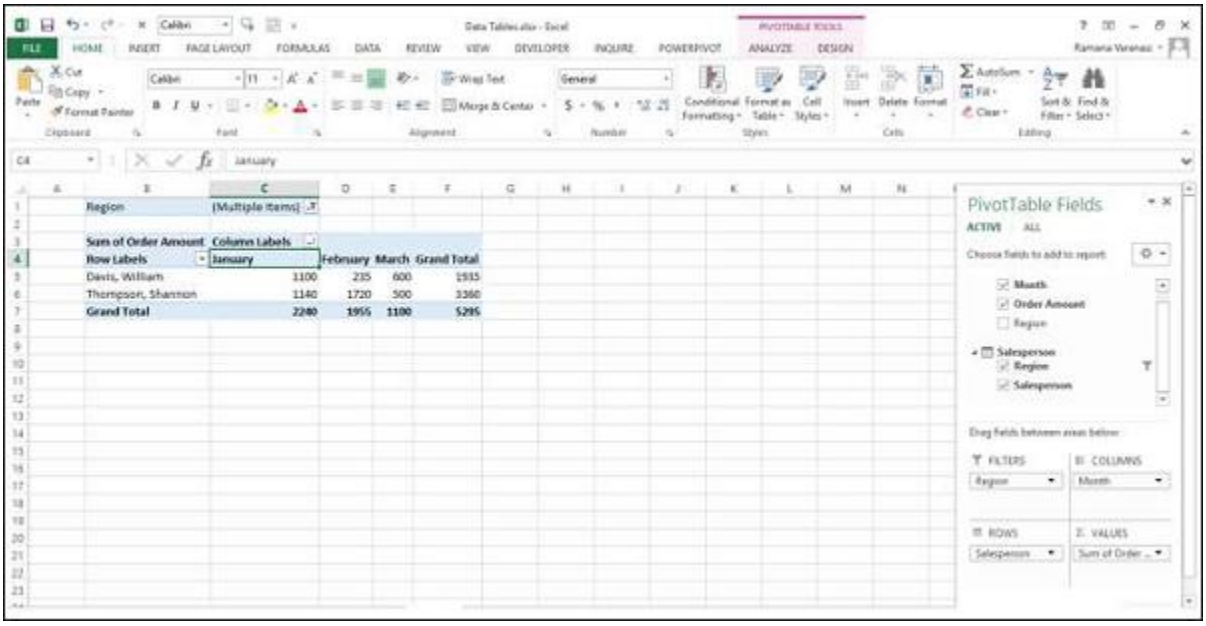
Region	All

Sum of Order Amount	Column Labels			
Row Labels	February	January	March	Grand Total
Albertson, Kathy	1375	925	350	2650
Brennan, Michael	550	2750	400	3700
Davis, William	235	1100	600	1935
Thompson, Shannon	1720	1140	500	3360
Grand Total	3880	5915	1850	11645

- Click the arrow next to ALL in the Region filter box.
- Click Select Multiple Items.
- Select North and South and click OK.



Sort the column labels in the ascending order.



Power PivotTable can be modified dynamically explore and report data.

Basics of DAX

DAX (Data Analysis eXpression) language is the language of Power Pivot. DAX is used by Power Pivot for data modeling and it is convenient for you to use for self-service BI. DAX is based on data tables and columns in data tables. Note that it is not based on individual cells in the table as is the case with the formulas and functions in Excel.

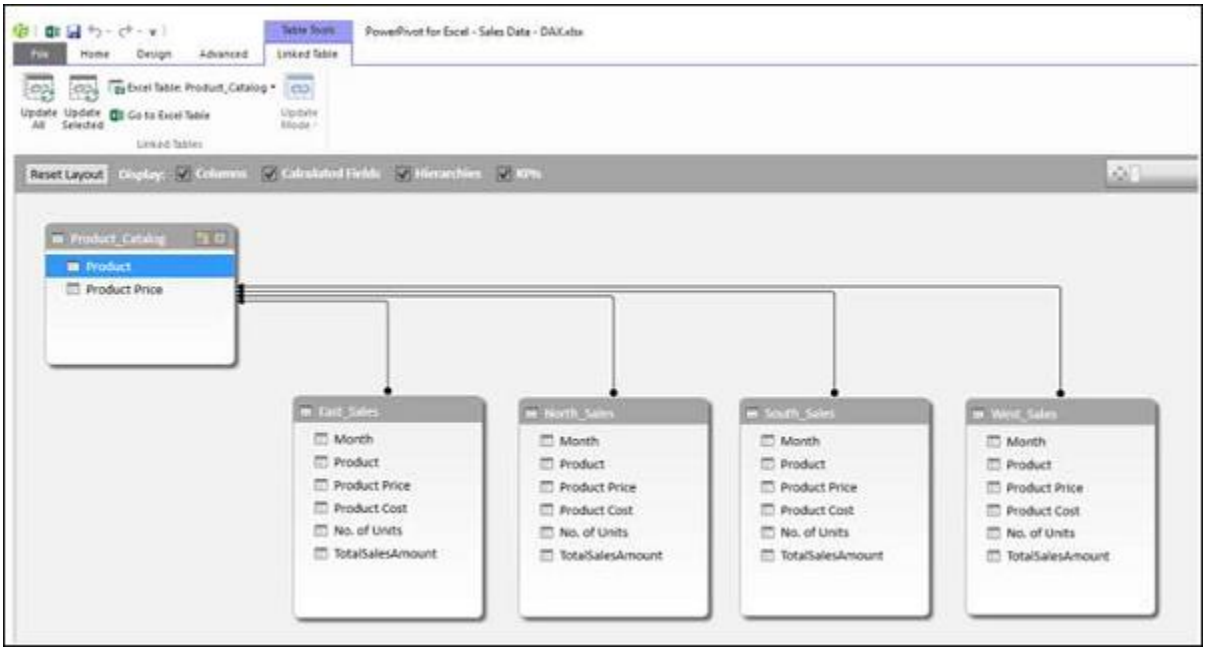
You will learn the two simple calculations that exist in Data Model − Calculated Column and Calculated Field in this module.

Calculated Column

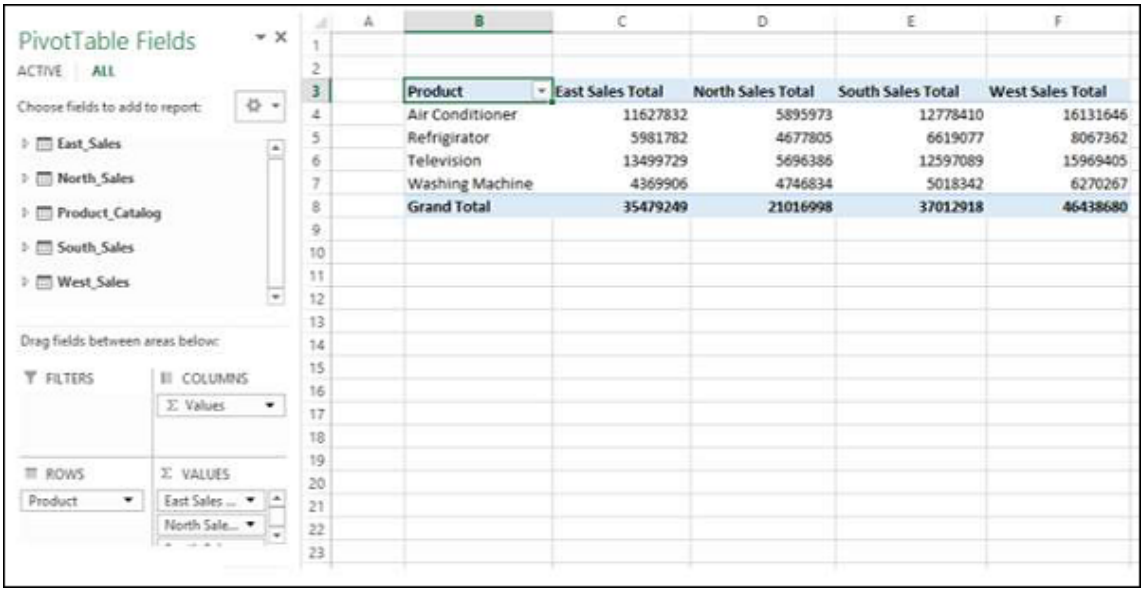
Calculated column is a column in the Data Model that is defined by a calculation and that extends the content of a data table. It can be visualized as a new column in an Excel table defined by a formula.

Extending the Data Model using Calculated Columns

Suppose you have sales data of products region-wise in data tables and also a Product Catalog in the Data Model.



Create a Power PivotTable with this data.



Product	East Sales Total	North Sales Total	South Sales Total	West Sales Total
Air Conditioner	11627832	5895973	12778410	16131646
Refrigirator	5981782	4677805	6619077	8067362
Television	13499729	5696386	12597089	15969405
Washing Machine	4369906	4746834	5018342	6270267
Grand Total	**35479249**	**21016998**	**37012918**	**46438680**

As you can observe, the Power PivotTable has summarized the sales data from all the regions. Suppose you want to know the gross profit made on each of the products. You know the price of each product, the cost at which it is sold and the number of units sold.

Product	Product Price
Refrigirator	17500
Television	38000
Washing Machine	13500
Air Conditioner	38250

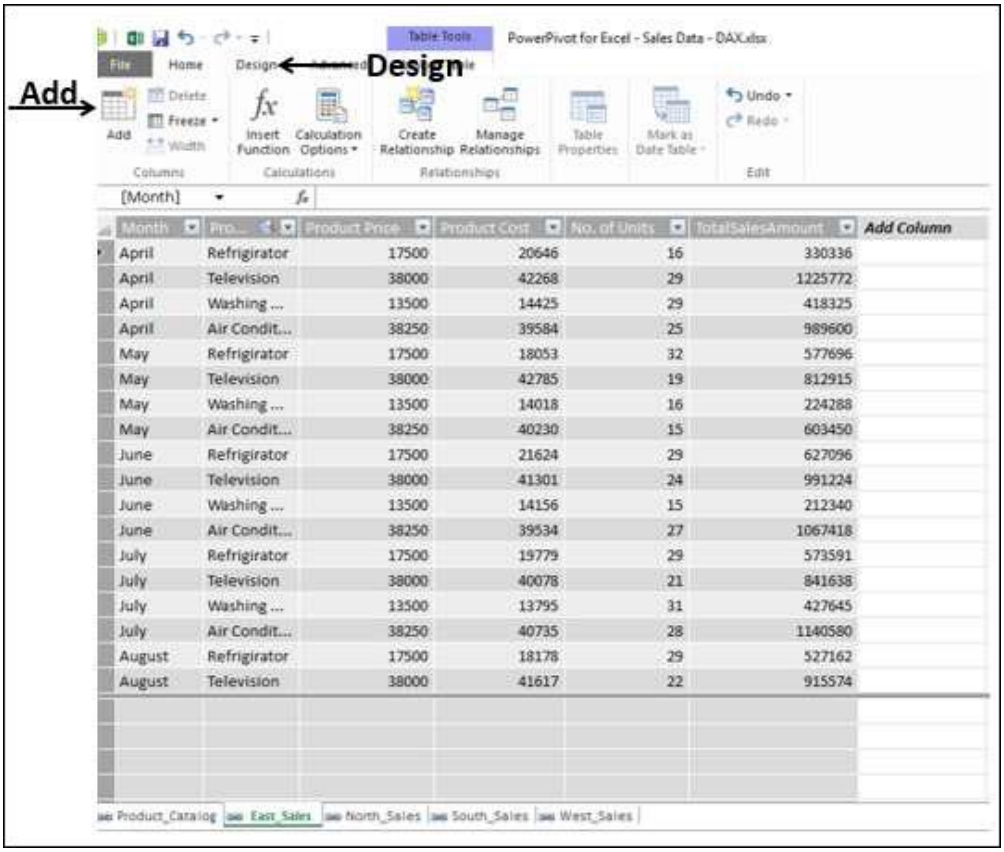
Month	Pro...	Product Price	Product Cost	No. of Units	TotalSalesAmount
April	Refrigirator	17500	20646	16	330336
April	Television	38000	42268	29	1225772
April	Washing ...	13500	14425	29	418325
April	Air Condit...	38250	39584	25	989600
May	Refrigirator	17500	18053	32	577696
May	Television	38000	42785	19	812915
May	Washing ...	13500	14018	16	224288
May	Air Condit...	38250	40230	15	603450
June	Refrigirator	17500	21624	29	627096
June	Television	38000	41301	24	991224
June	Washing ...	13500	14156	15	212340
June	Air Condit...	38250	39534	27	1067418
July	Refrigirator	17500	19779	29	573591
July	Television	38000	40078	21	841638
July	Washing ...	13500	13795	31	427645
July	Air Condit...	38250	40735	28	1140580
August	Refrigirator	17500	18178	29	527162
August	Television	38000	41617	22	915574

However, if you need to calculate the gross profit, you need to have two more columns in each of the data tables of the regions − Total Product Price and Gross Profit. This is because, PivotTable requires columns in data tables to summarize the results.

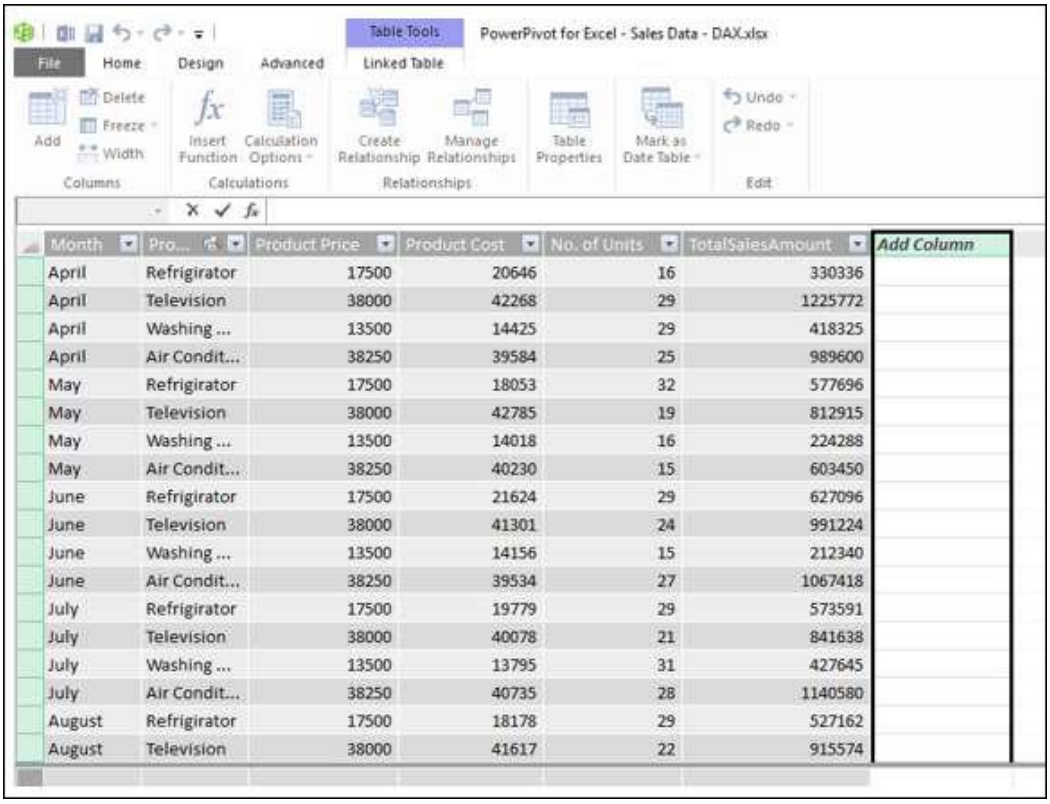
As you know, Total Product Price is Product Price * No. of Units and Gross Profit is Total Amount − Total Product Price.

You need to use DAX Expressions to add the Calculated Columns as follows:

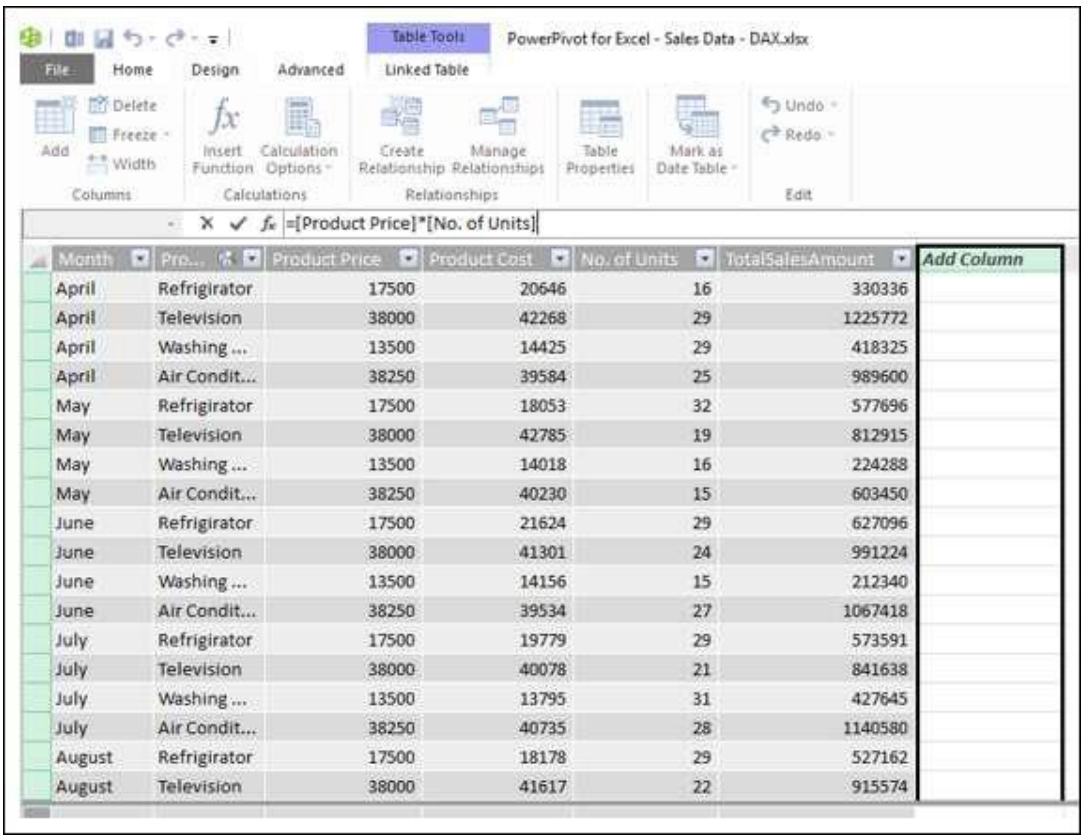
- Click the East_Sales tab in Data View of the Power Pivot window to view the East_Sales Data Table.
- Click the Design tab on the Ribbon.
- Click Add.



The column on the right side with the header − Add Column is highlighted.

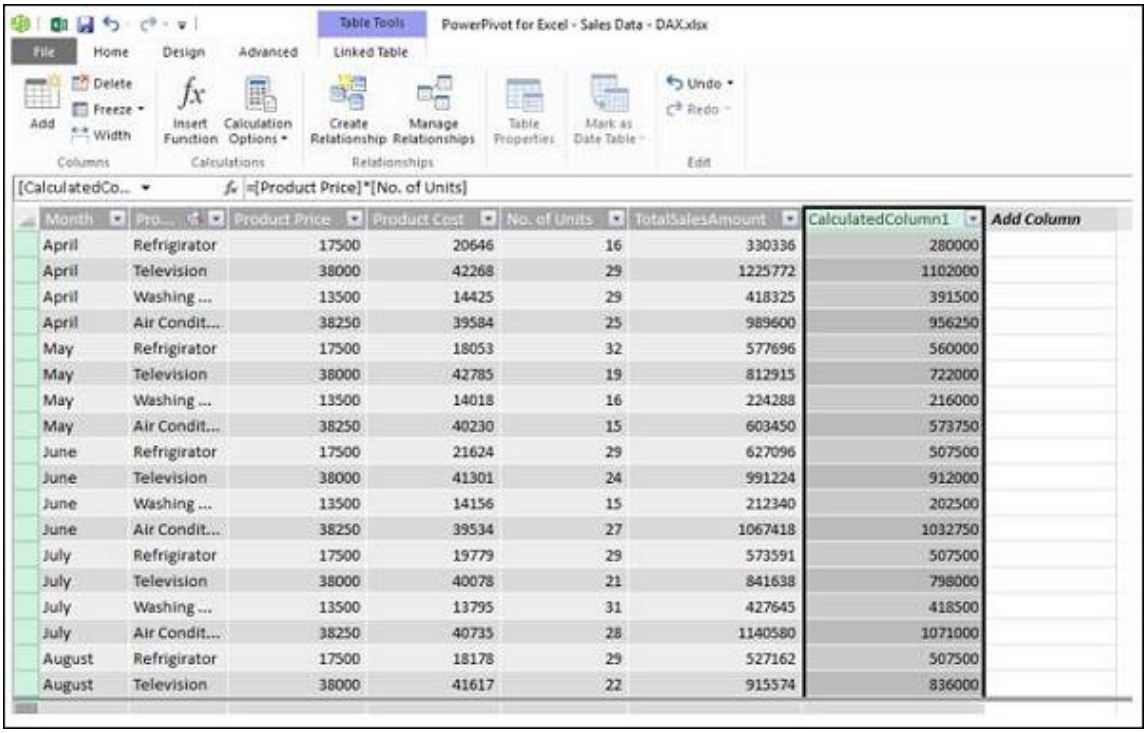


Type = **[Product Price] * [No. of Units]** in the formula bar and press **Enter**.



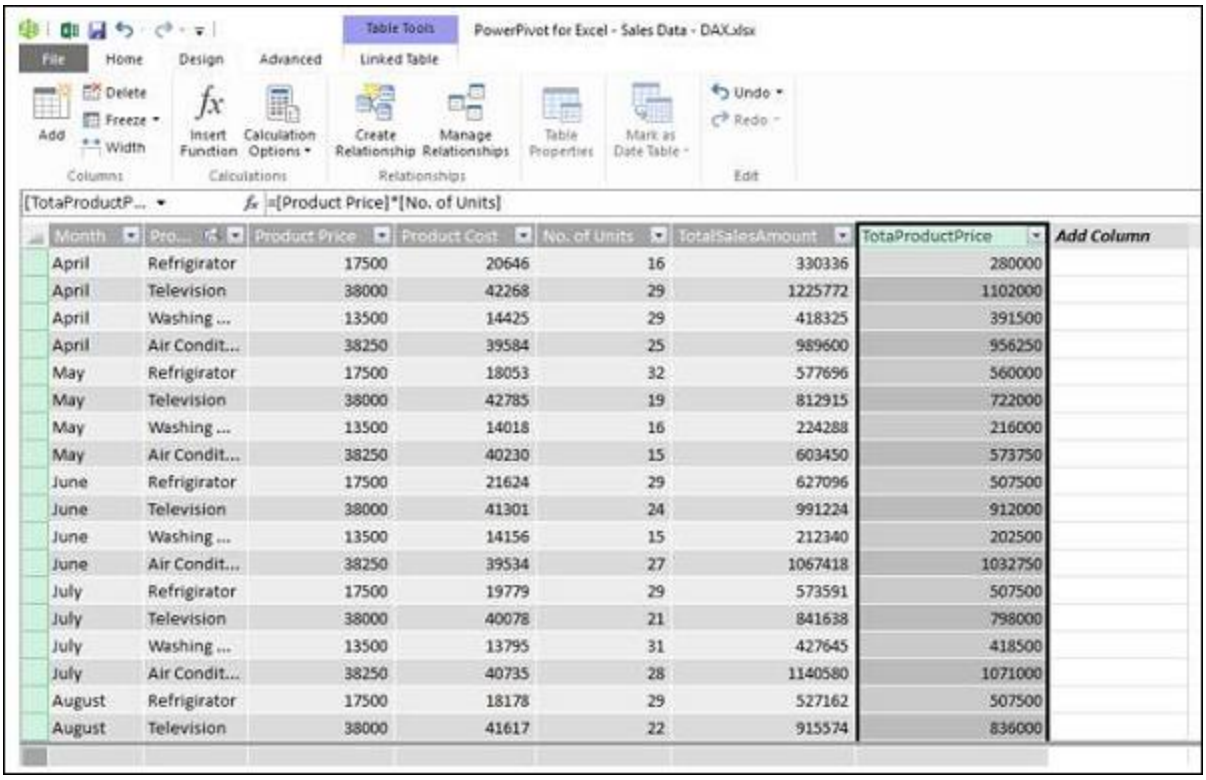
Month	Pro...	Product Price	Product Cost	No. of Units	TotalSalesAmount	Add Column
April	Refrigirator	17500	20646	16	330336	
April	Television	38000	42268	29	1225772	
April	Washing ...	13500	14425	29	418325	
April	Air Condit...	38250	39584	25	989600	
May	Refrigirator	17500	18053	32	577696	
May	Television	38000	42785	19	812915	
May	Washing ...	13500	14018	16	224288	
May	Air Condit...	38250	40230	15	603450	
June	Refrigirator	17500	21624	29	627096	
June	Television	38000	41301	24	991224	
June	Washing ...	13500	14156	15	212340	
June	Air Condit...	38250	39534	27	1067418	
July	Refrigirator	17500	19779	29	573591	
July	Television	38000	40078	21	841638	
July	Washing ...	13500	13795	31	427645	
July	Air Condit...	38250	40735	28	1140580	
August	Refrigirator	17500	18178	29	527162	
August	Television	38000	41617	22	915574	

A new column with header **CalculatedColumn1** is inserted with the values calculated by the formula you entered.



Month	Pro...	Product Price	Product Cost	No. of Units	TotalSalesAmount	CalculatedColumn1	Add Column
April	Refrigirator	17500	20646	16	330336	280000	
April	Television	38000	42268	29	1225772	1102000	
April	Washing ...	13500	14425	29	418325	391500	
April	Air Condit...	38250	39584	25	989600	956250	
May	Refrigirator	17500	18053	32	577696	560000	
May	Television	38000	42785	19	812915	722000	
May	Washing ...	13500	14018	16	224288	216000	
May	Air Condit...	38250	40230	15	603450	573750	
June	Refrigirator	17500	21624	29	627096	507500	
June	Television	38000	41301	24	991224	912000	
June	Washing ...	13500	14156	15	212340	202500	
June	Air Condit...	38250	39534	27	1067418	1032750	
July	Refrigirator	17500	19779	29	573591	507500	
July	Television	38000	40078	21	841638	798000	
July	Washing ...	13500	13795	31	427645	418500	
July	Air Condit...	38250	40735	28	1140580	1071000	
August	Refrigirator	17500	18178	29	527162	507500	
August	Television	38000	41617	22	915574	836000	

- Double click the header of the new calculated column.
- Rename the header as **TotalProductPrice**.

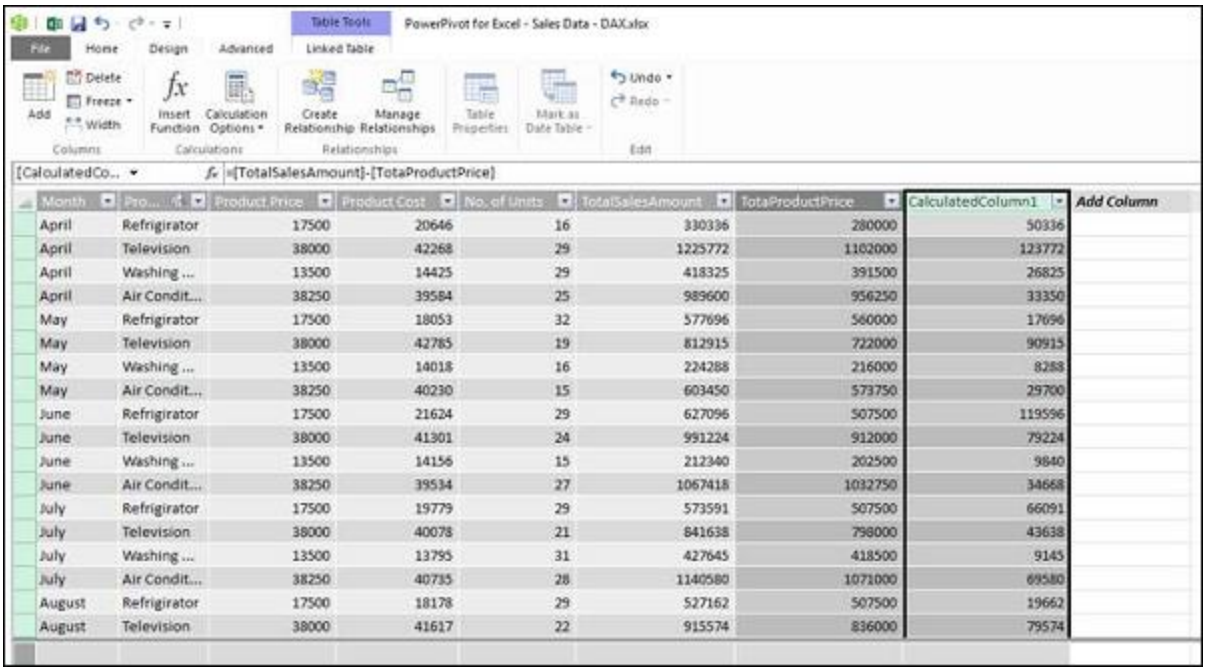


Month	Pro...	Product Price	Product Cost	No. of Units	TotalSalesAmount	TotaProductPrice	Add Column
April	Refrigirator	17500	20646	16	330336	280000	
April	Television	38000	42268	29	1225772	1102000	
April	Washing ...	13500	14425	29	418325	391500	
April	Air Condit...	38250	39584	25	989600	956250	
May	Refrigirator	17500	18053	32	577696	560000	
May	Television	38000	42785	19	812915	722000	
May	Washing ...	13500	14018	16	224288	216000	
May	Air Condit...	38250	40230	15	603450	573750	
June	Refrigirator	17500	21624	29	627096	507500	
June	Television	38000	41301	24	991224	912000	
June	Washing ...	13500	14156	15	212340	202500	
June	Air Condit...	38250	39534	27	1067418	1032750	
July	Refrigirator	17500	19779	29	573591	507500	
July	Television	38000	40078	21	841638	798000	
July	Washing ...	13500	13795	31	427645	418500	
July	Air Condit...	38250	40735	28	1140580	1071000	
August	Refrigirator	17500	18178	29	527162	507500	
August	Television	38000	41617	22	915574	836000	

Add one more calculated column for Gross Profit as follows:

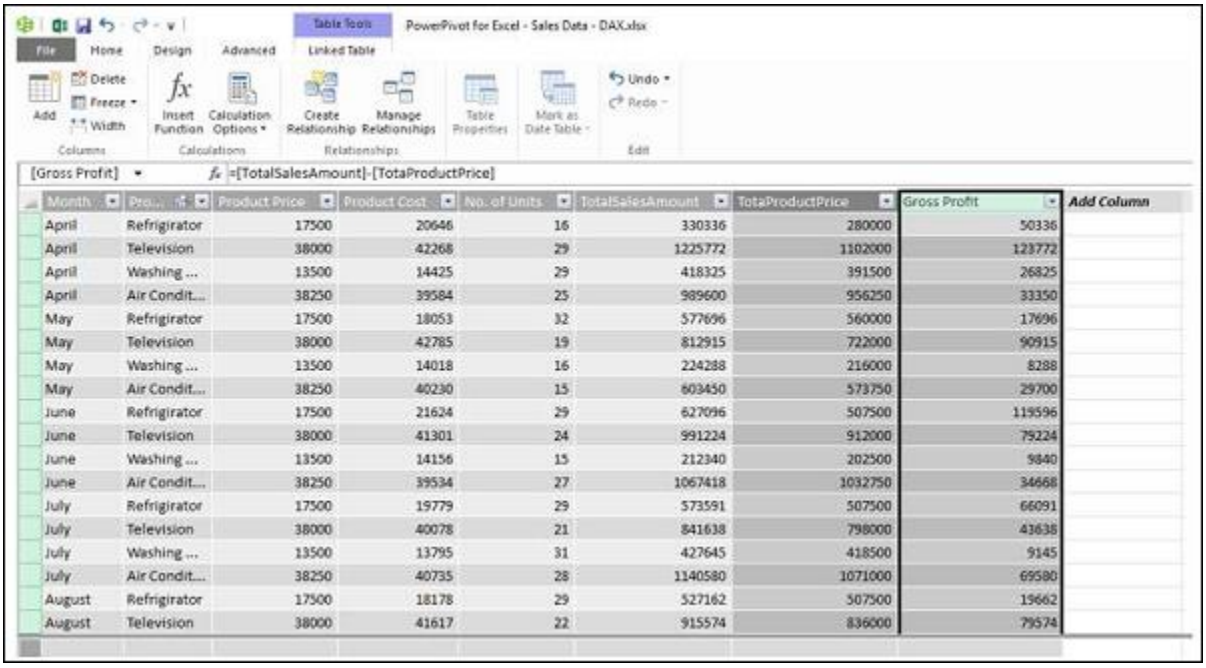
- Click the Design tab on the Ribbon.
- Click Add.
- The column on the right side with the header − Add Column is highlighted.
- Type = **[TotalSalesAmount] − [TotaProductPrice]** in the formula bar.
- Press Enter.

A new column with header **CalculatedColumn1** is inserted with the values calculated by the formula you entered.



Month	Pro...	Product Price	Product Cost	No. of Units	TotalSalesAmount	TotaProductPrice	CalculatedColumn1	Add Column
April	Refrigirator	17500	20646	16	330336	280000	50336	
April	Television	38000	42268	29	1225772	1102000	123772	
April	Washing ...	13500	14425	29	418325	391500	26825	
April	Air Condit...	38250	39584	25	989600	956250	33350	
May	Refrigirator	17500	18053	32	577696	560000	17696	
May	Television	38000	42785	19	812915	722000	90915	
May	Washing ...	13500	14018	16	224288	216000	8288	
May	Air Condit...	38250	40230	15	603450	573750	29700	
June	Refrigirator	17500	21624	29	627096	507500	119596	
June	Television	38000	41301	24	991224	912000	79224	
June	Washing ...	13500	14156	15	212340	202500	9840	
June	Air Condit...	38250	39534	27	1067418	1032750	34668	
July	Refrigirator	17500	19779	29	573591	507500	66091	
July	Television	38000	40078	21	841638	798000	43638	
July	Washing ...	13500	13795	31	427645	418500	9145	
July	Air Condit...	38250	40735	28	1140580	1071000	69580	
August	Refrigirator	17500	18178	29	527162	507500	19662	
August	Television	38000	41617	22	915574	836000	79574	

- Double click the header of the new calculated column.
- Rename the header as Gross Profit.



Month	Pro...	Product Price	Product Cost	No. of Units	TotalSalesAmount	TotaProductPrice	Gross Profit	Add Column
April	Refrigirator	17500	20646	16	330336	280000	50336	
April	Television	38000	42268	29	1225772	1102000	123772	
April	Washing ...	13500	14425	29	418325	391500	26825	
April	Air Condit...	38250	39584	25	989600	956250	33350	
May	Refrigirator	17500	18053	32	577696	560000	17696	
May	Television	38000	42785	19	812915	722000	90915	
May	Washing ...	13500	14018	16	224288	216000	8288	
May	Air Condit...	38250	40230	15	603450	573750	29700	
June	Refrigirator	17500	21624	29	627096	507500	119596	
June	Television	38000	41301	24	991224	912000	79224	
June	Washing ...	13500	14156	15	212340	202500	9840	
June	Air Condit...	38250	39534	27	1067418	1032750	34668	
July	Refrigirator	17500	19779	29	573591	507500	66091	
July	Television	38000	40078	21	841638	798000	43638	
July	Washing ...	13500	13795	31	427645	418500	9145	
July	Air Condit...	38250	40735	28	1140580	1071000	69580	
August	Refrigirator	17500	18178	29	527162	507500	19662	
August	Television	38000	41617	22	915574	836000	79574	

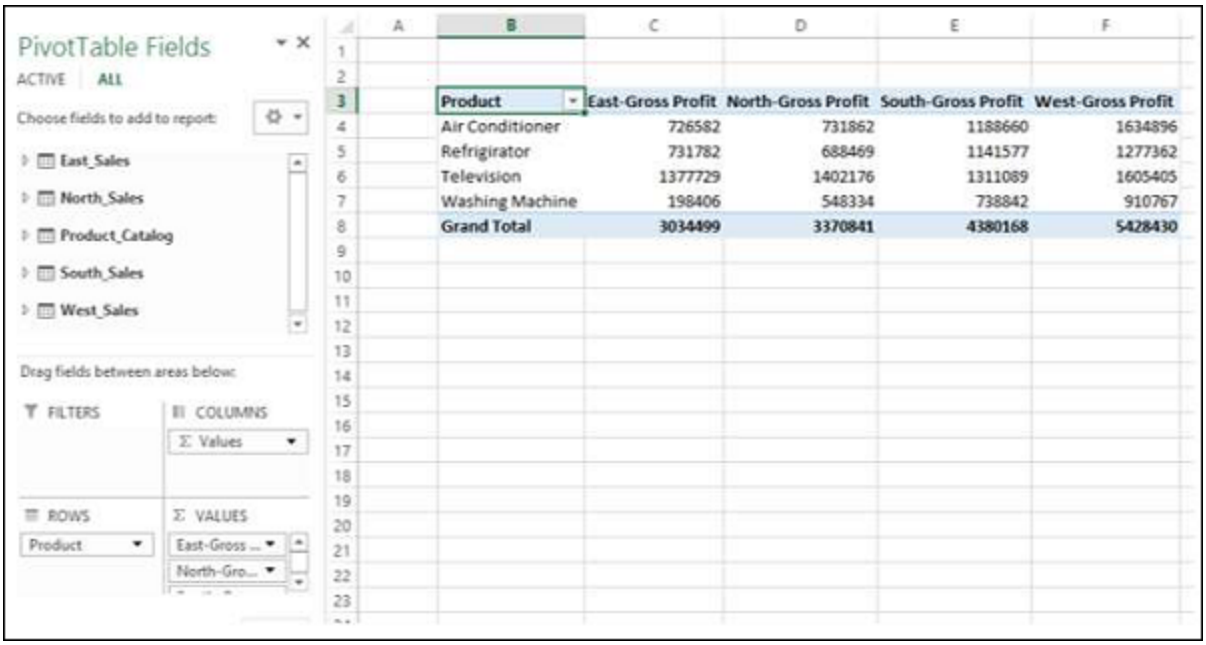
Add the Calculated Columns in the **North_Sales** data table in a similar way. Consolidating all the steps, proceed as follows:

- Click the Design tab on the Ribbon.
- Click Add. The column on the right side with the header − Add Column is highlighted.

- Type = **[Product Price] * [No. of Units]** in the formula bar and press Enter.
- A new column with header CalculatedColumn1 gets inserted with the values calculated by the formula you entered.
- Double click the header of the new calculated column.
- Rename the header as **TotalProductPrice**.
- Click the Design tab on the Ribbon.
- Click Add. The column on the right side with the header - Add Column is highlighted.
- Type = **[TotalSalesAmount] − [TotaProductPrice]** in the formula bar and press Enter. A new column with header **CalculatedColumn1** gets inserted with the values calculated by the formula you entered.
- Double click the header of the new calculated column.
- Rename the header as **Gross Profit**.

Repeat the above given steps for the South Sales data table and West Sales data table.

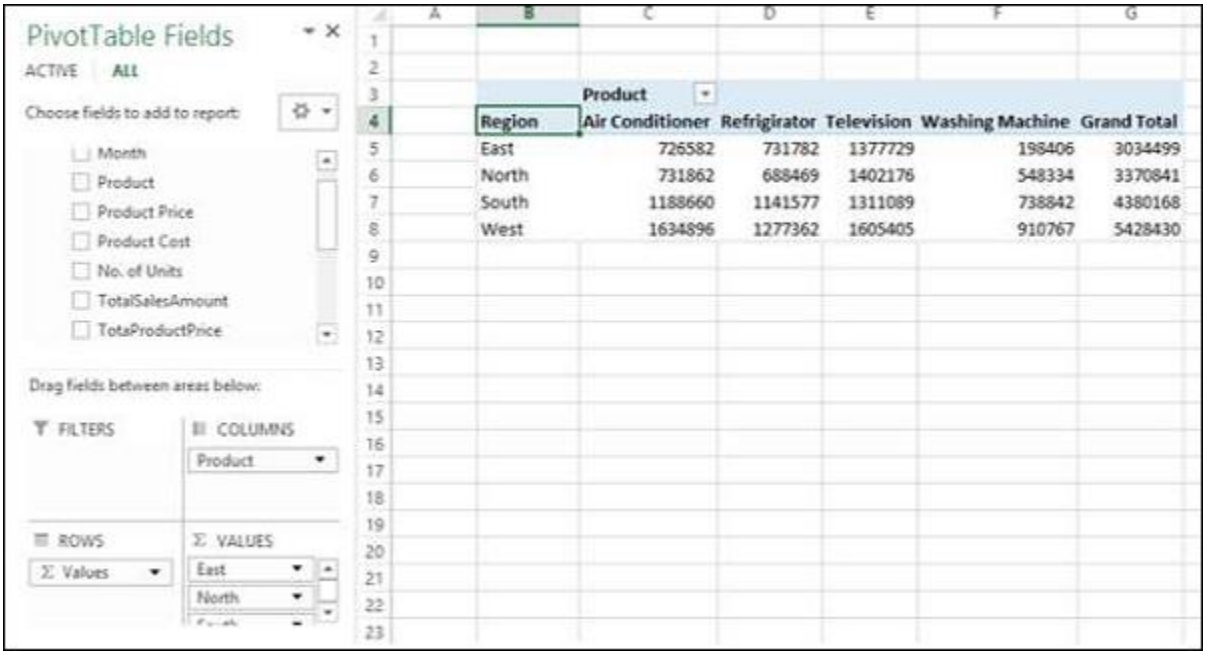
You have the necessary columns to summarize the Gross Profit. Now, create the Power PivotTable.



Product	East-Gross Profit	North-Gross Profit	South-Gross Profit	West-Gross Profit
Air Conditioner	726582	731862	1188660	1634896
Refrigirator	731782	688469	1141577	1277362
Television	1377729	1402176	1311089	1605405
Washing Machine	198406	548334	738842	910767
Grand Total	**3034499**	**3370841**	**4380168**	**5428430**

You are able to summarize the **Gross Profit** that became possible with the calculated columns in the Power Pivot and it all can be done just in a few steps that are error-free.

You can summarize it region wise for the products as given below also −

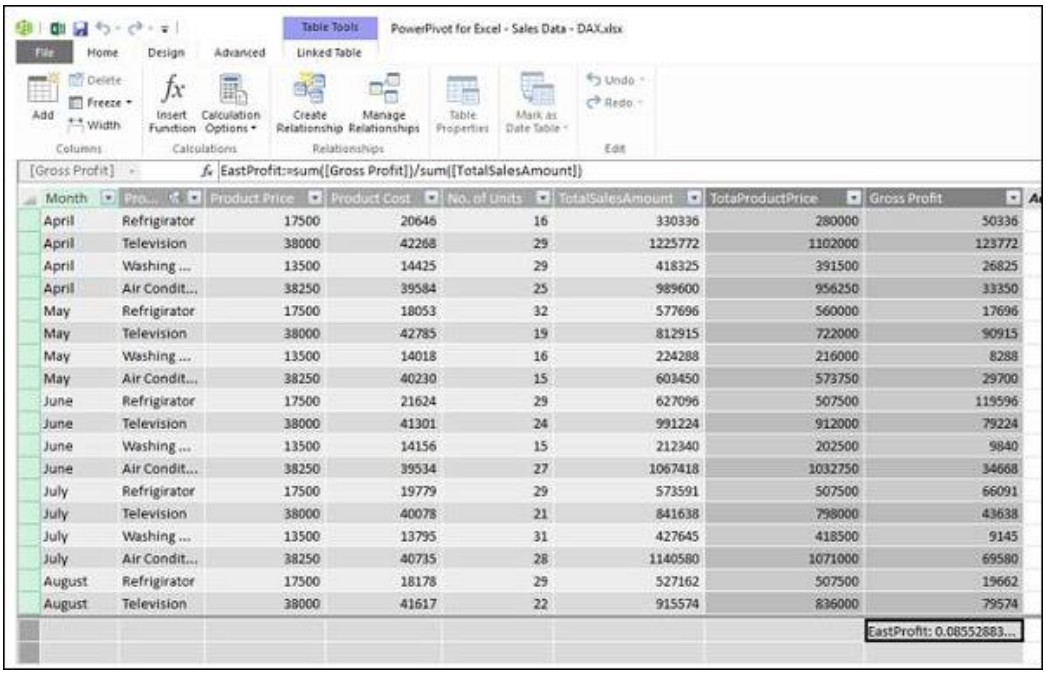


	Product				
Region	Air Conditioner	Refrigirator	Television	Washing Machine	Grand Total
East	726582	731782	1377729	198406	3034499
North	731862	688469	1402176	548334	3370841
South	1188660	1141577	1311089	738842	4380168
West	1634896	1277362	1605405	910767	5428430

Calculated Field

Suppose you want to calculate the percentage of profit made by each region product-wise. You can do so by adding a calculated field to the Data Table.

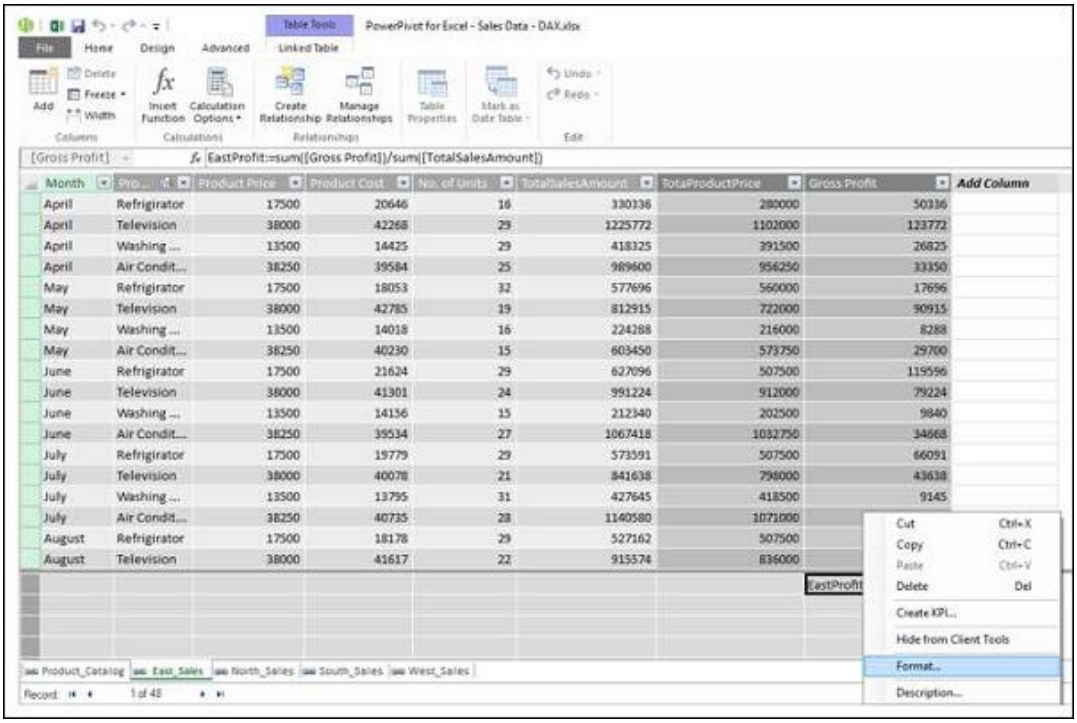
- Click below the column Gross Profit in the **East_Sales** table in Power Pivot window.
- Type **EastProfit: = SUM ([Gross Profit]) / sum ([TotalSalesAmount])** in the formula bar.
- Press Enter.



Month	Pro...	Product Price	Product Cost	No. of Units	TotalSalesAmount	TotaProductPrice	Gross Profit
April	Refrigirator	17500	20646	16	330336	280000	50336
April	Television	38000	42268	29	1225772	1102000	123772
April	Washing ...	13500	14425	29	418325	391500	26825
April	Air Condit...	38250	39584	25	989600	956250	33350
May	Refrigirator	17500	18053	32	577696	560000	17696
May	Television	38000	42785	19	812915	722000	90915
May	Washing ...	13500	14018	16	224288	216000	8288
May	Air Condit...	38250	40230	15	603450	573750	29700
June	Refrigirator	17500	21624	29	627096	507500	119596
June	Television	38000	41301	24	991224	912000	79224
June	Washing ...	13500	14156	15	212340	202500	9840
June	Air Condit...	38250	39534	27	1067418	1032750	34668
July	Refrigirator	17500	19779	29	573591	507500	66091
July	Television	38000	40078	21	841638	798000	43638
July	Washing ...	13500	13795	31	427645	418500	9145
July	Air Condit...	38250	40735	28	1140580	1071000	69580
August	Refrigirator	17500	18178	29	527162	507500	19662
August	Television	38000	41617	22	915574	836000	79574

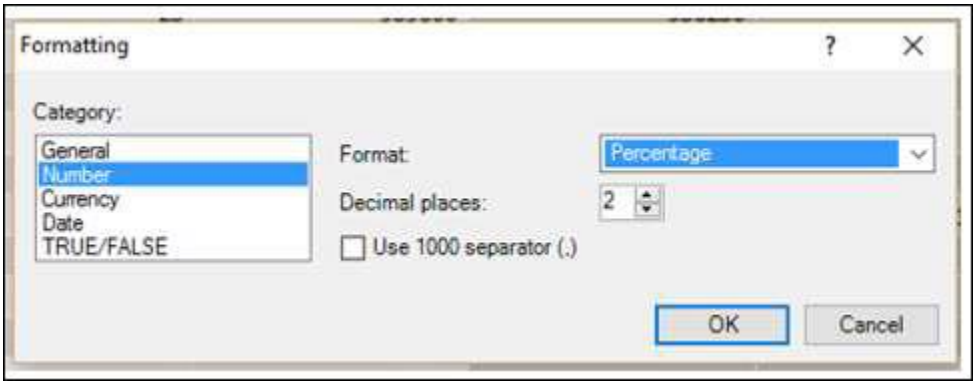
The calculated field EastProfit is inserted below the Gross Profit column.

- Right click the calculated field − EastProfit.
- Select **Format** from the dropdown list.

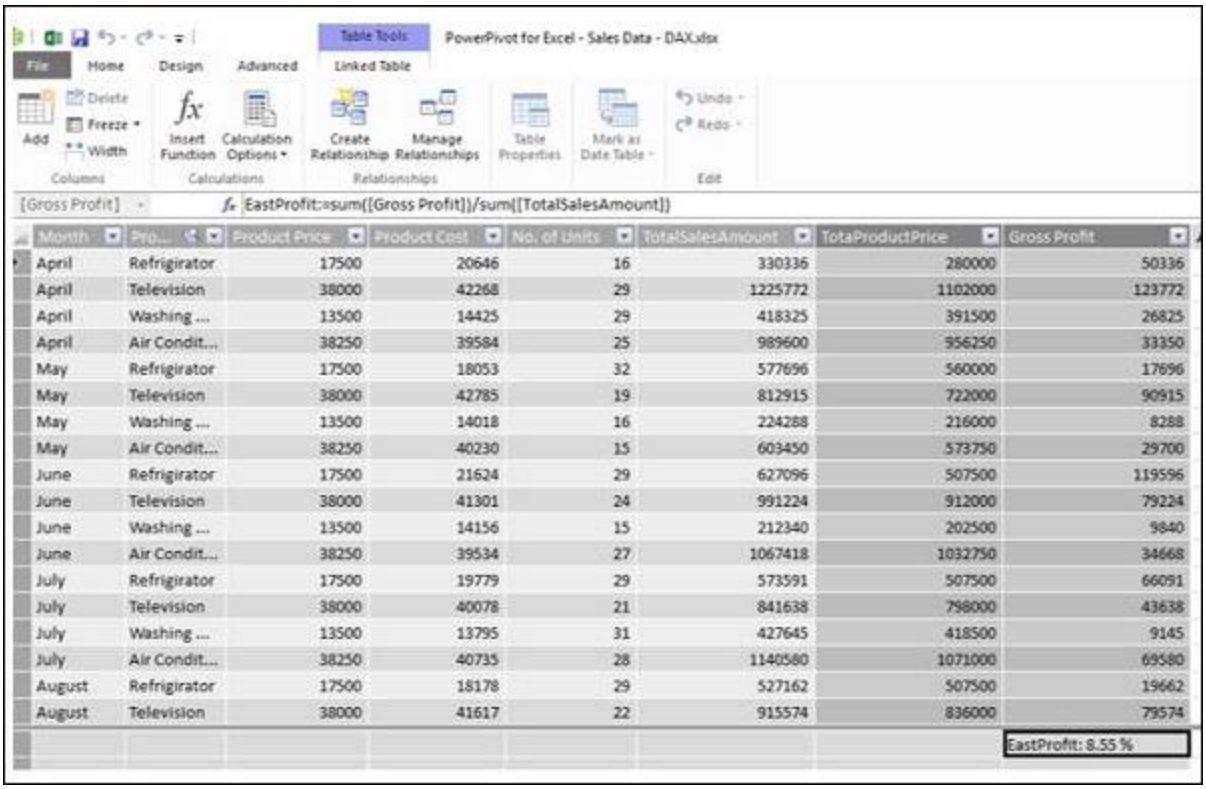


The Formatting dialog box appears.

- Select **Number** under Category.
- In the Format box, select Percentage and click OK.



The calculated field EastProfit is formatted to percentage.



Month	Pro...	Product Price	Product Cost	No. of Units	TotalSalesAmount	TotaProductPrice	Gross Profit
April	Refrigirator	17500	20646	16	330336	280000	50336
April	Television	38000	42268	29	1225772	1102000	123772
April	Washing ...	13500	14425	29	418325	391500	26825
April	Air Condit...	38250	39584	25	989600	956250	33350
May	Refrigirator	17500	18053	32	577696	560000	17696
May	Television	38000	42785	19	812915	722000	90915
May	Washing ...	13500	14018	16	224288	216000	8288
May	Air Condit...	38250	40230	15	603450	573750	29700
June	Refrigirator	17500	21624	29	627096	507500	119596
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June	Air Condit...	38250	39534	27	1067418	1032750	34668
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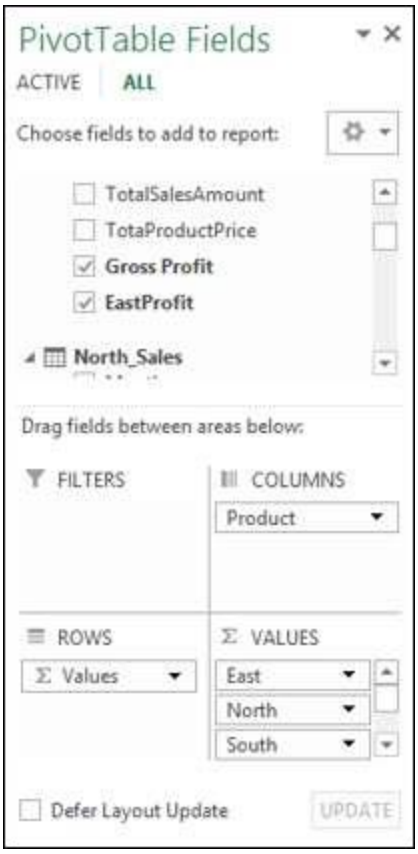
July	Television	38000	40078	21	841638	798000	43638
July	Washing ...	13500	13795	31	427645	418500	9145
July	Air Condit...	38250	40735	28	1140580	1071000	69580
August	Refrigirator	17500	18178	29	527162	507500	19662
August	Television	38000	41617	22	915574	836000	79574

Repeat the steps to insert the following calculated fields −

- NorthProfit in North_Sales data table.
- SouthProfit in South_Sales data table.
- WestProfit in West_Sales data table.

Note − You cannot define more than one calculated field with a given name.

Click on the Power PivotTable. You can see that the calculated fields appear in the tables.



- Select the fields − EastProfit, NorthProfit, SouthProfit and WestProfit from the tables in the PivotTable Fields list.
- Arrange the fields such that the Gross Profit and Percentage Profit appear together. The Power PivotTable looks as follows:

	A	B	C	D	E	F	G
1							
2							
3			Product				
4		Region	Air Conditioner	Refrigirator	Television	Washing Machine	Grand Total
5		East	726582	731782	1377729	198406	3034499
6		Profit %	6.25 %	12.23 %	10.21 %	4.54 %	8.55 %
7		North	731862	688469	1402176	548334	3370841
8		Profit %	6.13 %	12.20 %	11.08 %	11.55 %	9.64 %
9		South	1188660	1141577	1311089	738842	4380168
10		Profit %	10.26 %	20.84 %	11.62 %	17.26 %	13.42 %
11		West	1634896	1277362	1605405	910767	5428430
12		Profit %	10.13 %	15.83 %	10.05 %	14.53 %	11.69 %

Note − The **Calculate Fields** were called **Measures** in earlier versions of Excel.

Exploring Data

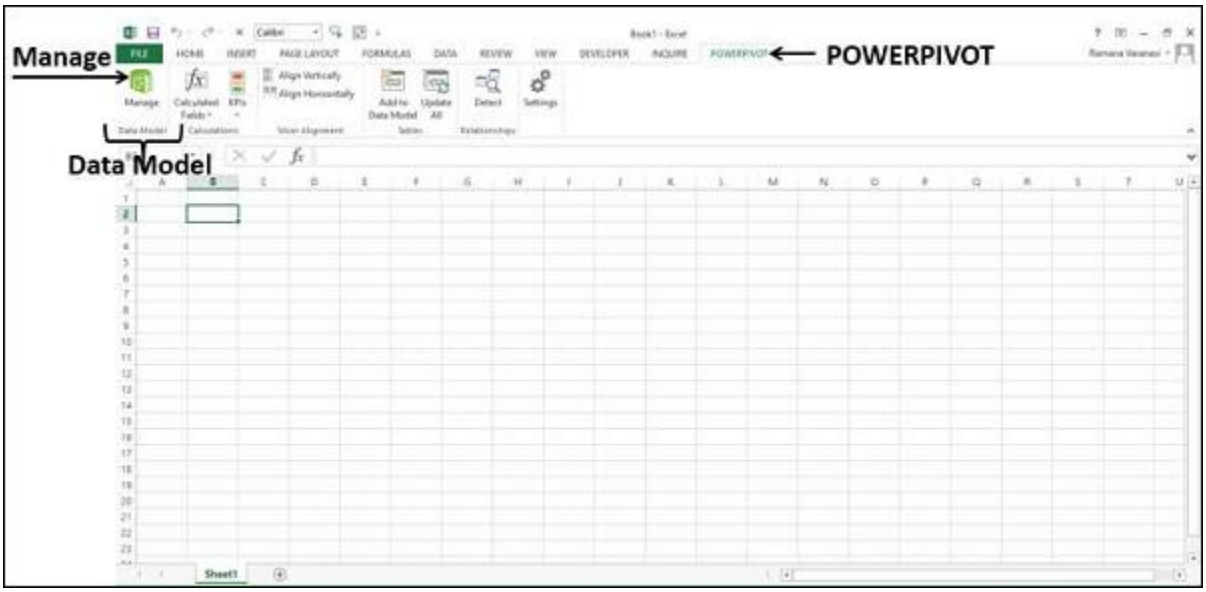
In the previous module, you have learnt how to create a Power PivotTable from a normal set of data tables. In this module, you will learn how you can explore data with Power PivotTable, when the data tables contain thousands of rows.

For a better understanding, we will import the data from an access database, which you know is a relational database.

Loading Data from Access Database

To load data from the Access database, follow the given steps −

- Open a new blank workbook in Excel.
- Click Manage in the Data Model group.
- Click the POWERPIVOT tab on the Ribbon.

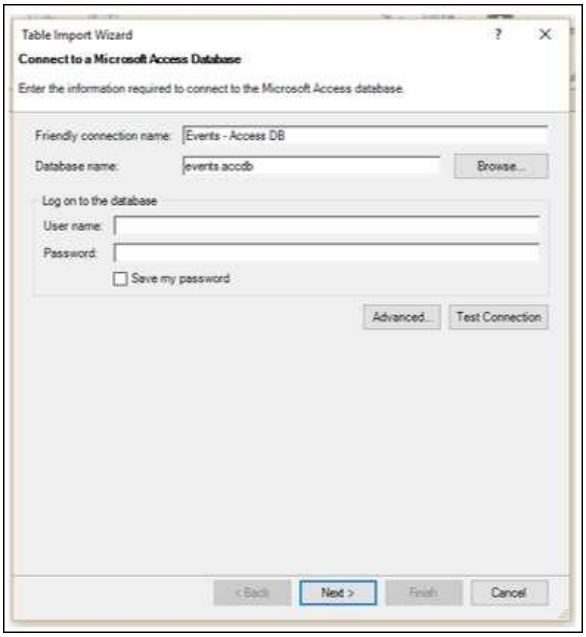


The Power Pivot window appears.

- Click the Home tab in the Power Pivot window.
- Click **From Database** in the Get External Data group.
- Select **From Access** from the dropdown list.

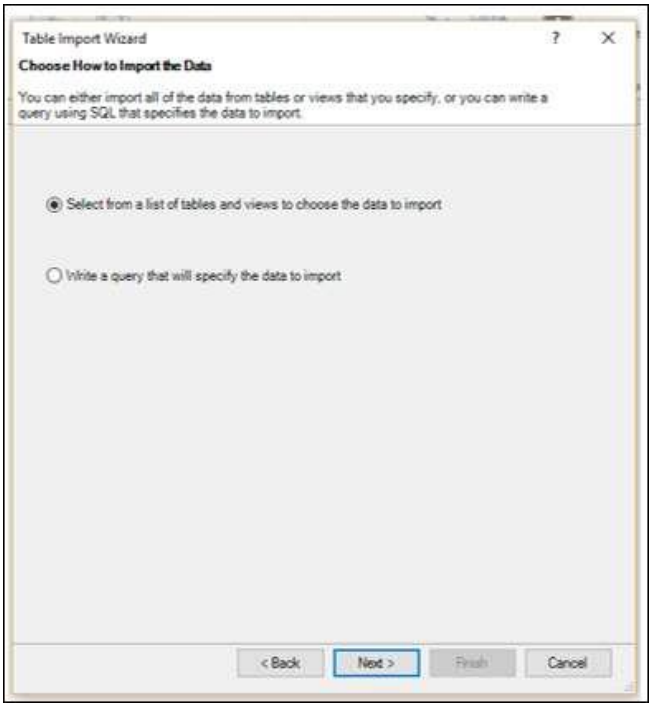
The Table Import Wizard appears.

- Provide **Friendly connection** name.
- Browse to the Access database file, Events.accdb, the Events database file.
- Click on the Next > button.

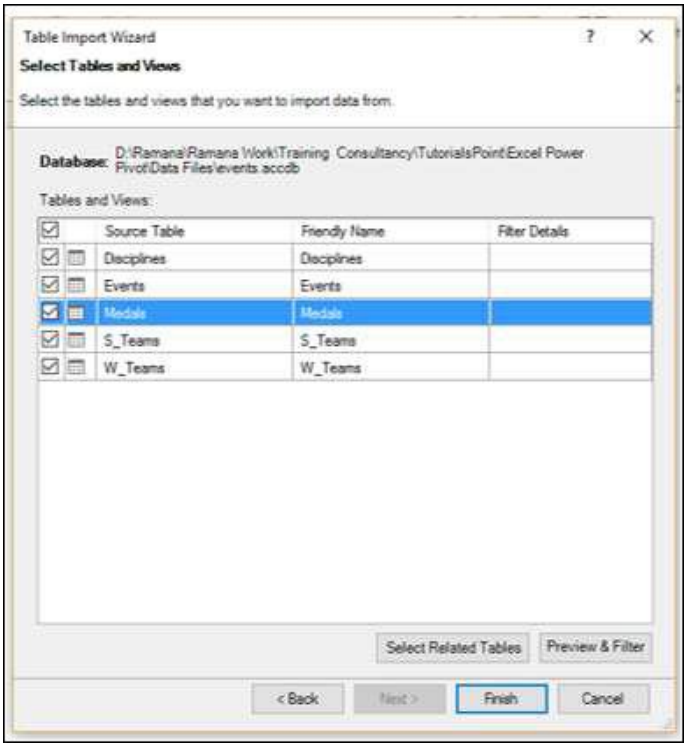


The **Table Import** wizard displays options for choosing how to import data.

Click **Select from a list of tables and views to choose the data to import** and click **Next**.

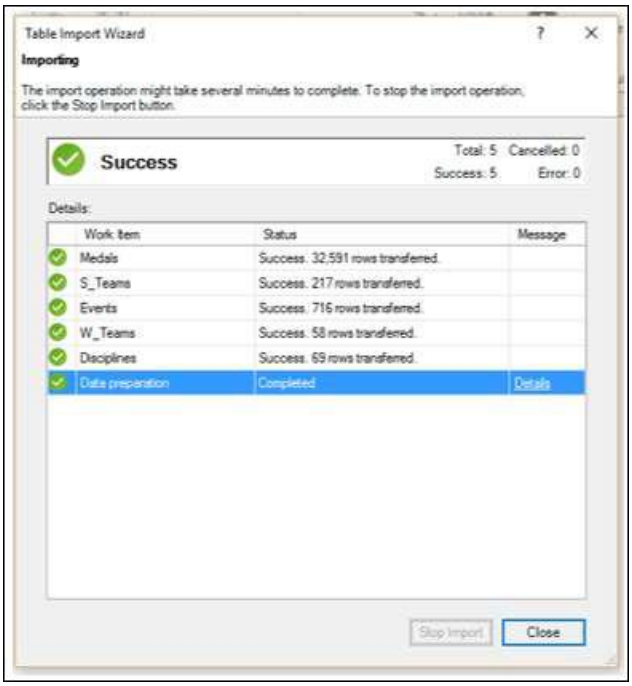


The **Table Import** Wizard displays all the tables in the Access database that you have selected. Check all the boxes to select all the tables and click Finish.

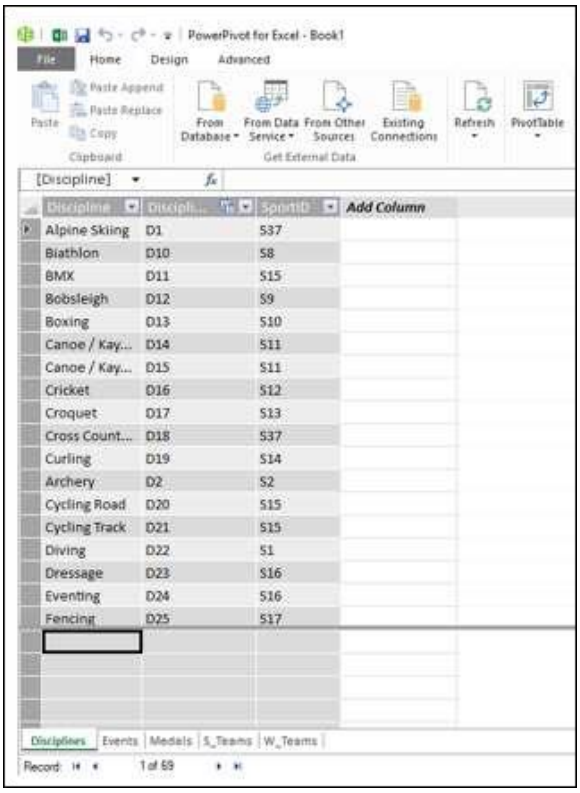


The **Table Import** Wizard displays – **Importing** and shows the status of the import. This may take a few minutes and you can stop the import by clicking the **Stop Import** button.

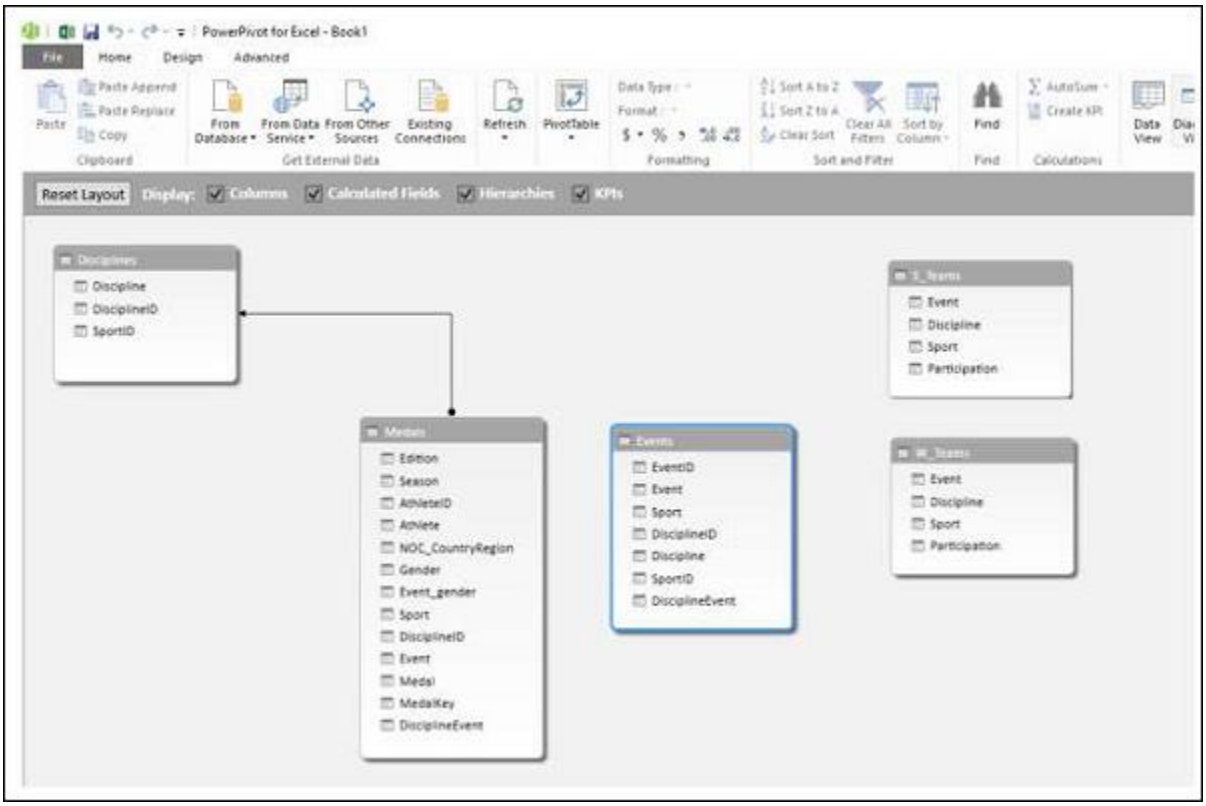
Once the data import is complete, Table Import Wizard displays – **Success** and shows the results of the import. Click **Close**.



Power Pivot displays all the imported tables in different tabs in Data View.



Click on the Diagram View.

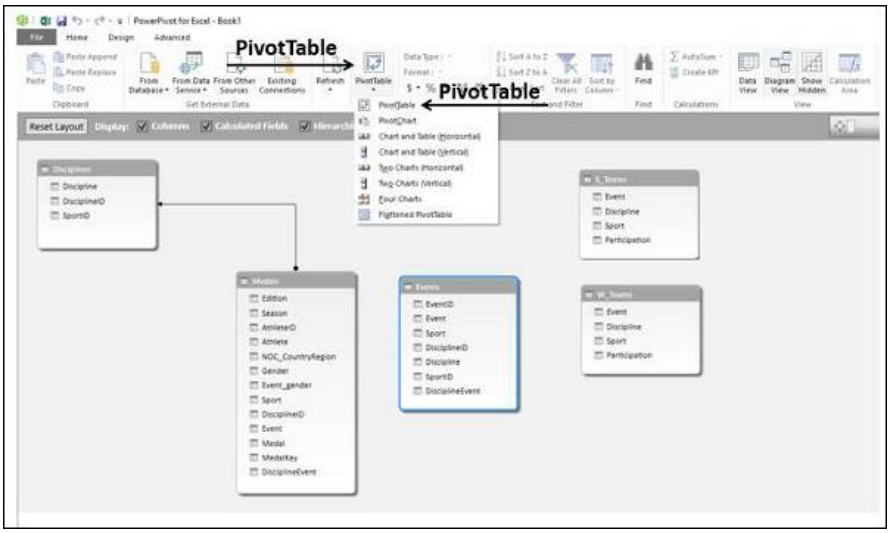


You can observe that a relationship exists between the tables – **Disciplines and Medals**. This is because, when you import data from a relational database such as Access, the relationships that exist in the database also are imported to the Data Model in Power Pivot.

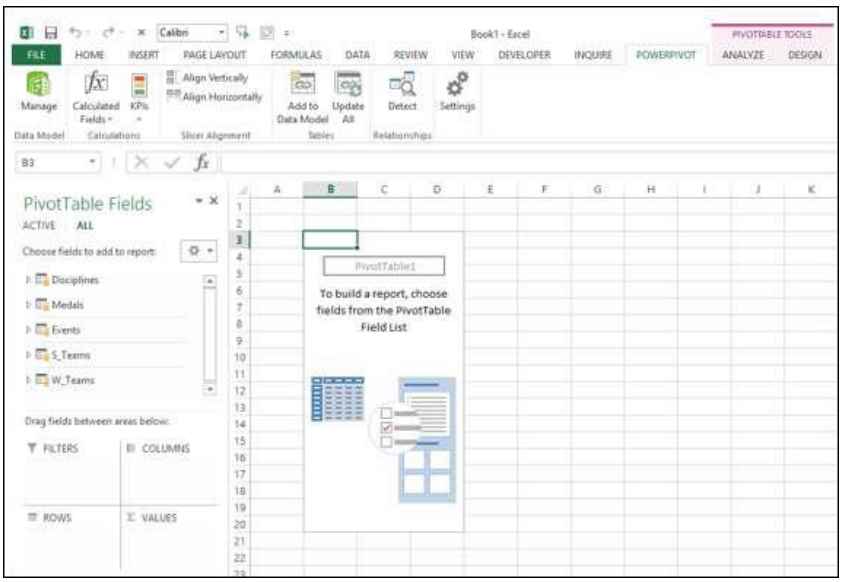
Creating a PivotTable from the Data Model

Create a PivotTable with the tables that you have imported in the previous section as follows:

- Click PivotTable on the Ribbon.
- Select PivotTable from the drop down list.
- Select New Worksheet in the Create PivotTable dialog box that appears and click OK.



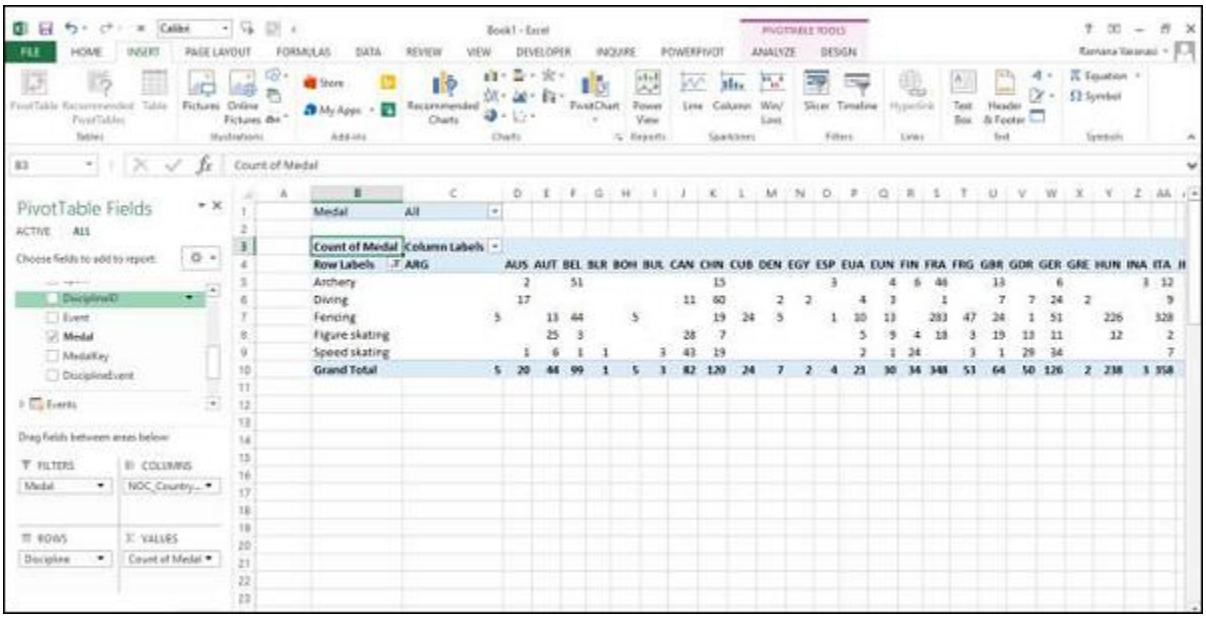
An empty PivotTable is created in a new worksheet in the Excel window.



All the imported tables that are a part of Power Pivot Data Model appear in the PivotTable Fields list.

- Drag the **NOC_CountryRegion** field in the Medals table to the COLUMNS area.
- Drag Discipline from the Disciplines table to the ROWS area.
- Filter Discipline to display only five sports: Archery, Diving, Fencing, Figure Skating, and Speed Skating. This can be done either in PivotTable Fields area, or from the Row Labels filter in the PivotTable itself.
- Drag Medal from the Medals table to the VALUES area.
- Select Medal from the Medals table again and drag it into the FILTERS area.

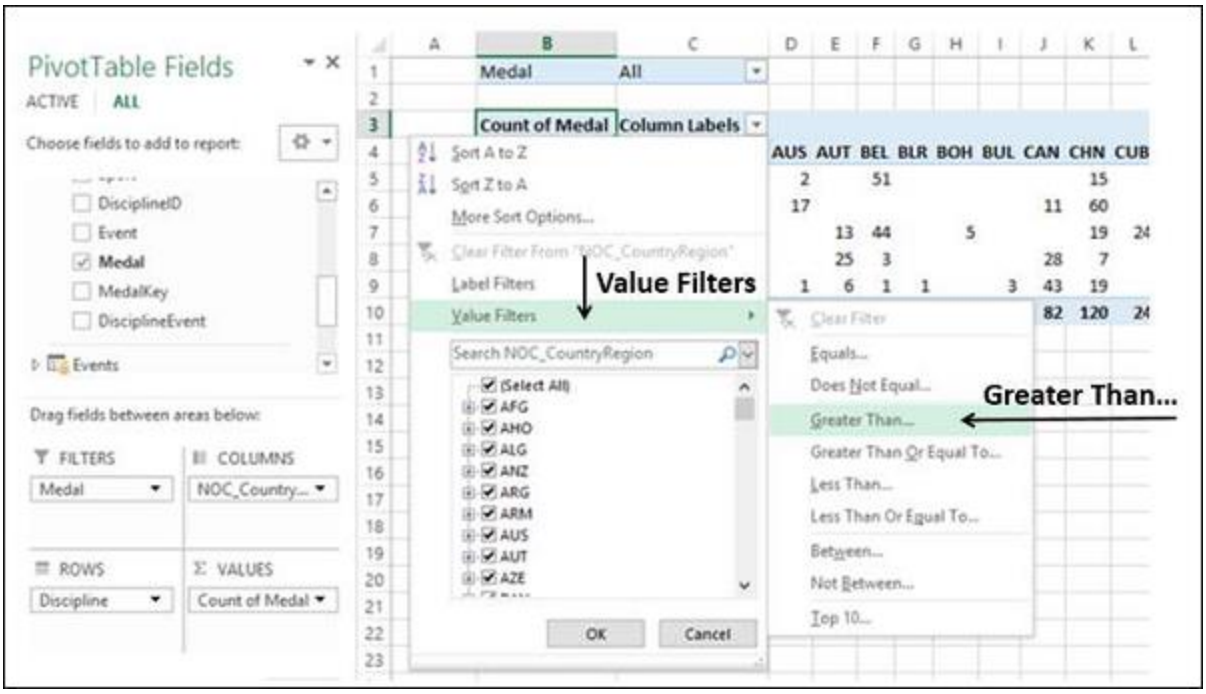
The PivotTable is populated with the added fields and in the chosen layout from the areas.



Exploring Data with PivotTable

You might want to display only those values with Medal Count > 80. To perform this, follow the given steps −

- Click the arrow to the right of Column Labels.
- Select **Value Filters** from the dropdown list.
- Select **Greater Than…**. from the second dropdown list.
- Click OK.



The **Value Filter** dialog box appears. Type 80 in the right-most box and click OK.

The PivotTable displays only those regions with total number of medals more than 80.

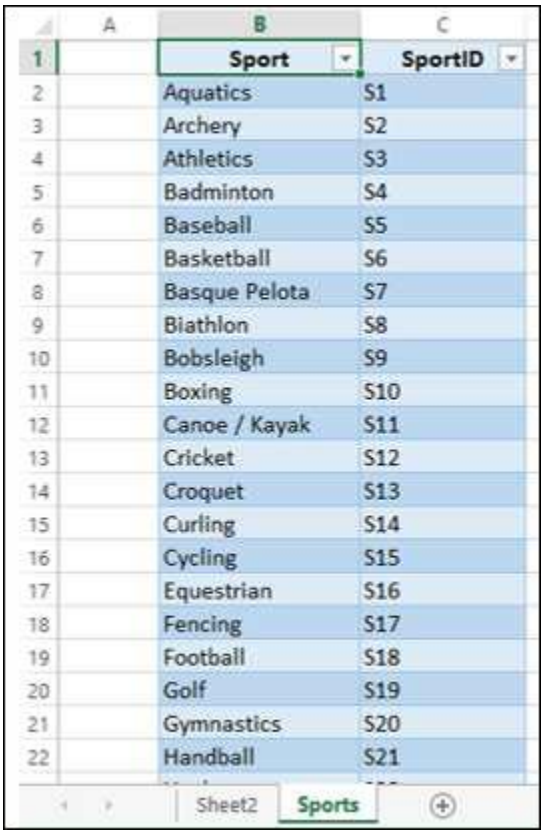
Medal	All															
Count of Medal	Column Labels															
Row Labels	BEL	CAN	CHN	FRA	GER	HUN	ITA	NED	NOR	POL	RUS	URS	USA	Grand Total		
Archery	51		15	46	6		12	9		4	1	7	52	203		
Diving		11	60	1	24		9				24	14	131	274		
Fencing	44		19	283	51	226	328	24		81	41	145	48	1290		
Figure skating	3	28	7	18	11	12	2	3	7		29	42	51	213		
Speed skating	1	43	19		34		7	75	79	2	8	60	73	401		
Grand Total	99	82	120	348	126	238	358	111	86	87	103	268	355	2381		

You could arrive at the specific report that you wanted from the different tables in just few steps. This became possible because of the pre-existing relationships among the tables in the Access database. As you imported all the tables from the database together at the same time, Power Pivot recreated the relationships in its Data Model.

Summarizing Data from Different Sources in Power Pivot

If you get the data tables from different sources or if you do not import the tables from a database at the same time, or if you create new Excel tables in your workbook and add them to the Data Model, you have to create the relationships among the tables that you want to use for your analysis and summarization in the PivotTable.

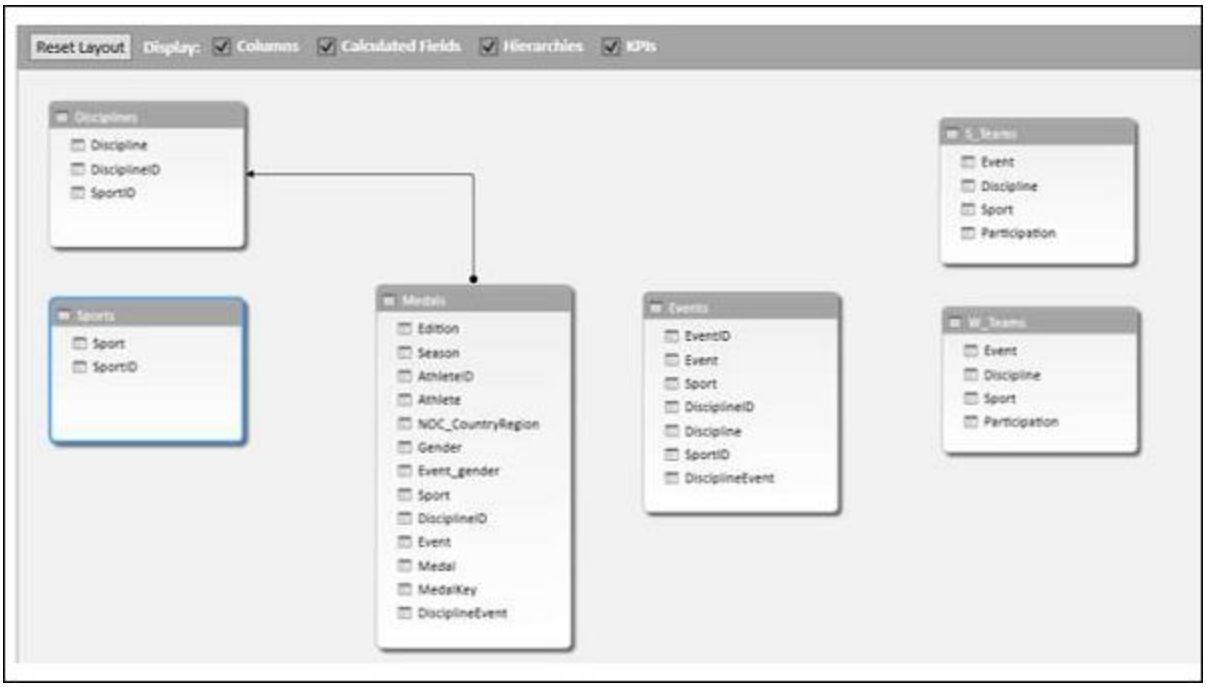
- Create a new worksheet in the workbook.
- Create an Excel table – Sports.



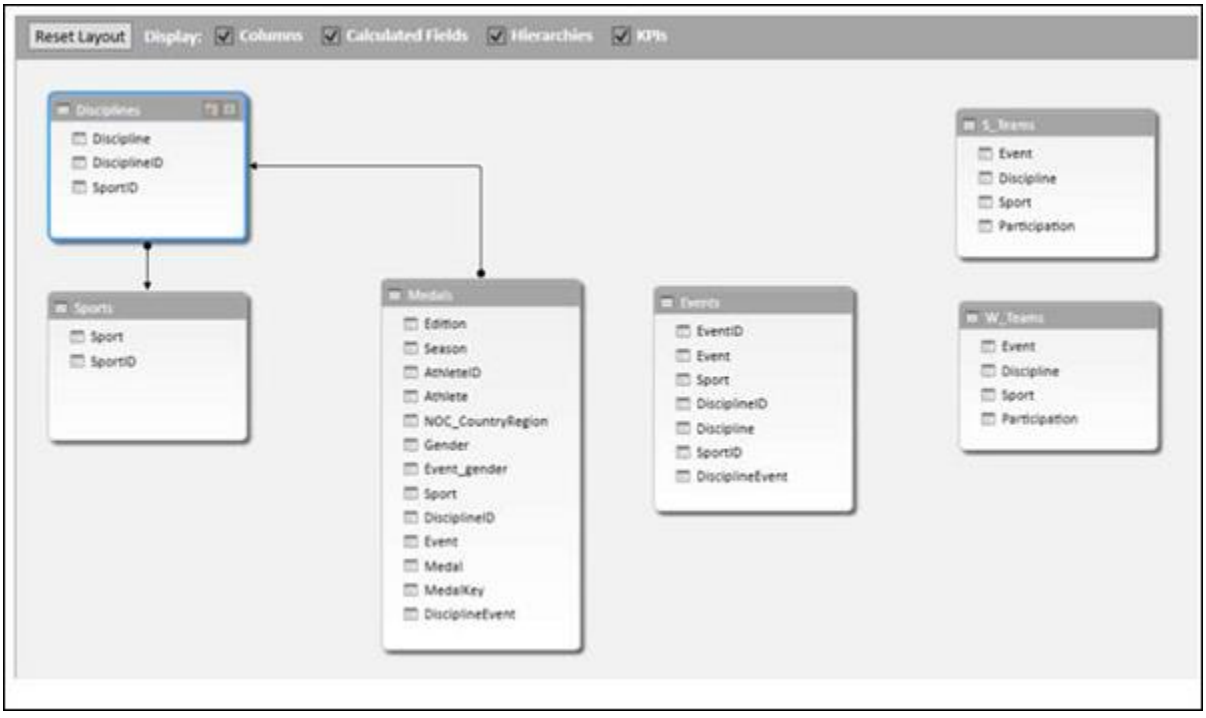
	A	B	C
1		Sport	SportID
2		Aquatics	S1
3		Archery	S2
4		Athletics	S3
5		Badminton	S4
6		Baseball	S5
7		Basketball	S6
8		Basque Pelota	S7
9		Biathlon	S8
10		Bobsleigh	S9
11		Boxing	S10
12		Canoe / Kayak	S11
13		Cricket	S12
14		Croquet	S13
15		Curling	S14
16		Cycling	S15
17		Equestrian	S16
18		Fencing	S17
19		Football	S18
20		Golf	S19
21		Gymnastics	S20
22		Handball	S21

Sheet2 Sports

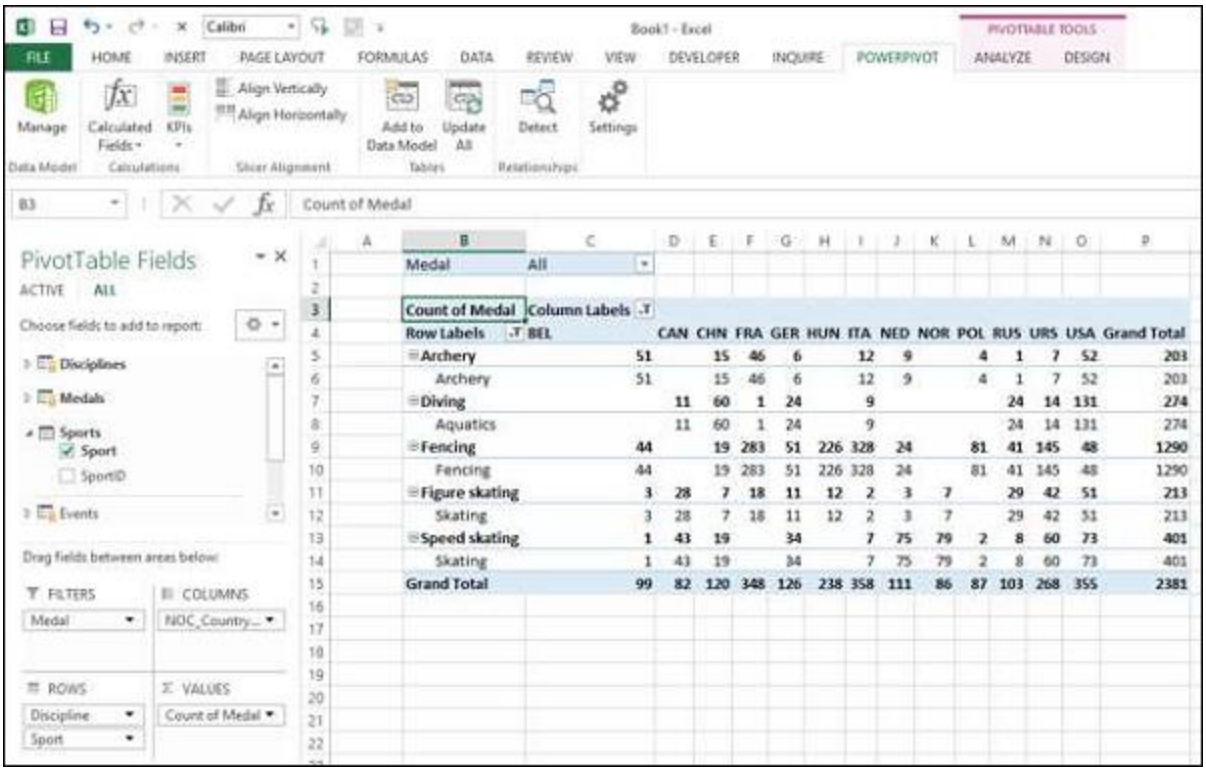
Add Sports table to Data Model.



Create a relationship between the tables **Disciplines and Sports** with the field **SportID**.



Add the field **Sport** to the PivotTable.



Medal	All													
Count of Medal	Column Labels													
Row Labels	BEL	CAN	CHN	FRA	GER	HUN	ITA	NED	NOR	POL	RUS	URS	USA	Grand Total
Archery	51		15	46	6		12	9		4	1	7	52	203
Archery	51		15	46	6		12	9		4	1	7	52	203
Diving		11	60	1	24		9				24	14	131	274
Aquatics		11	60	1	24		9				24	14	131	274
Fencing	44		19	283	51	226	328	24		81	41	145	48	1290
Fencing	44		19	283	51	226	328	24		81	41	145	48	1290
Figure skating	3	28	7	18	11	12	2	3	7		29	42	51	213
Skating	3	28	7	18	11	12	2	3	7		29	42	51	213
Speed skating	1	43	19		34		7	75	79	2	8	60	73	401
Skating	1	43	19		34		7	75	79	2	8	60	73	401
Grand Total	99	82	120	348	126	238	358	111	86	87	103	268	355	2381

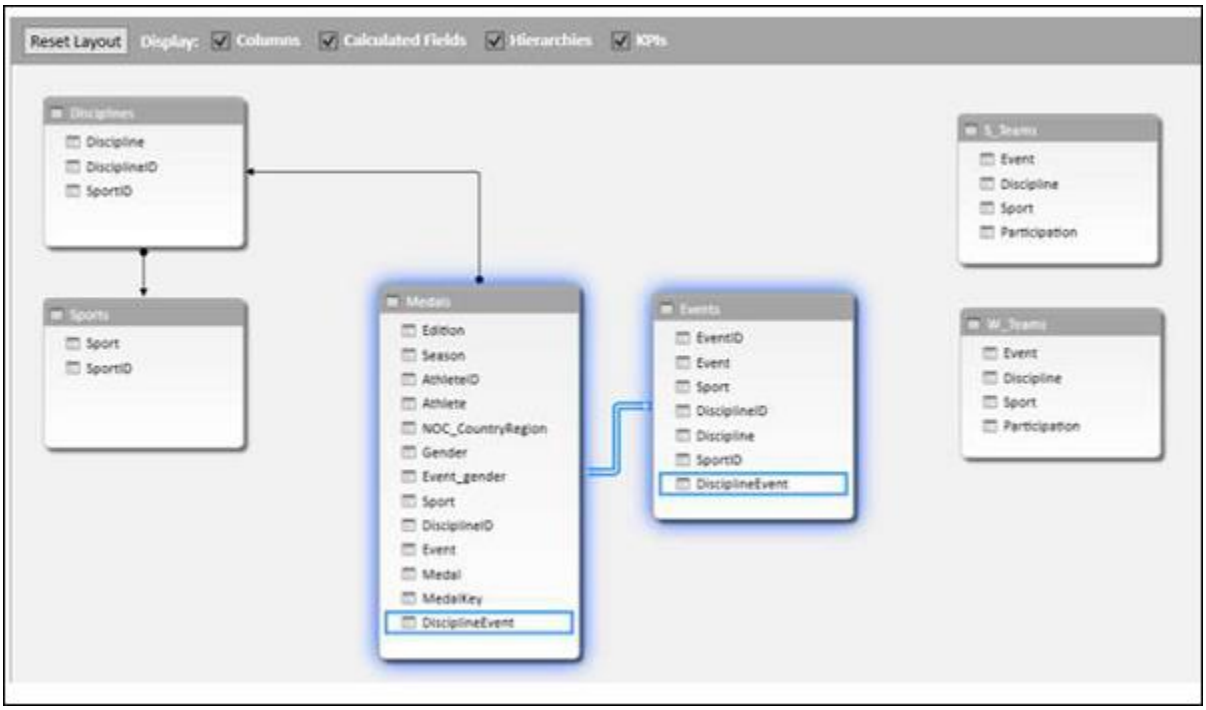
Shuffle the fields - **Discipline and Sport** in the ROWS area.

Medal	All													
Count of Medal	Column Labels													
Row Labels	BEL	CAN	CHN	FRA	GER	HUN	ITA	NED	NOR	POL	RUS	URS	USA	Grand Total
Aquatics		11	60	1	24		9				24	14	131	274
Diving		11	60	1	24		9				24	14	131	274
Archery	51		15	46	6		12	9		4	1	7	52	203
Archery	51		15	46	6		12	9		4	1	7	52	203
Fencing	44		19	283	51	226	328	24		81	41	145	48	1290
Fencing	44		19	283	51	226	328	24		81	41	145	48	1290
Skating	4	71	26	18	45	12	9	78	86	2	37	102	124	614
Figure skating	3	28	7	18	11	12	2	3	7		29	42	51	213
Speed skating	1	43	19		34		7	75	79	2	8	60	73	401
Grand Total	99	82	120	348	126	238	358	111	86	87	103	268	355	2381

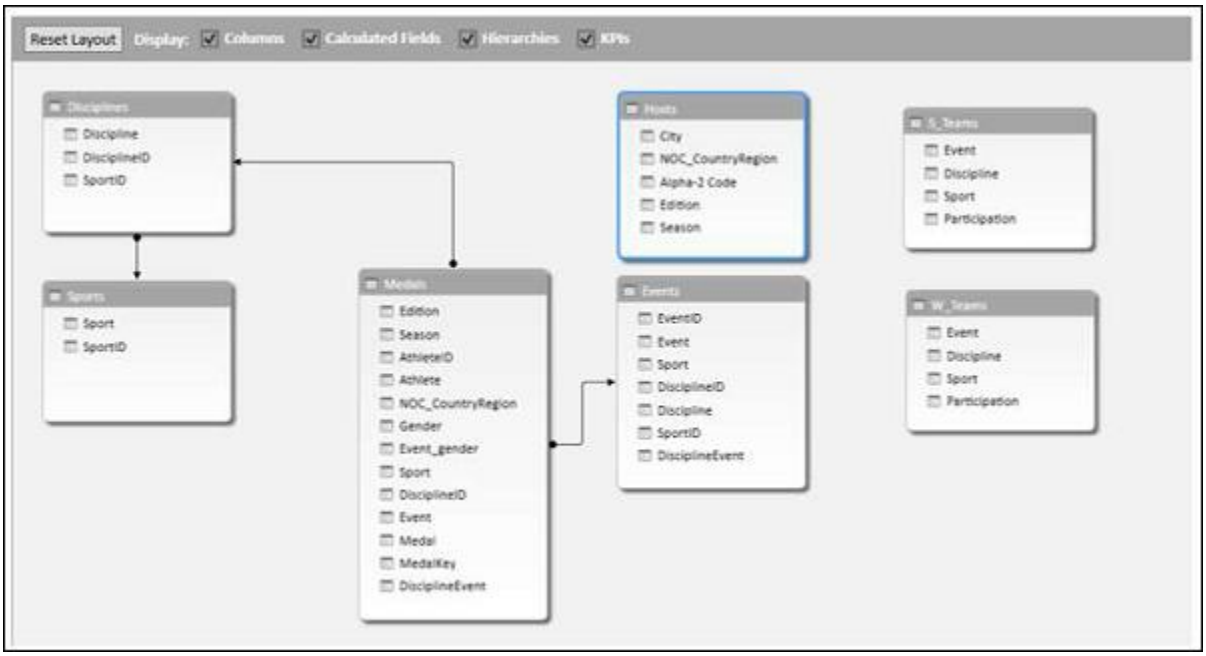
Extending Data Exploration

You can get the table **Events** also into further data exploration.

Create a relationship between the tables- **Events** and **Medals** with the field **DisciplineEvent**.



Add a table **Hosts** to the workbook and Data Model.

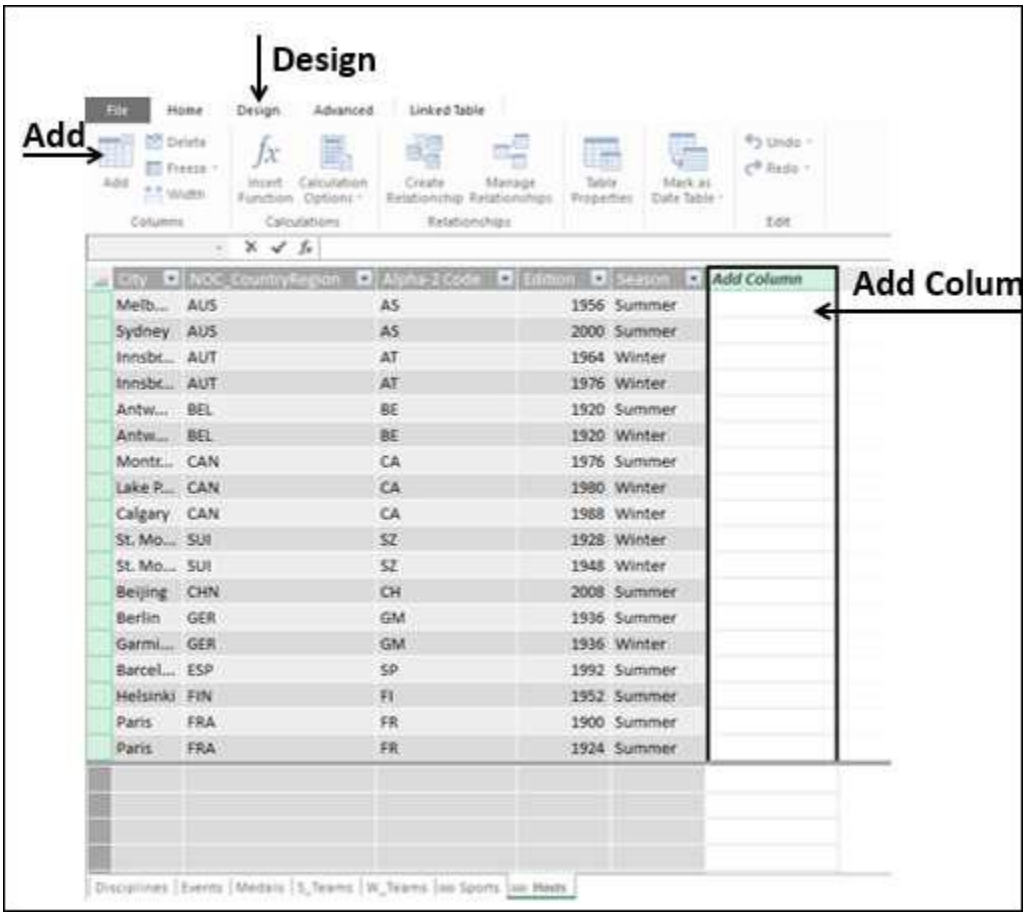


Extending the Data Model using Calculated Columns

To connect Hosts table to any of the other tables, it should have a field with values that uniquely identify each row in the Hosts table. As no such field exists in the Host table, you can create a calculated column in the Hosts table so that it contains unique values.

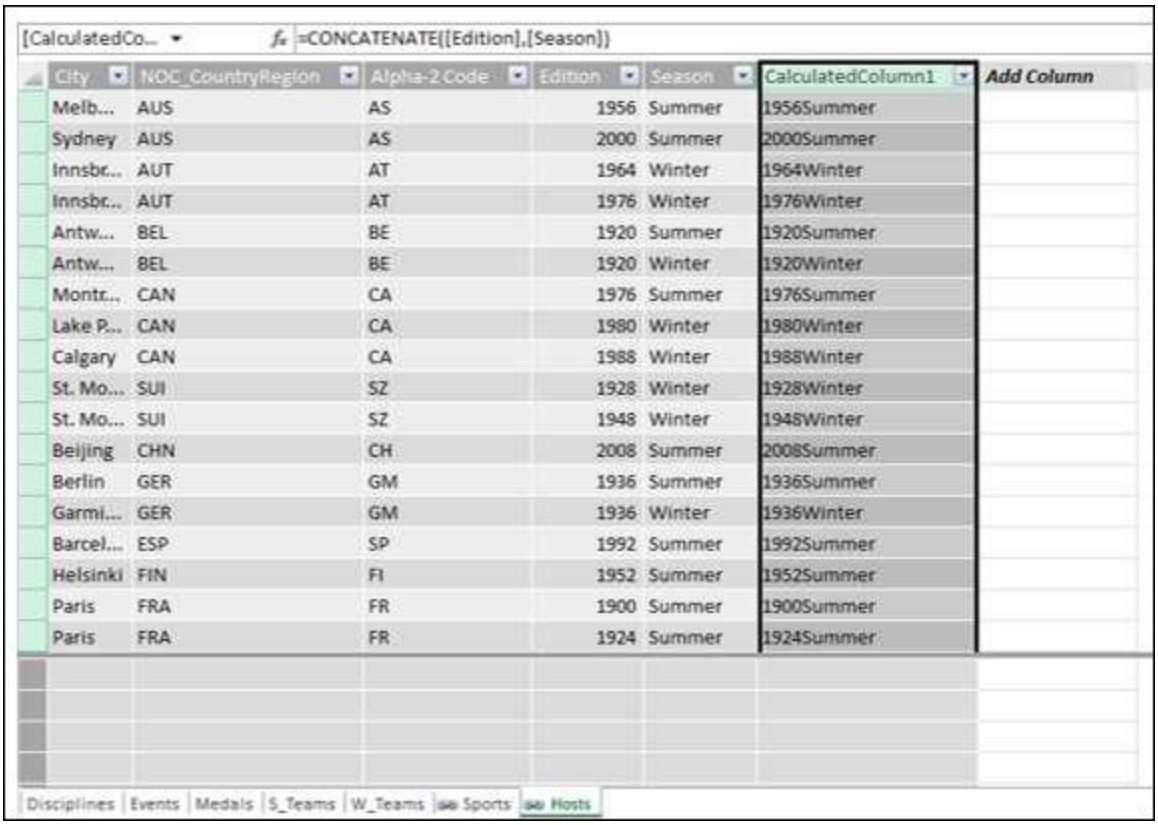
- Go to the Hosts table in Data View of the PowerPivot window.
- Click the Design tab on the Ribbon.
- Click Add.

The right-most column with the header Add Column is highlighted.

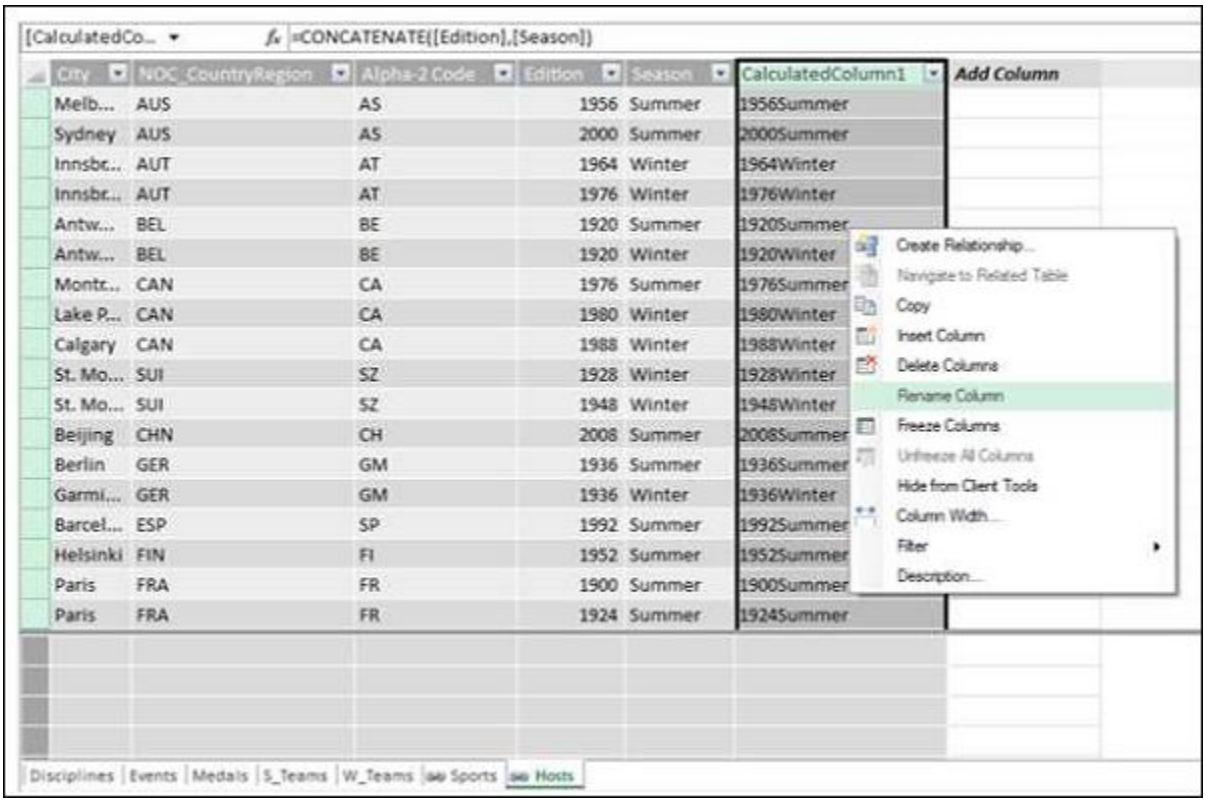


- Type the following DAX formula in the formula bar = **CONCATENATE ([Edition], [Season])**
- Press Enter.

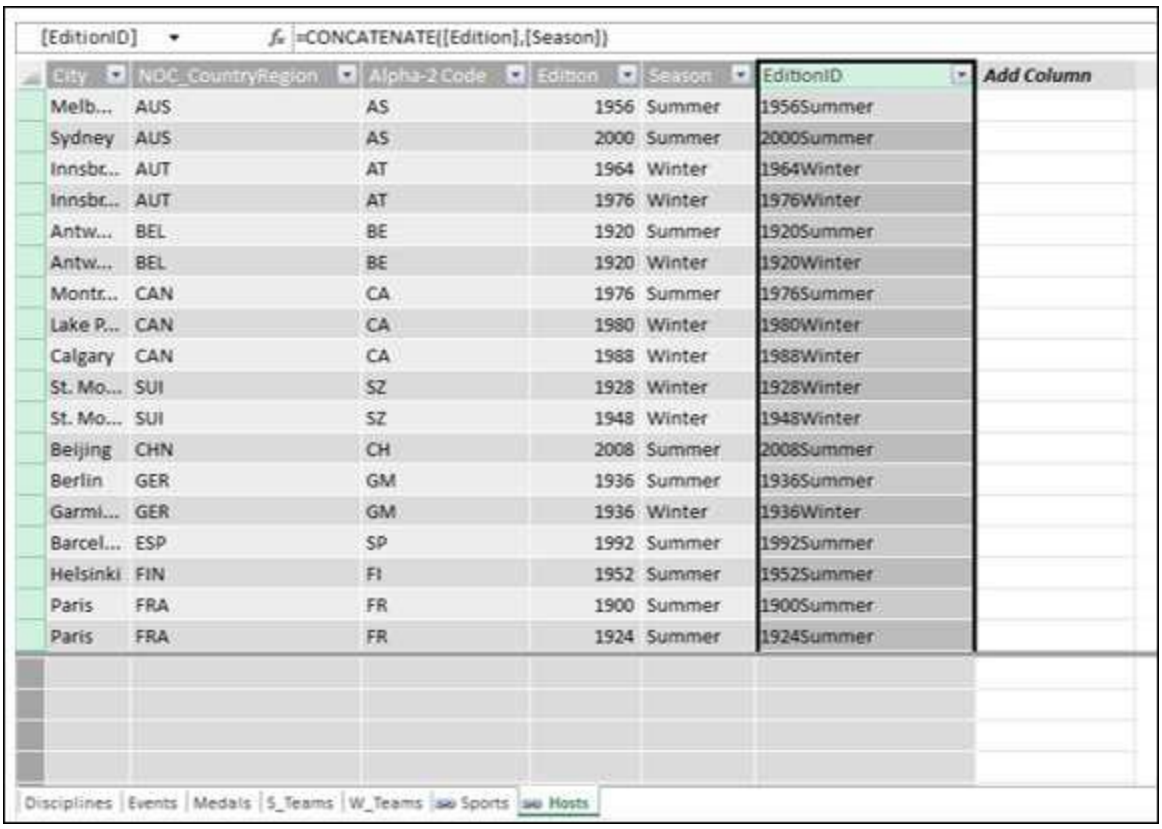
A new column is created with the header **CalculatedColumn1** and the column is filled by the values resulting from the above DAX formula.



Right-click on the new column and select Rename Column from the dropdown list.



Type **EditionID** in the header of the new column.



As you can see, the column **EditionID** has unique values in the Hosts table.

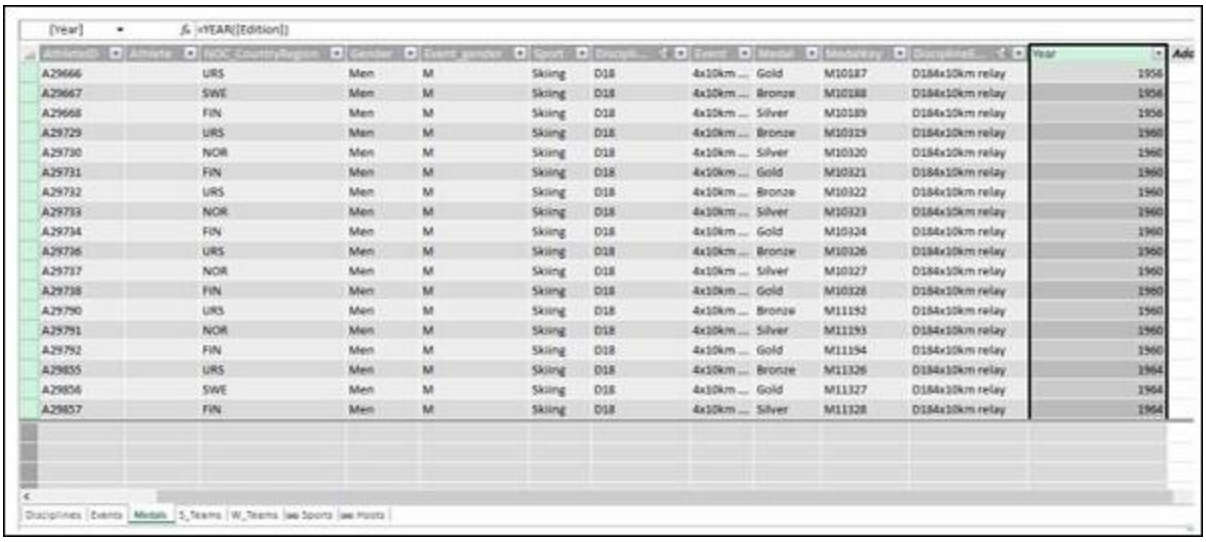
Creating a Relationship Using Calculated Columns

If you have to create a relationship between the **Hosts** table and the **Medals** table, the column **EditionID** should exist in the Medals table also. Create a calculated column in Medals table as follows:

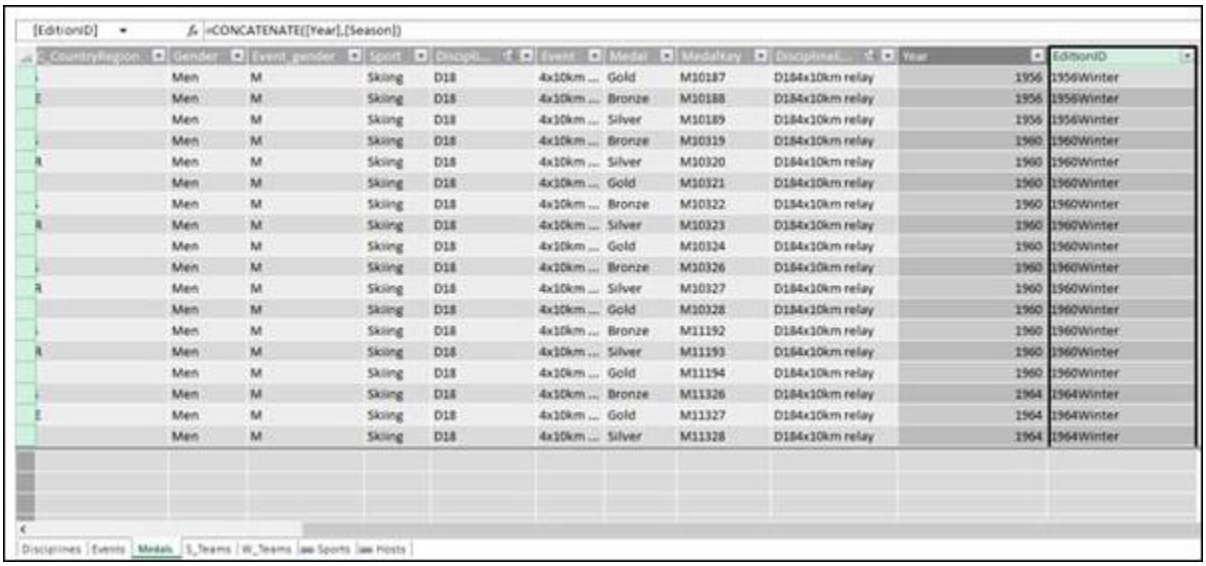
- Click on the Medals table in the Data View of Power Pivot.
- Click the Design tab on the Ribbon.
- Click Add.

Type the DAX formula in the formula bar = **YEAR ([EDITION])** and press Enter.

Rename the new column that is created as Year and click **Add**.

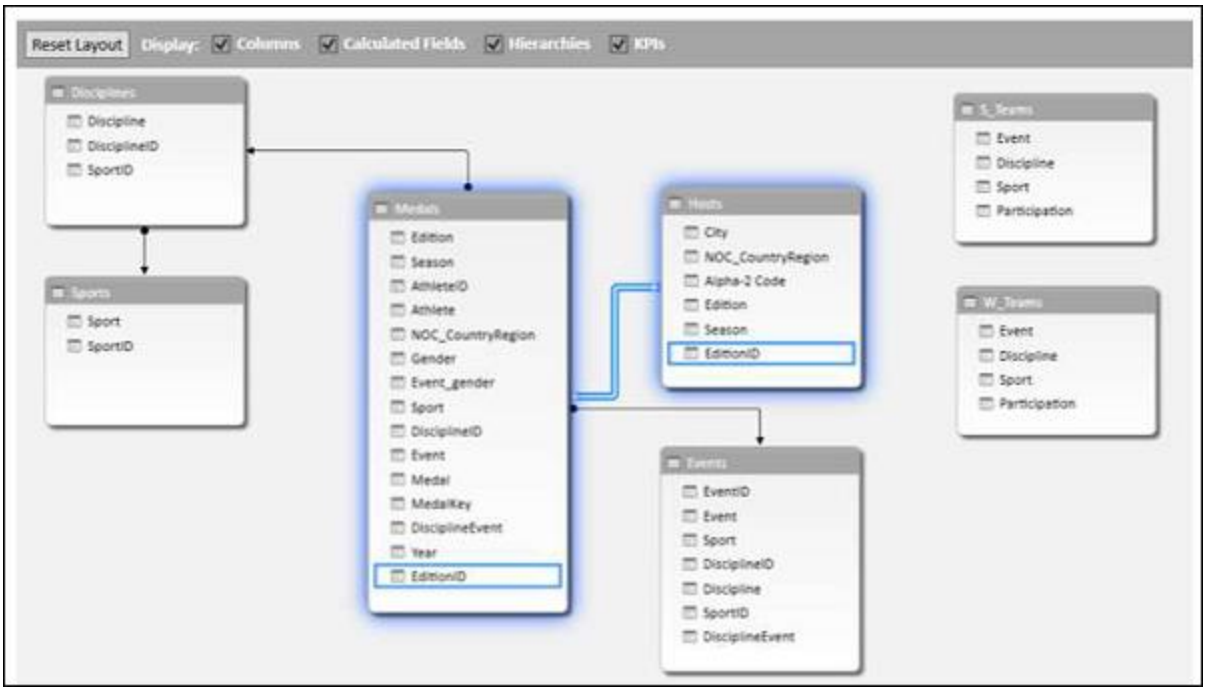


- Type the following DAX formula in the formula bar = **CONCATENATE ([Year], [Season])**
- Rename the new column that is created as **EditionID**.



As you can observe, the EditionID column in the Medals table has identical values as the EditionID column in the Hosts table. Therefore, you can create a relationship between the tables – Medals and Sports with the EditionID field.

- Switch to the diagram view in PowerPivot window.
- Create a relationship between the tables- Medals and Hosts with the field that is obtained from the calculated column i.e. **EditionID**.

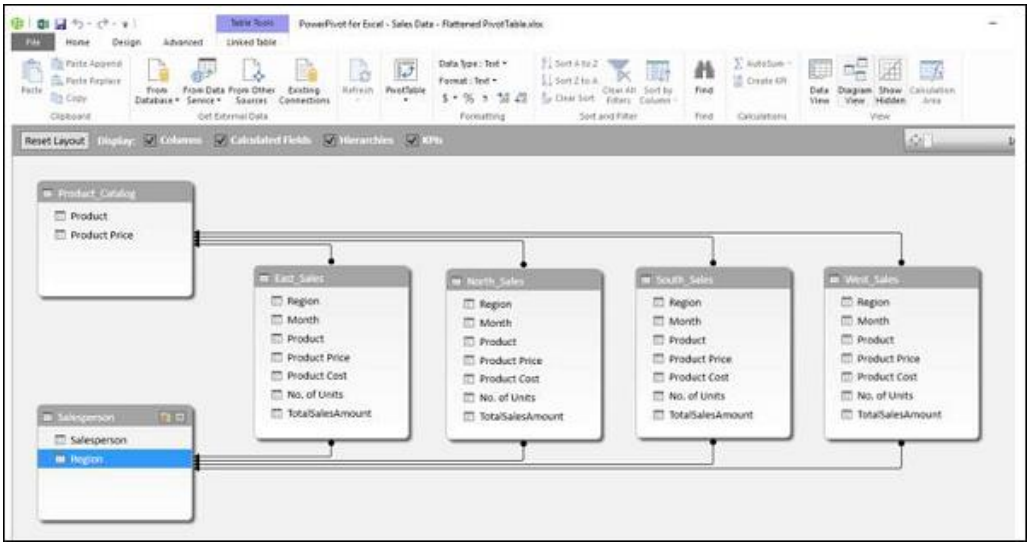


Now you can add fields from Hosts table to Power PivotTable.

Flattened

When the data has many levels, sometimes it becomes cumbersome to read the PivotTable report.

For example, consider the following Data Model.

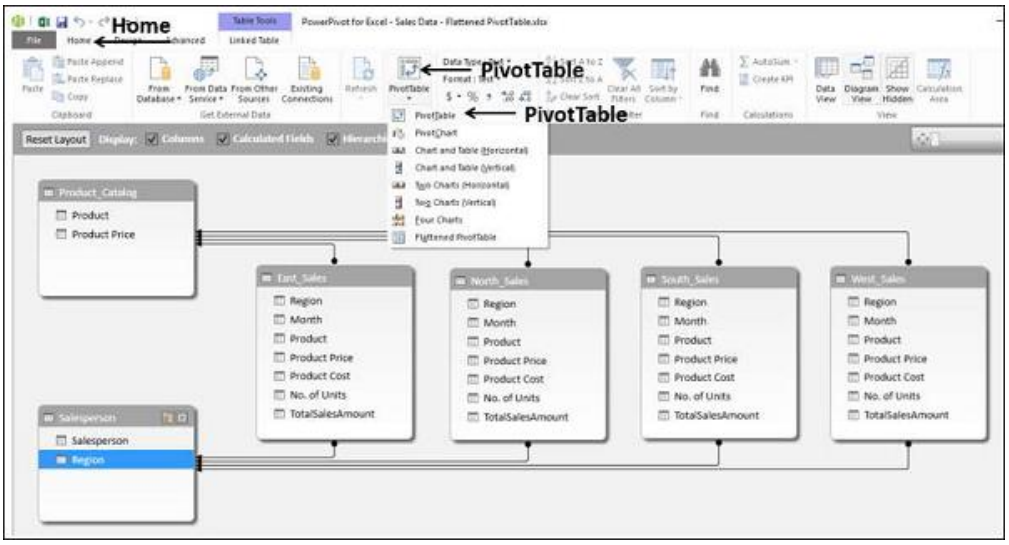


We will create a Power PivotTable and a Power Flattened PivotTable to get an understanding of the layouts.

Creating a PivotTable

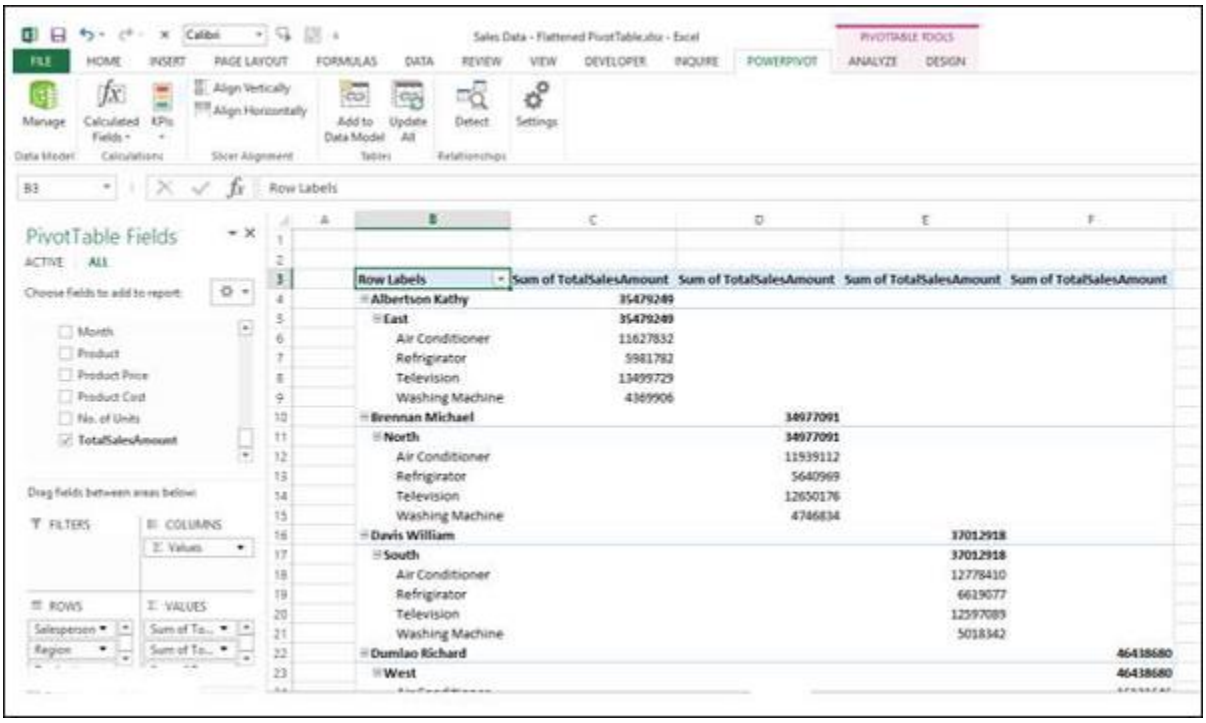
You can create a Power PivotTable as follows:

- Click the Home tab on the Ribbon in the PowerPivot window.
- Click PivotTable.
- Select PivotTable from the dropdown list.



An empty PivotTable will be created.

- Drag the fields − Salesperson, Region and Product from the PivotTable Fields list to the ROWS area.
- Drag the field − **TotalSalesAmount** from the Tables − East, North, South and West to the ∑ VALUES area.



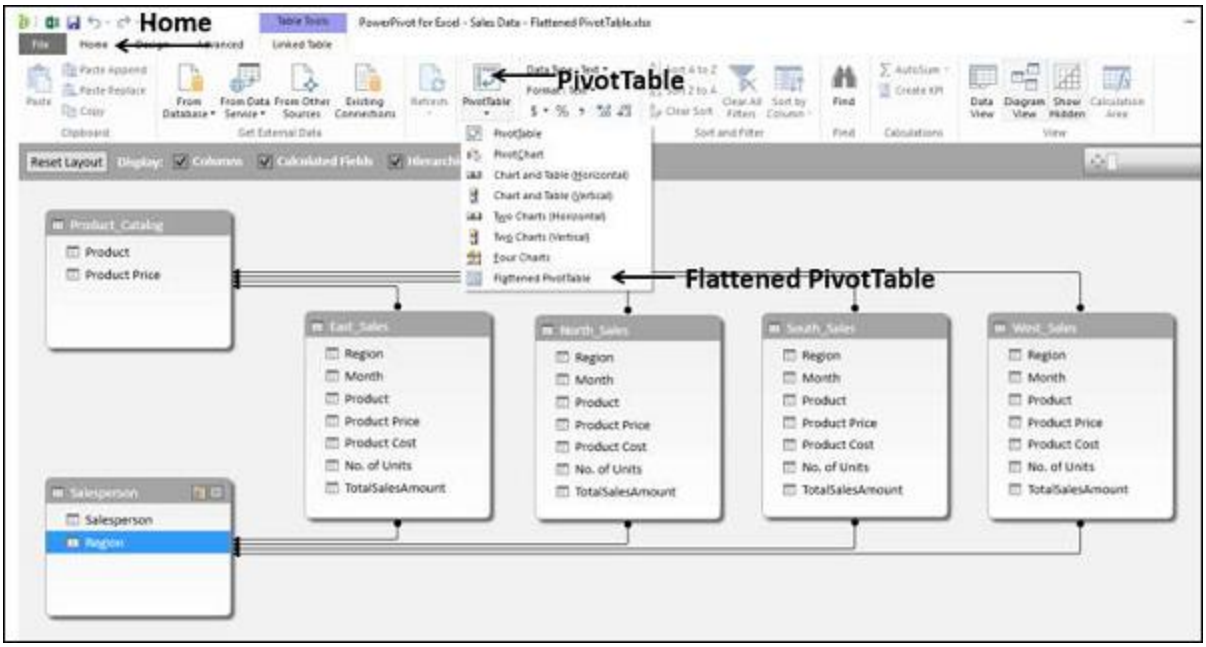
As you can see, it is a bit cumbersome read such a report. If the number of entries becomes more, the more difficult it will be.

Power Pivot provides a solution for a better representation of data with Flattened PivotTable.

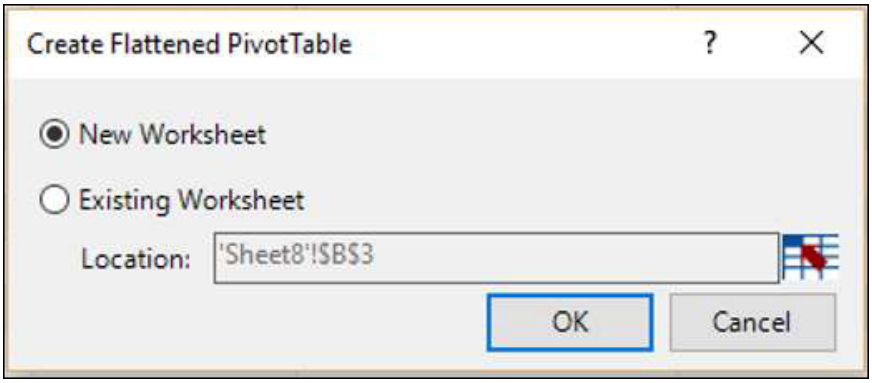
Creating a Flattened PivotTable

You can create a Power Flattened PivotTable as follows:

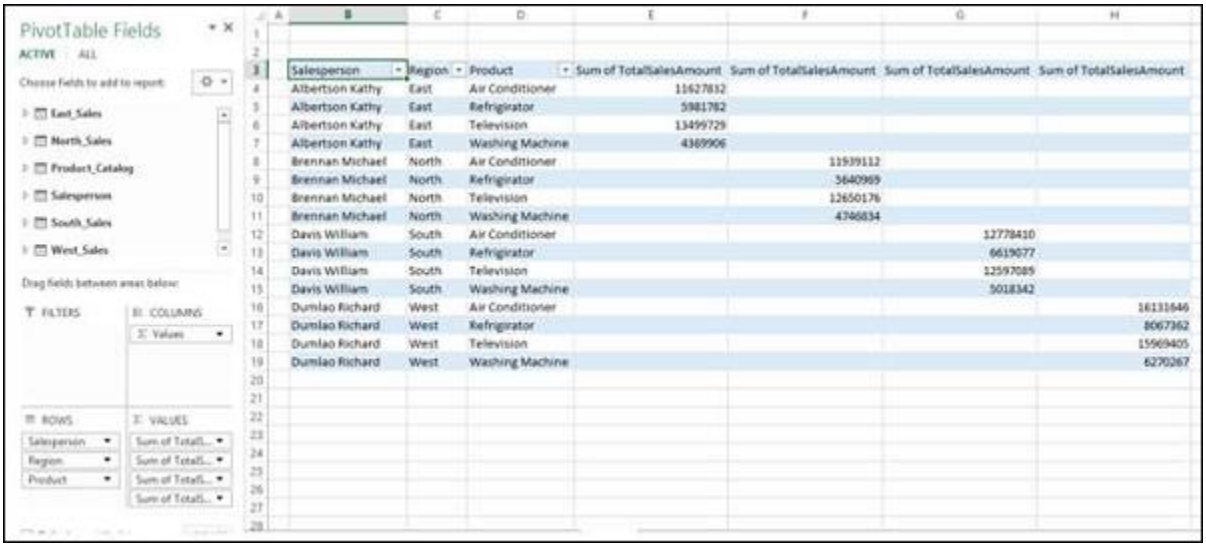
- Click the Home tab on the Ribbon in the PowerPivot window.
- Click PivotTable.
- Select **Flattened PivotTable** from the dropdown list.



Create Flattened PivotTable dialog box appears. Select New Worksheet and click OK.



As you can observe the data is flattened out in this PivotTable.

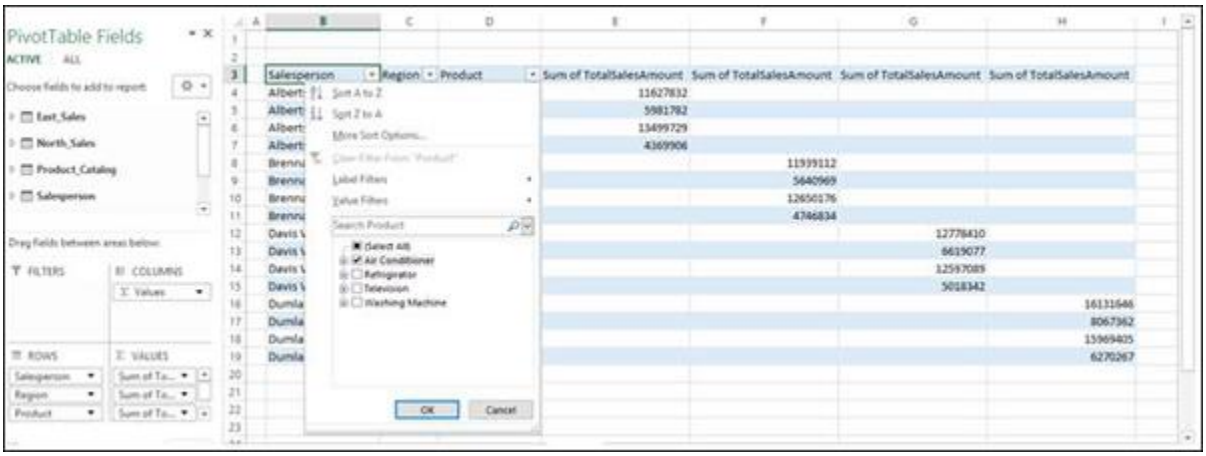


Note − In this case Salesperson, Region and Product are in ROWS area only as in the previous case. However, in the PivotTable layout, these three fields are appearing as three columns.

Exploring Data in Flattened PivotTable

Suppose you want to summarize the sales data for the product − Air Conditioner. You can do it in a simple way with the Flattened PivotTable as follows:

- Click the arrow next to the column header − Product.
- Check the box Air Conditioner and uncheck the other boxes. Click OK.



The Flattened PivotTable is filtered to the Air Conditioner sales data.

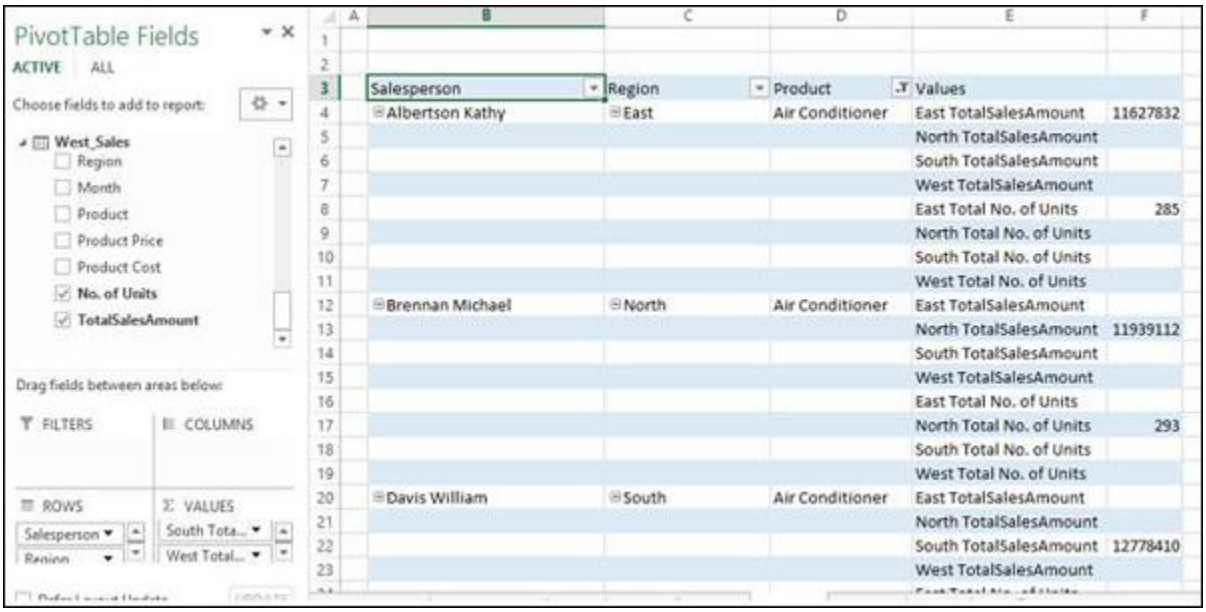
You can make it look more flattened by dragging ∑ **VALUES** to ROWS area from the COLUMNS area.

Rename the custom names of the summation values in the ∑ **VALUES** area to make them more meaningful as follows:

- Click on a summation value, say, Sum of TotalSalesAmount for East.
- Select Value Field Settings from the dropdown list.
- Change the Custom Name to East TotalSalesAmount.
- Repeat the steps for the other three summation values.

You can also summarize the number of units sold.

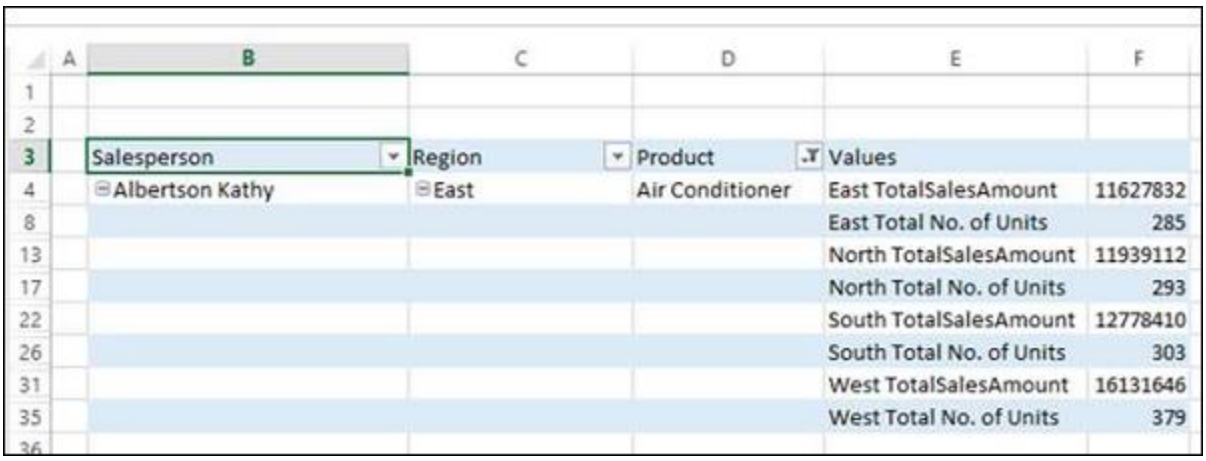
- Drag No. of Units to the ∑ VALUES area from each of the tables − East_Sales, North_Sales, South_Sales and West_Sales.
- Rename the values to East Total No. of Units, North Total No. of Units, South Total No. of Units and West Total No. of Units respectively.



As you can observe, in both of the above tables, there are rows with empty values, as each salesperson represents a single region and each region is represented only by a single salesperson.

- Select the rows with empty values.
- Right click and click on Hide in the dropdown list.

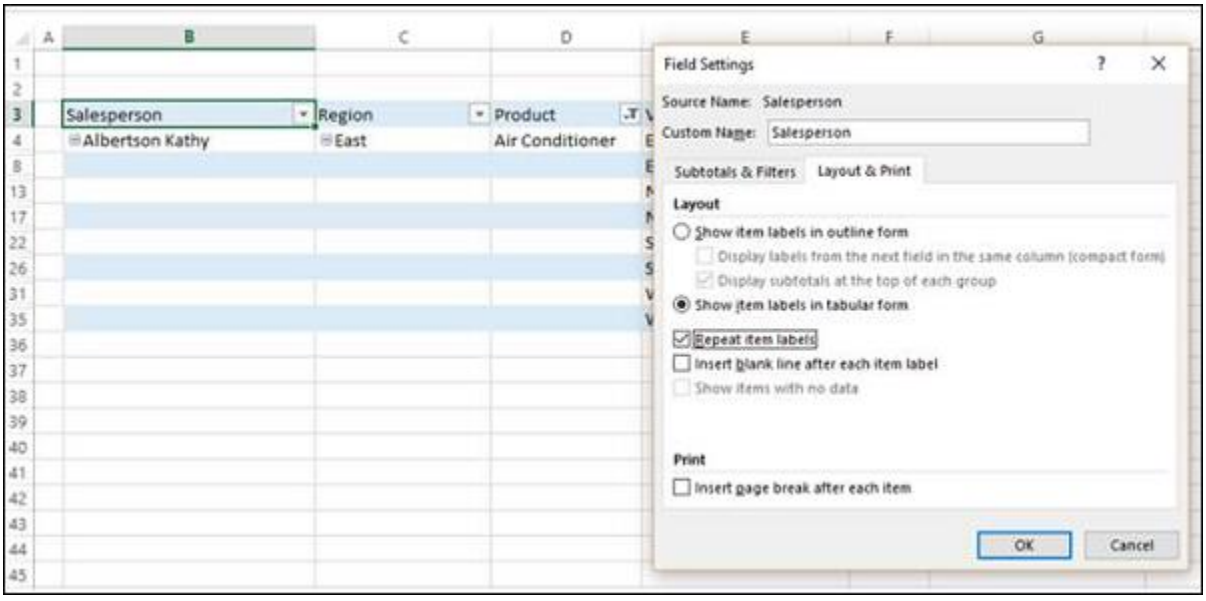
All the rows with empty values will be hidden.



Salesperson	Region	Product	Values	
Albertson Kathy	East	Air Conditioner	East TotalSalesAmount	11627832
			East Total No. of Units	285
			North TotalSalesAmount	11939112
			North Total No. of Units	293
			South TotalSalesAmount	12778410
			South Total No. of Units	303
			West TotalSalesAmount	16131646
			West Total No. of Units	379

As you can observe, though the rows with empty values are not displayed, the information on the Salesperson also got hidden.

- Click on the column header − Salesperson.
- Click the ANALYZE tab on the Ribbon.
- Click Field Settings. The Field Settings dialog box appears.
- Click the Layout & Print tab.
- Check the box - **Repeat Item Labels**.
- Click OK.



As you can observe, the Salesperson information is displayed and the rows with empty values are hidden. Further, the column Region in the report is redundant, as the values in the Values column are self-explanatory.

	A	B	C	D	E	F
1						
2						
3		Salesperson	Region	Product	Values	
4		Albertson Kathy	East	Air Conditioner	East TotalSalesAmount	11627832
8		Albertson Kathy			East Total No. of Units	285
13		Brennan Michael			North TotalSalesAmount	11939112
17		Brennan Michael			North Total No. of Units	293
22		Davis William			South TotalSalesAmount	12778410
26		Davis William			South Total No. of Units	303
31		Dumlao Richard			West TotalSalesAmount	16131646
35		Dumlao Richard			West Total No. of Units	379
36						

Drag the field Regions out of Area.

	A	B	C	D	E
1					
2					
3		Salesperson	Product	Values	
4		Albertson Kathy	Air Conditioner	East TotalSalesAmount	11627832
8		Albertson Kathy		East Total No. of Units	285
13		Brennan Michael		North TotalSalesAmount	11939112
17		Brennan Michael		North Total No. of Units	293
22		Davis William		South TotalSalesAmount	12778410
26		Davis William		South Total No. of Units	303
31		Dumlao Richard		West TotalSalesAmount	16131646
35		Dumlao Richard		West Total No. of Units	379
36					

Reverse the order of the fields − Salesperson and Product in the ROWS area.

	A	B	C	D	E
1					
2					
3		Product	Salesperson	Values	
4		Air Conditioner	Albertson Kathy	East TotalSalesAmount	11627832
8			Albertson Kathy	East Total No. of Units	285
13			Brennan Michael	North TotalSalesAmount	11939112
17			Brennan Michael	North Total No. of Units	293
22			Davis William	South TotalSalesAmount	12778410
26			Davis William	South Total No. of Units	303
31			Dumlao Richard	West TotalSalesAmount	16131646
35			Dumlao Richard	West Total No. of Units	379
36					

You have arrived at a concise report combining data from six tables in the Power Pivot.

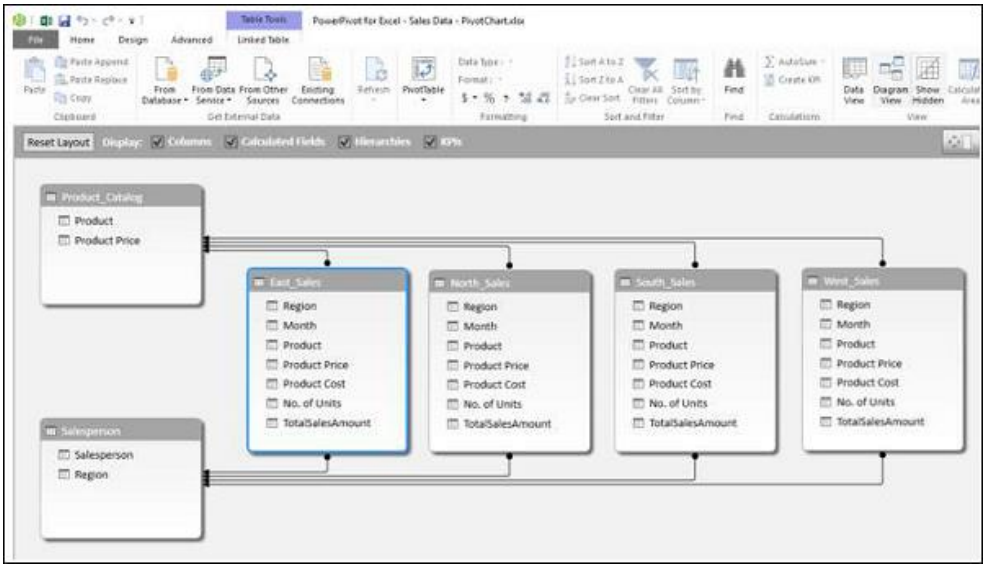
PivotChart Creation

A PivotChart based on Data Model and created from the Power Pivot window is a Power PivotChart. Though it has some features similar to Excel PivotChart, there are other features that make it more powerful.

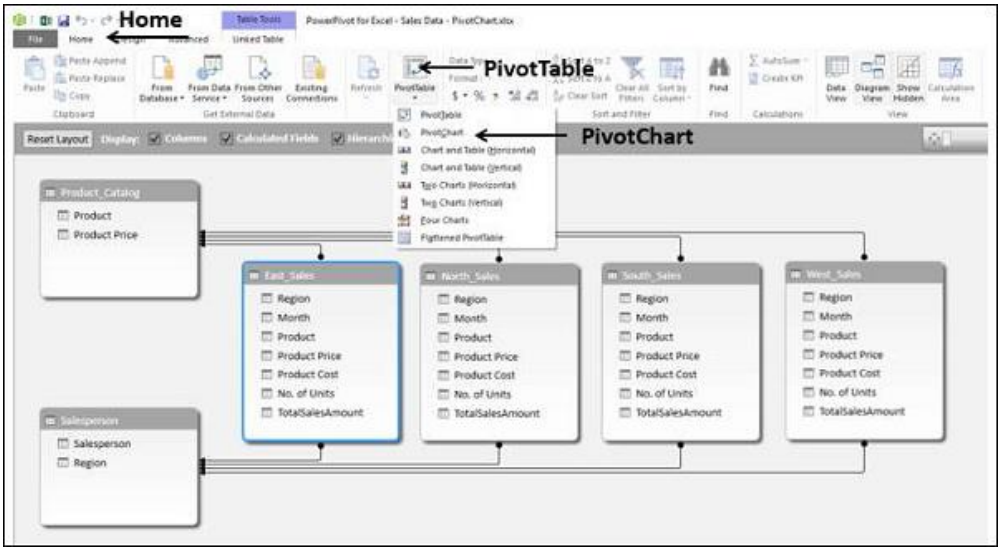
In this module, you will learn about Power PivotCharts. Henceforth we refer to them as PivotCharts, for simplicity.

Creating a PivotChart

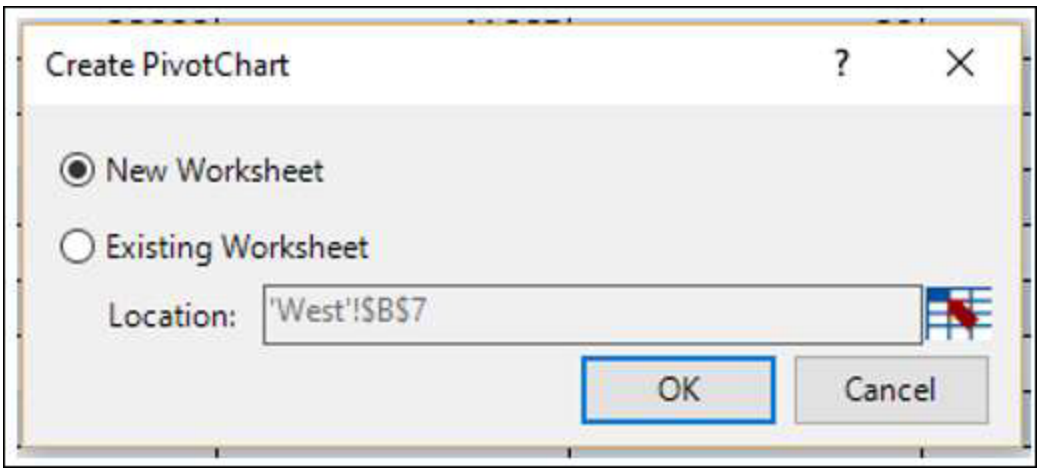
Suppose you want to create a PivotChart based on the following Data Model.



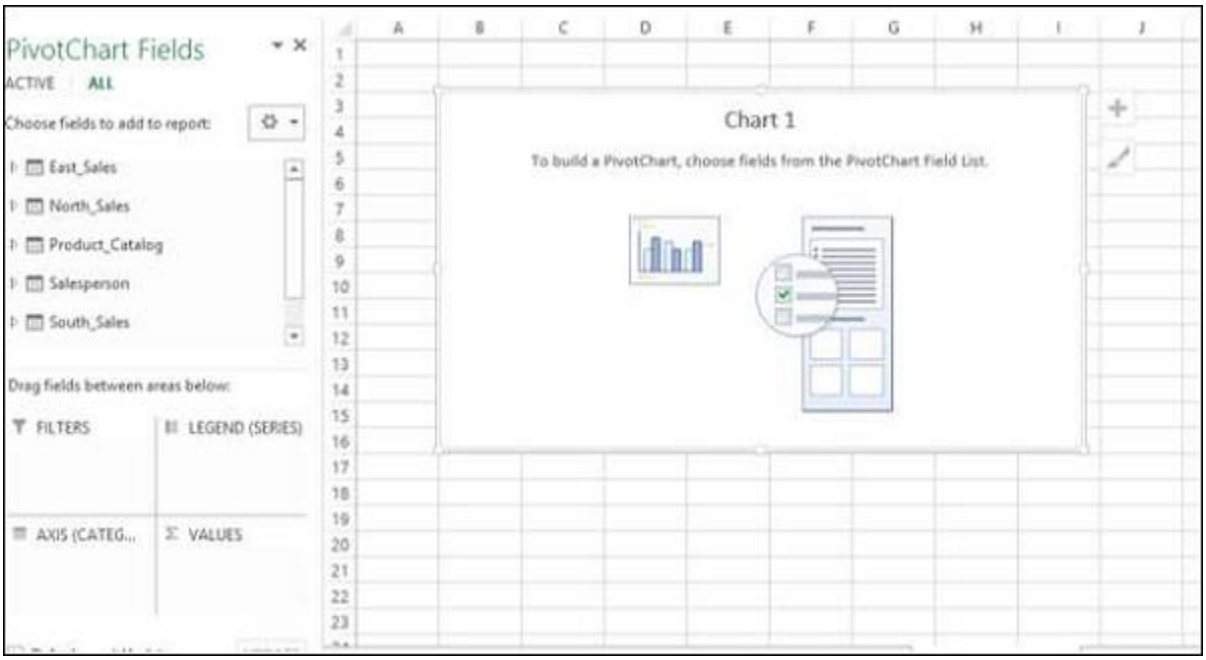
- Click the Home tab on the Ribbon in Power Pivot window.
- Click PivotTable.
- Select PivotChart from the dropdown list.



The **Create PivotChart** dialog box appears. Select New Worksheet and click OK.



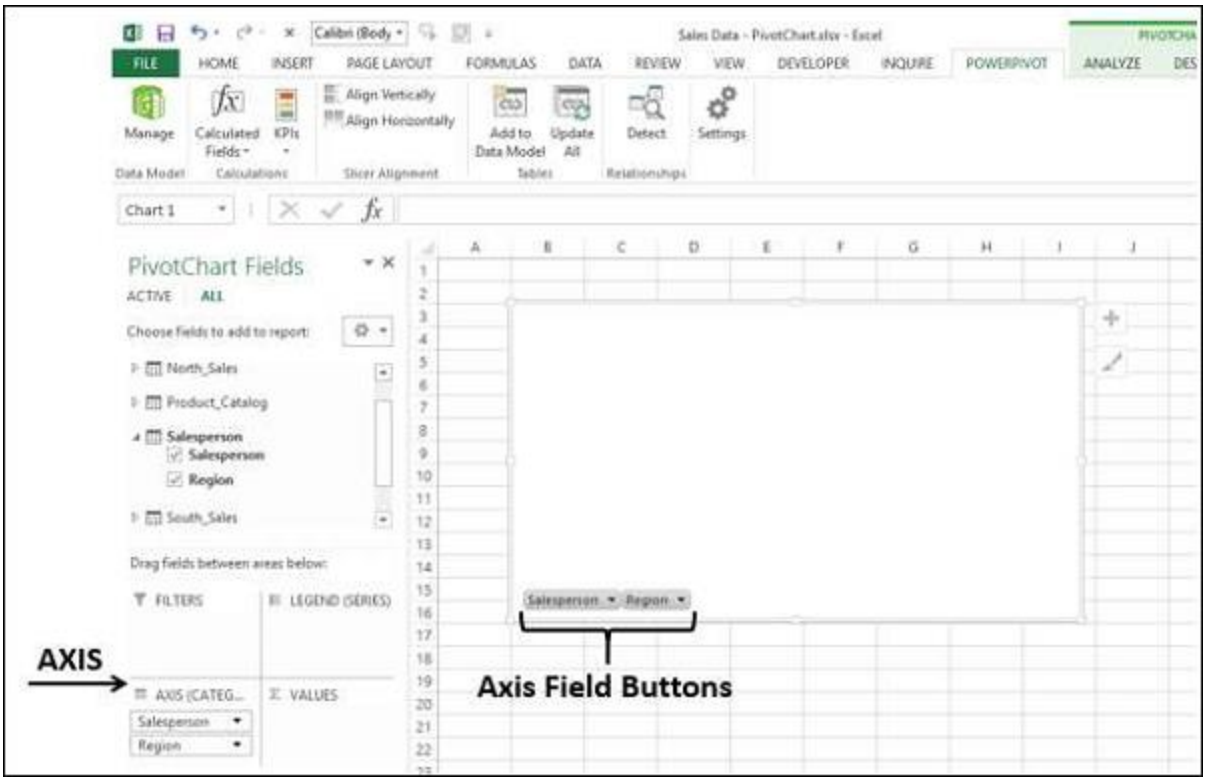
An empty PivotChart is created on a new worksheet in the Excel window.



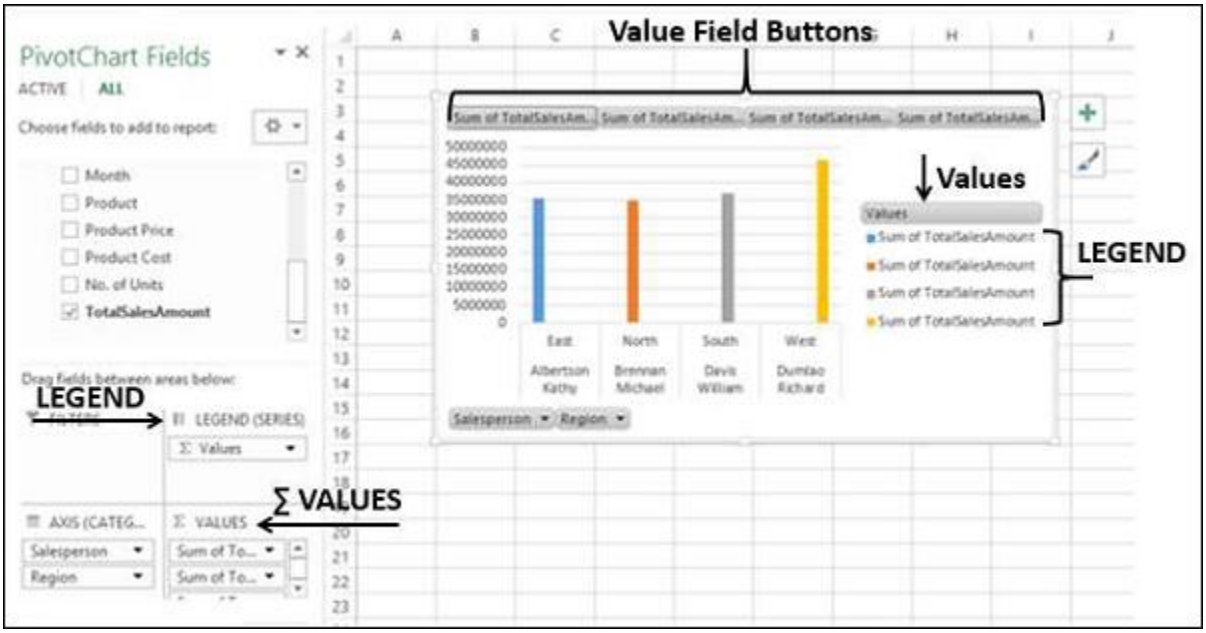
As you can observe, all the tables in the data model are displayed in the PivotChart Fields list.

- Click on the Salesperson table in the PivotChart Fields list.
- Drag the fields − Salesperson and Region to AXIS area.

Two field buttons for the two selected fields appear on the PivotChart. These are the Axis field buttons. The use of field buttons is to filter data that is displayed on the PivotChart.



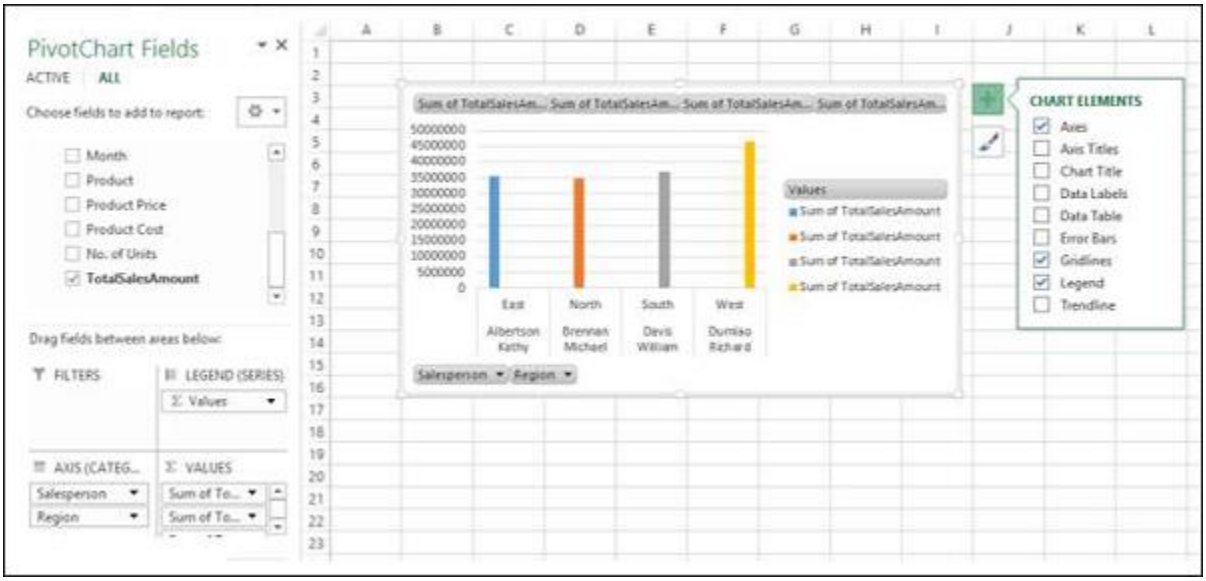
Drag **TotalSalesAmount** from each of the four tables– East_Sales, North_Sales, South_Sales and West_Sales to ∑ VALUES area.



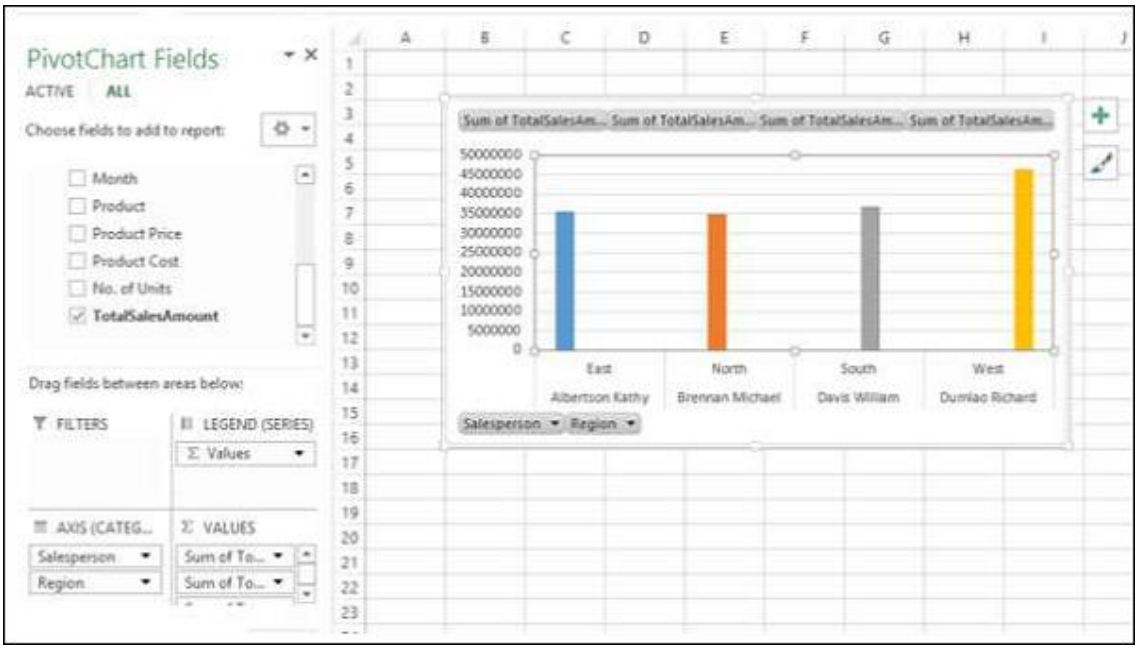
The following appear on the worksheet −

- In the PivotChart, column chart is displayed by default.
- In the LEGEND area, ∑ VALUES are added.

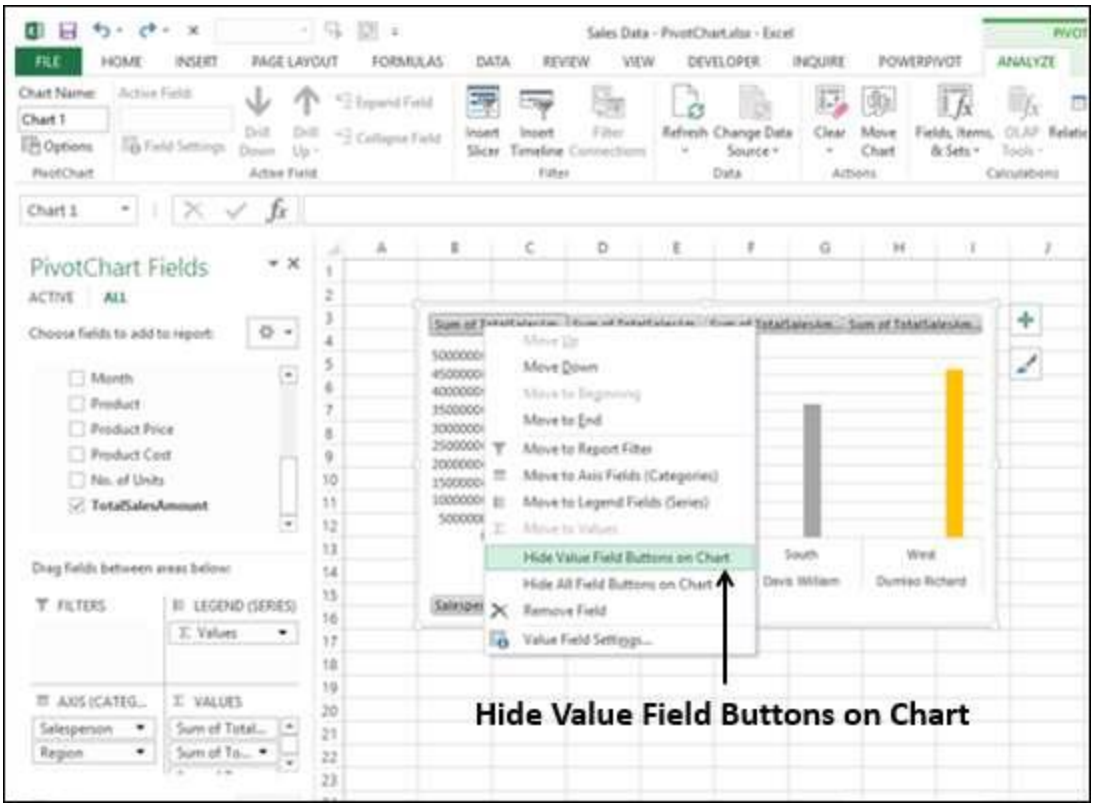
- The Values appear in the Legend in the PivotChart, with title Values.
- The Value Field Buttons appear on the PivotChart. You can remove the legend and the value field buttons for a tidier look of the PivotChart.
- Click on the  button at the top right corner of the PivotChart. The **Chart Elements** dropdown list appears.



Uncheck the box Legend in the Chart Elements list. The Legend is removed from the PivotChart.

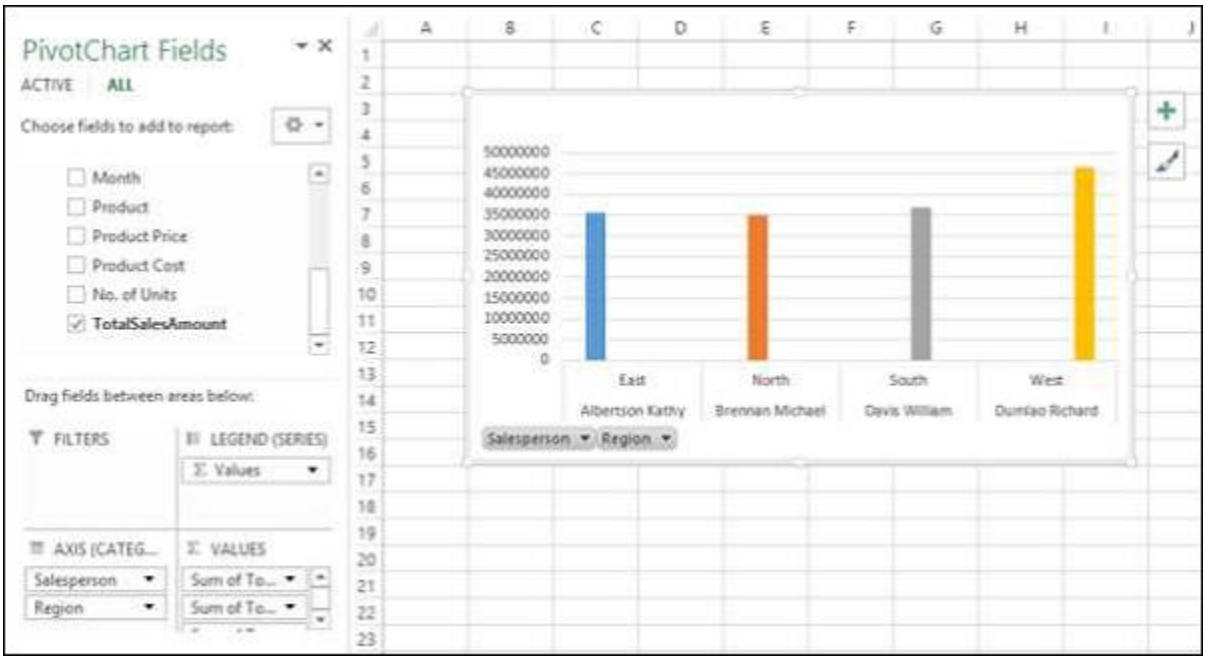


- Right click on the value field buttons.
- Select Hide Value Field Buttons on Chart from the dropdown list.



The value field buttons on the chart are removed.

Note − The display of field buttons and/or legend depends on the context of the PivotChart. You need to decide what is required to be displayed.



PivotChart Fields List

As in the case of Power PivotTable, Power PivotChart Fields list also contains two tabs – ACTIVE and ALL. Under the ALL tab, all the data tables in the Power Pivot Data Model are displayed. Under the ACTIVE tab, the tables from which the fields are added to PivotChart are displayed.

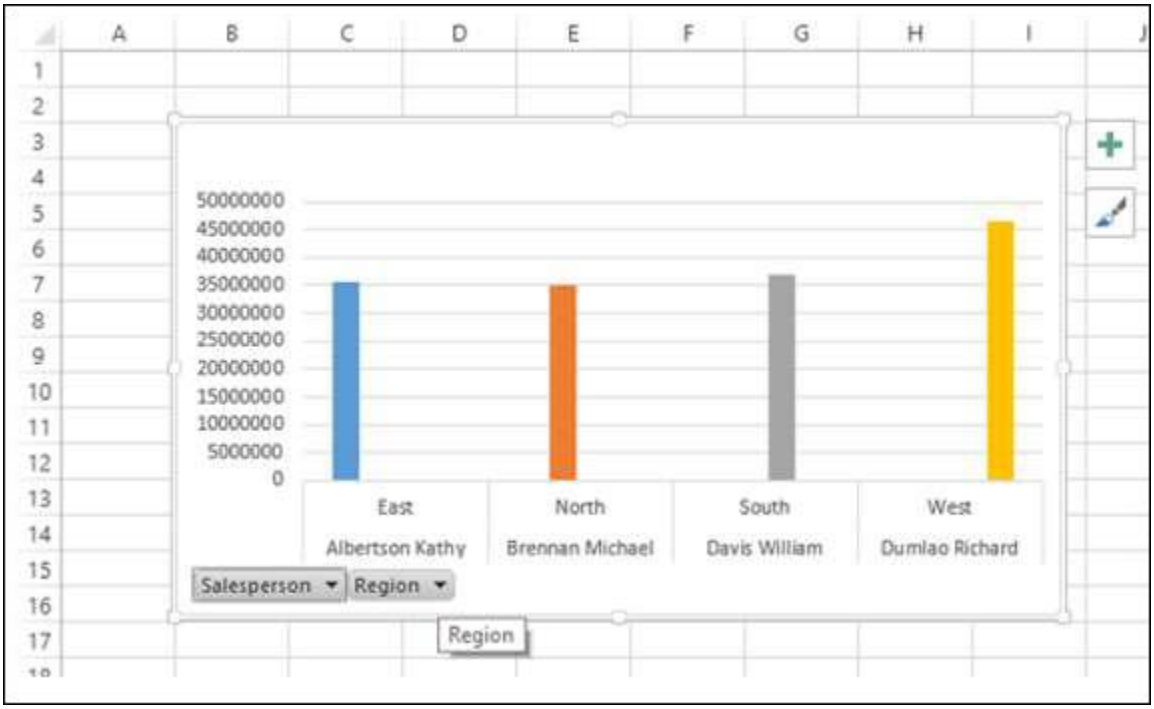
Likewise, the areas are as in the case of Excel PivotChart. There four areas are −

- **AXIS (Categories)**
- **LEGEND (Series)**
- **∑ VALUES**
- **FILTERS**

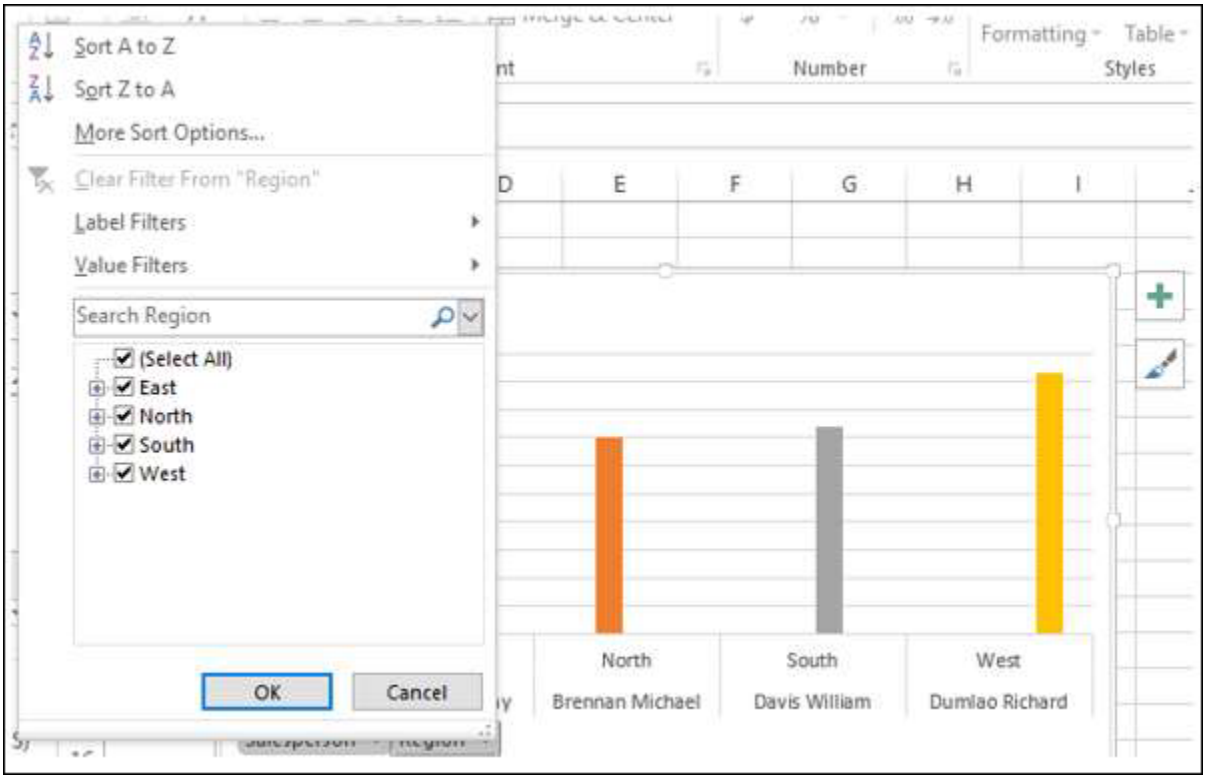
As you have seen in the previous section, Legend is populated with ∑ Values. Further, field buttons are added to the PivotChart for the ease of filtering the data that is being displayed.

Filters in PivotChart

You can use the Axis field buttons on the chart to filter the data being displayed. Click on the arrow on the Axis field button – Region.

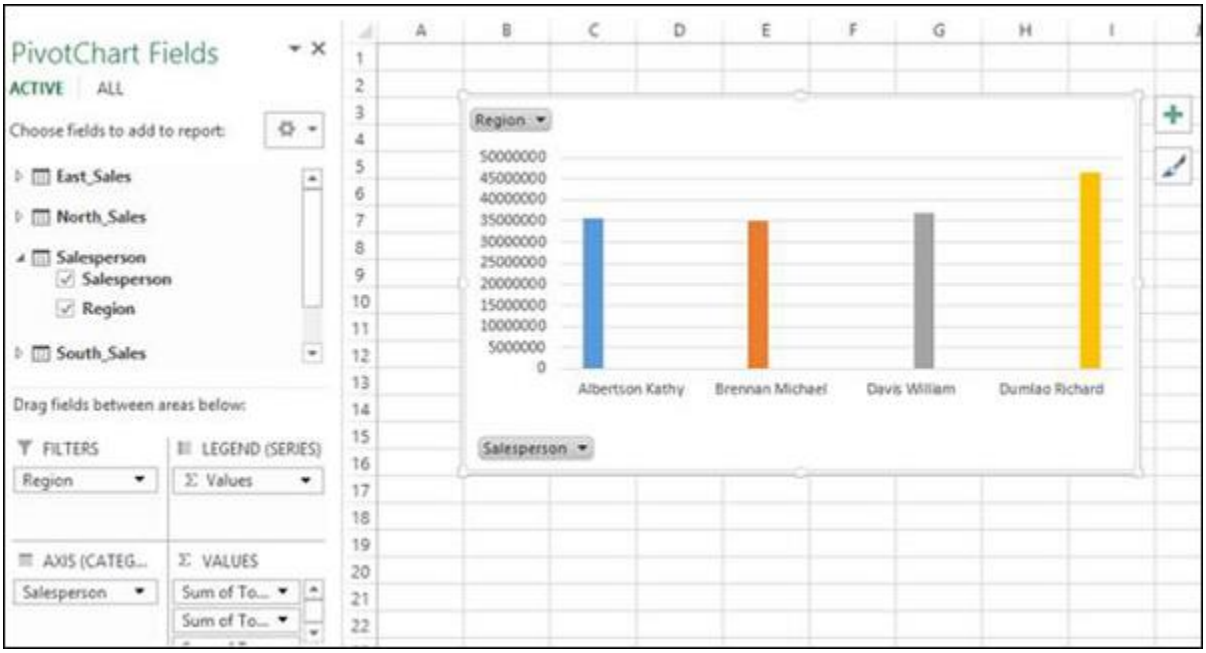


The dropdown list that appears looks as follows:

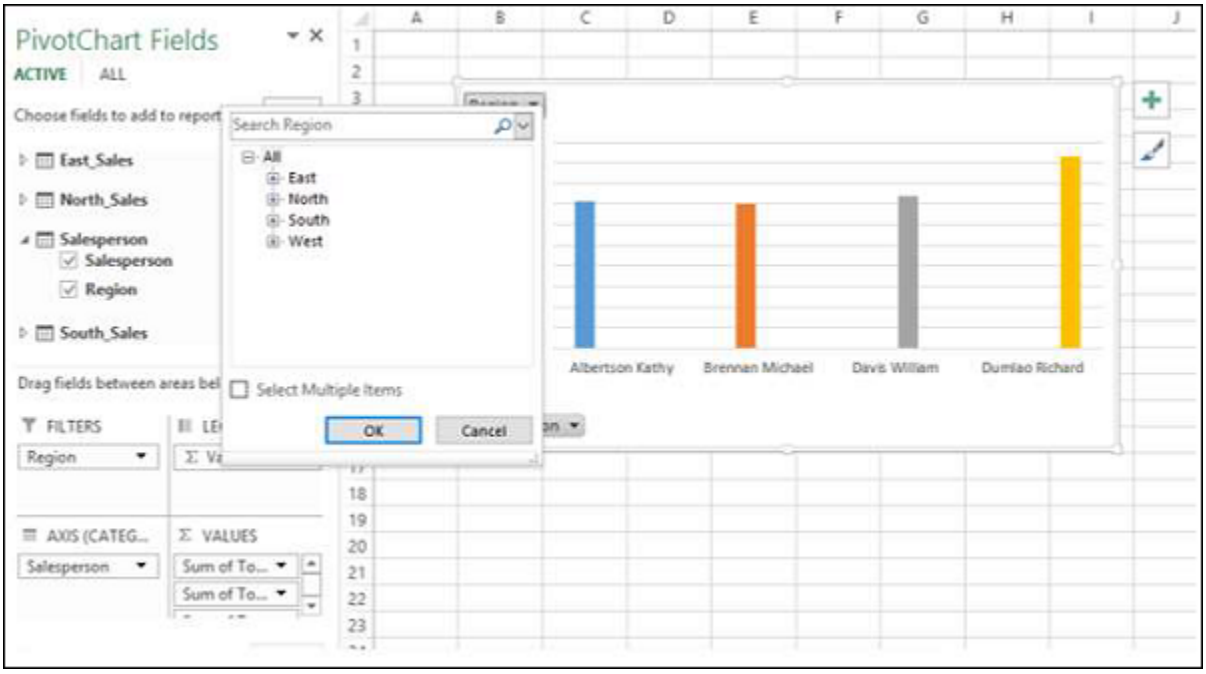


You can select the values that you want to display. Alternatively, you can place the field in FILTERS area for filtering the values.

Drag the field Region to FILTERS area. The Report Filter button - Region appears on the PivotChart.



Click on the arrow on the Report Filter button − Region. The dropdown list that appears looks as follows:

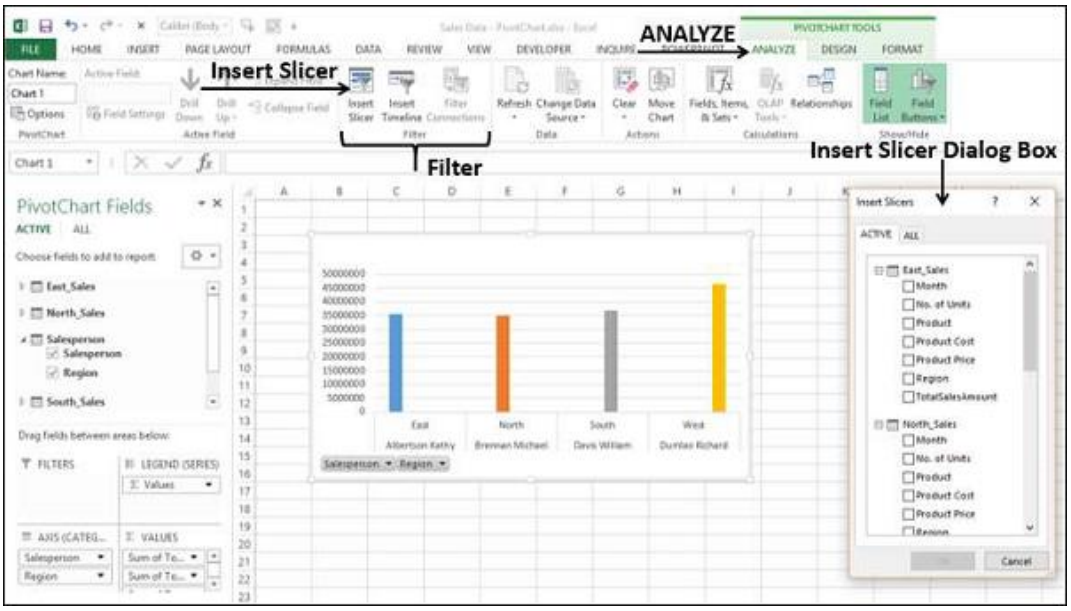


You can select the values that you want to display.

Slicers in PivotChart

Using Slicers is another option to filter data in the Power PivotChart.

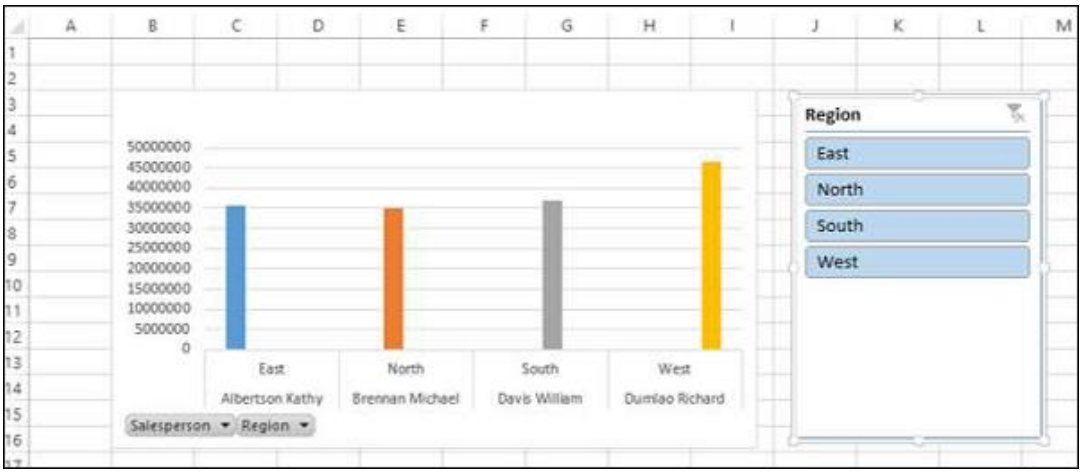
- Click the ANALYZE tab under PIVOTCHART tools on the Ribbon.
- Click Insert Slicer in the Filter group. The **Insert Slicer** dialog box appears.



All the tables and the corresponding fields appear in the Insert Slicer dialog box.

Click the field Region in Salesperson table in the Insert Slicer dialog box.

Slicer for the field Region appears on the worksheet.



As you can observe, the Region field still exists as an Axis field. You can select the values that you want to display by clicking on the Slicer buttons.

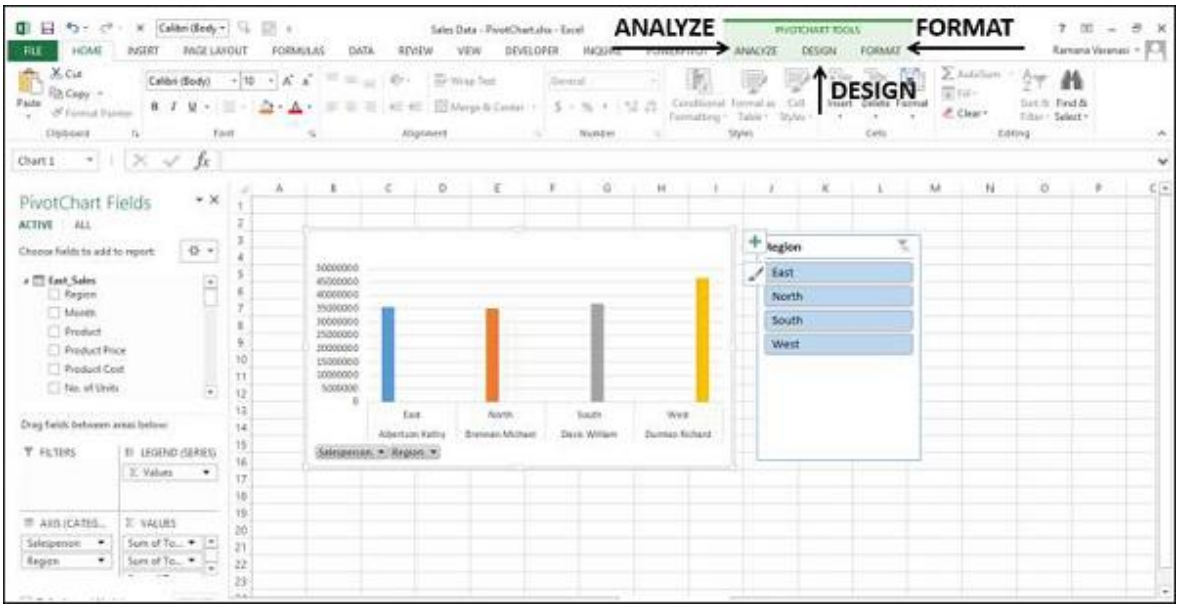
Remember that you are able to do all these in a few minutes and also dynamically because of the Power Pivot Data Model and defined relationships.

PivotChart Tools

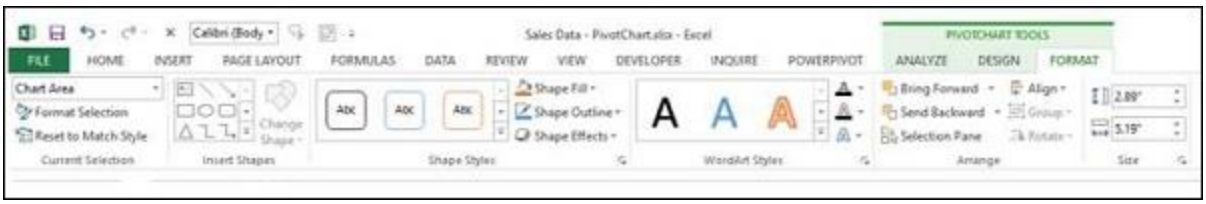
In Power PivotChart, the PIVOTCHART TOOLS has three tabs on the Ribbon as against two tabs in Excel PivotChart −

- **ANALYZE**
- **DESIGN**
- **FORMAT**

The third tab − FORMAT is the additional tab in Power PivotChart.



Click the FORMAT tab on the Ribbon.



The options on the Ribbon under FORMAT tab are all for adding splendor to your PivotChart. You can use these options judiciously, without getting over bored.

Table and Chart Combinations

Power Pivot provides you with different combinations of Power PivotTable and Power PivotChart for data exploration, visualization, and reporting. You have learnt the PivotTables and PivotCharts in the previous modules.

In this module, you will learn how to create the Table and Chart combinations from within the Power Pivot window.

Consider the following Data Model in Power Pivot that we will use for illustrations −

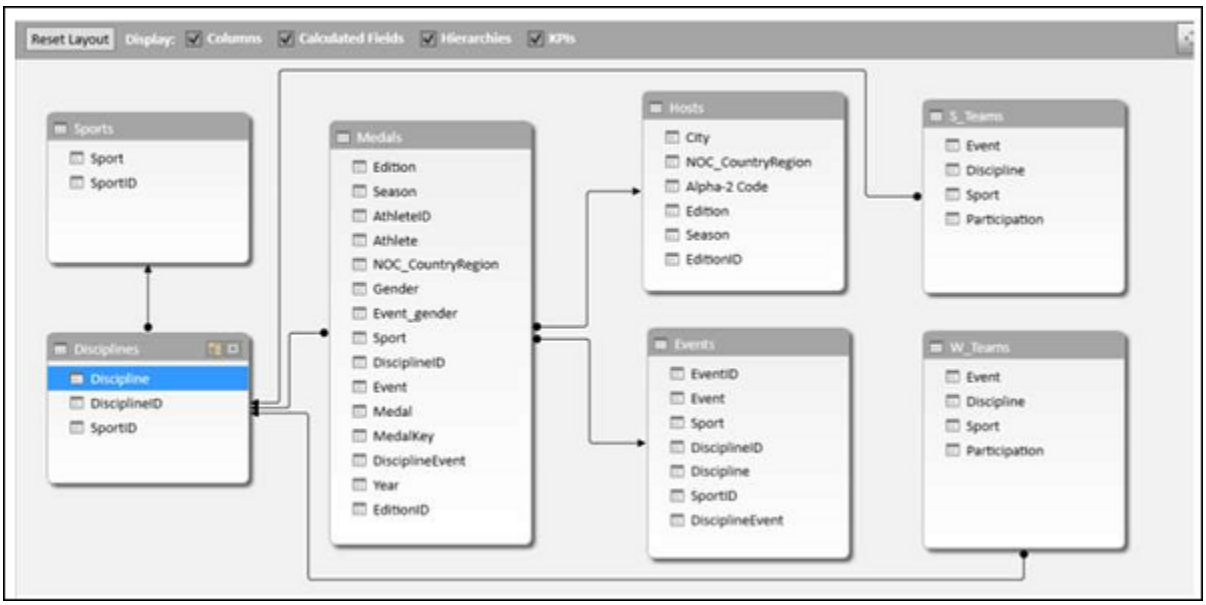
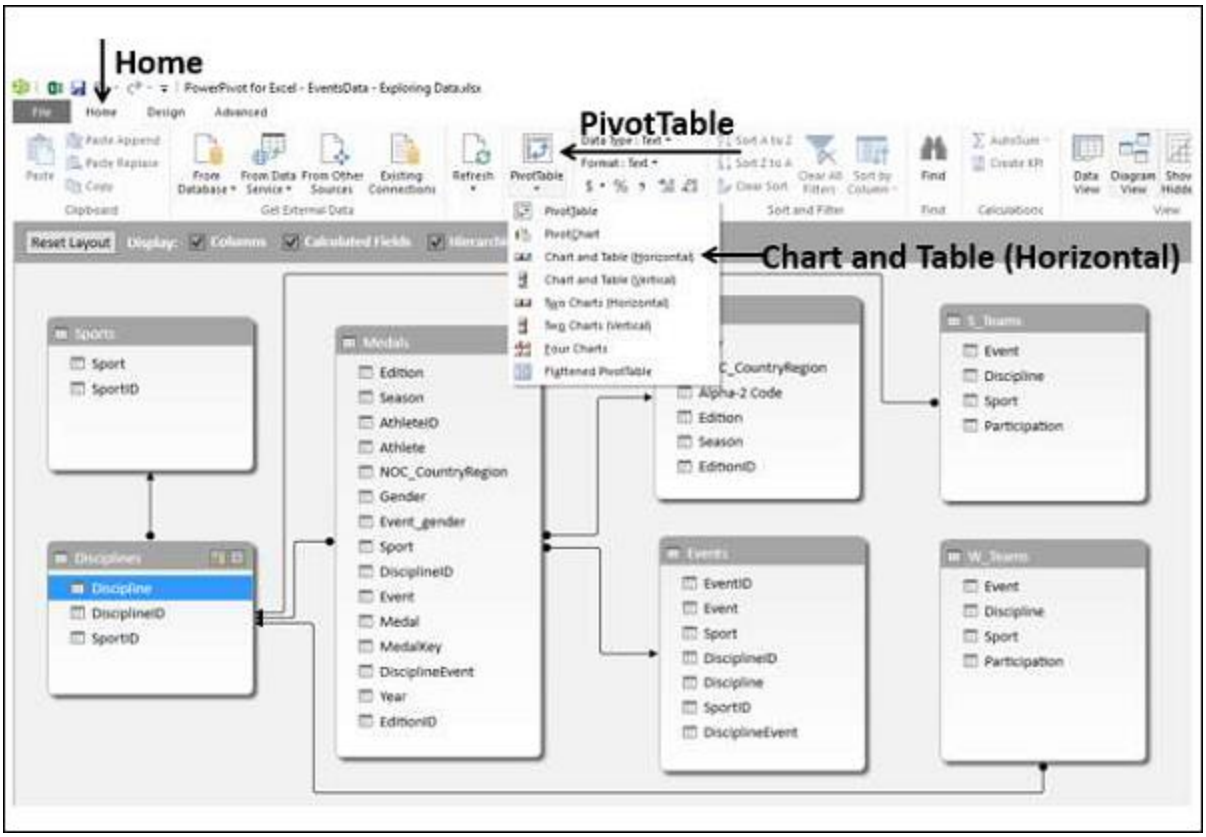


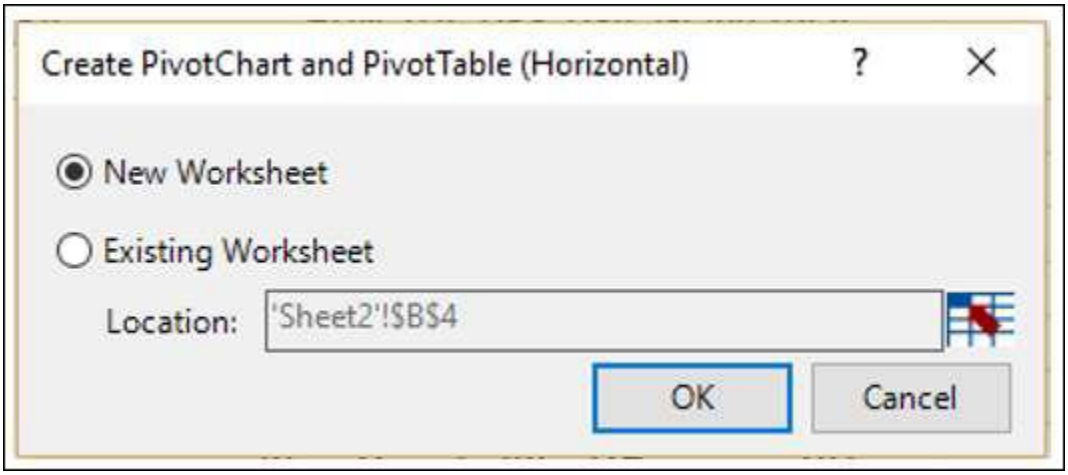
Chart and Table (Horizontal)

With this option, you can create a Power PivotChart and a Power PivotTable, one next another horizontally in the same worksheet.

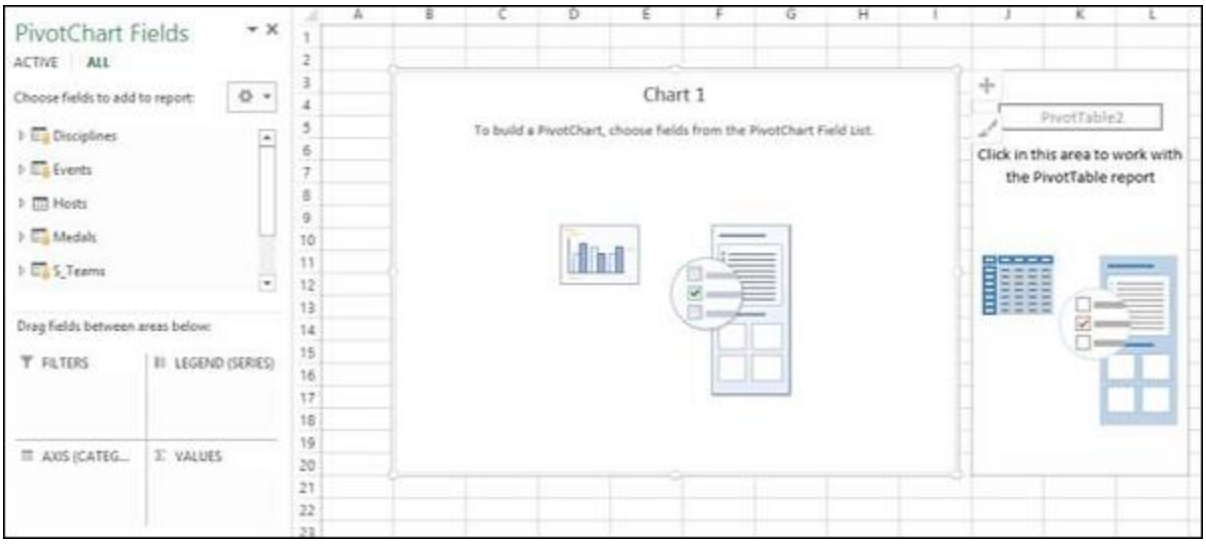
- Click the Home tab in Power Pivot window.
- Click PivotTable.
- Select Chart and Table (Horizontal) from the dropdown list.



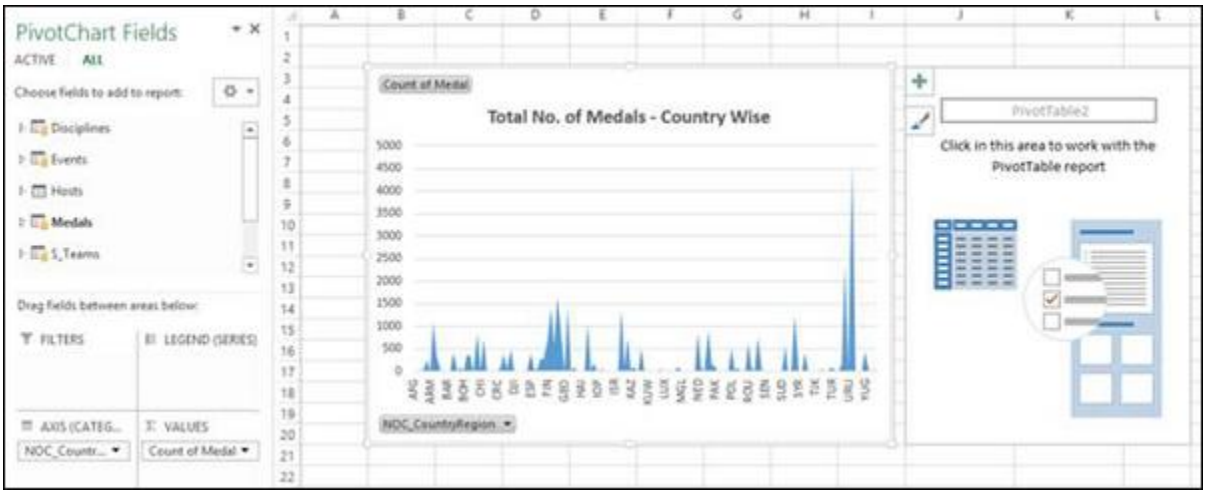
Create PivotChart and PivotTable (Horizontal) dialog box appears. Select New Worksheet and click OK.



An empty PivotChart and an empty PivotTable appear on a new worksheet.

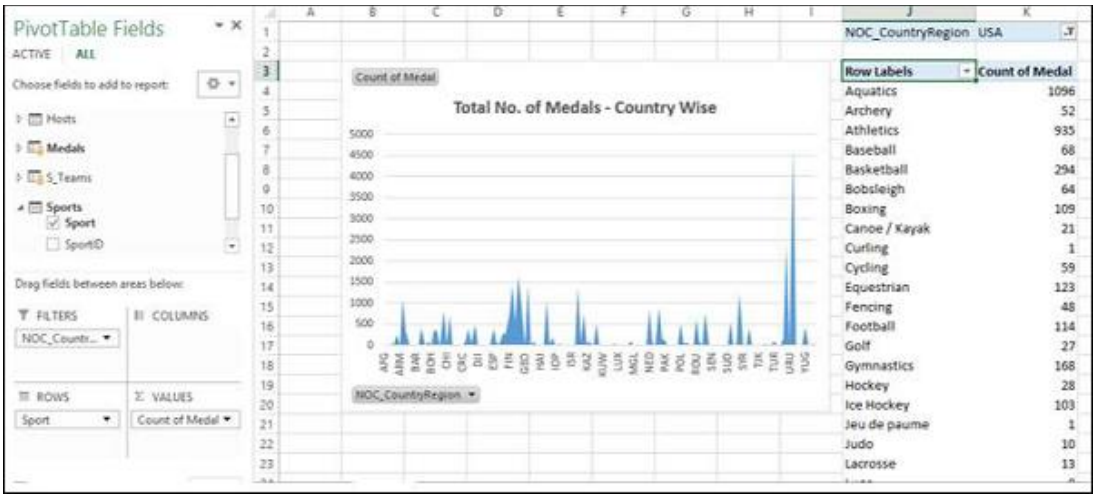


- Click on the PivotChart.
- Drag **NOC_CountryRegion** from Medals table to the AXIS area.
- Drag Medal from Medals table to the ∑ VALUES area.
- Right click on the Chart and select **Change Chart Type** from the dropdown list.
- Select Area Chart.
- Change the Chart Title to **Total No. of Medals − Country Wise**.

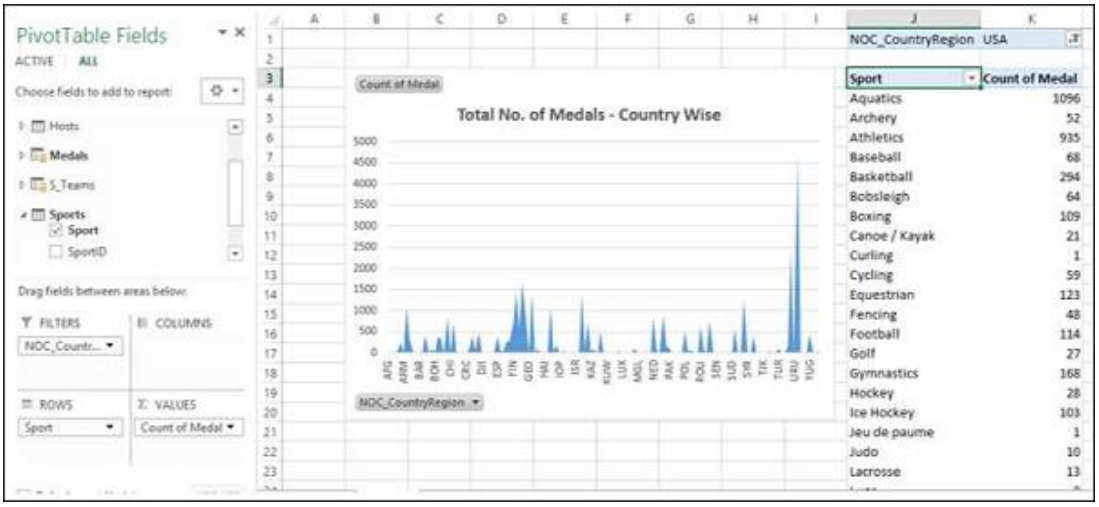


As you can see, USA has the highest number of Medals (> 4500).

- Click on the PivotTable.
- Drag Sport from the Sports table to the ROWS area.
- Drag Medal from the Medals table to the ∑ VALUES area.
- Drag **NOC_CountryRegion** from Medals table to FILTERS area.
- Filter the **NOC_CountryRegion** field to the value USA.



Change the **PivotTable Report** Layout to **Outline** Form.



- Deselect Sport from the Sports table.
- Drag Gender from the Medals table to the ROWS area.

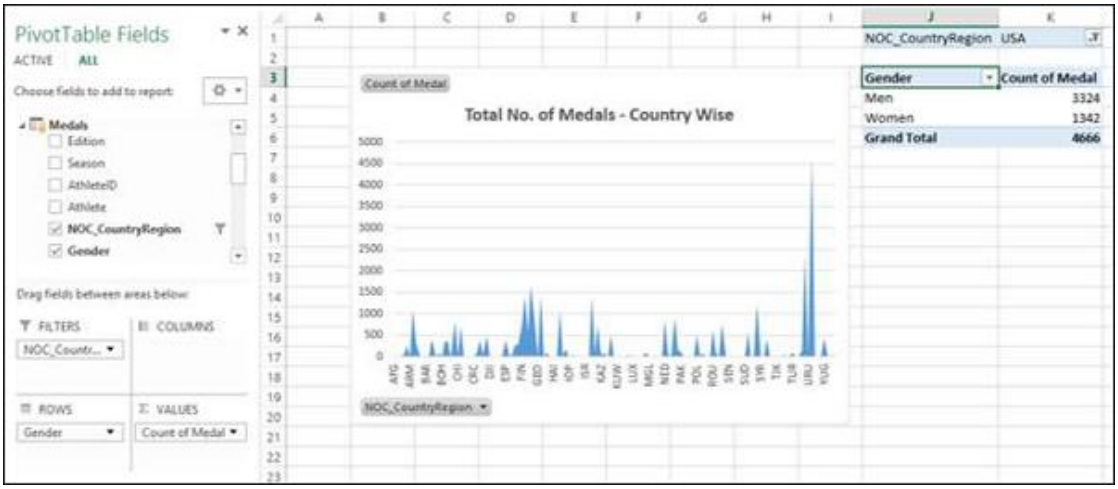
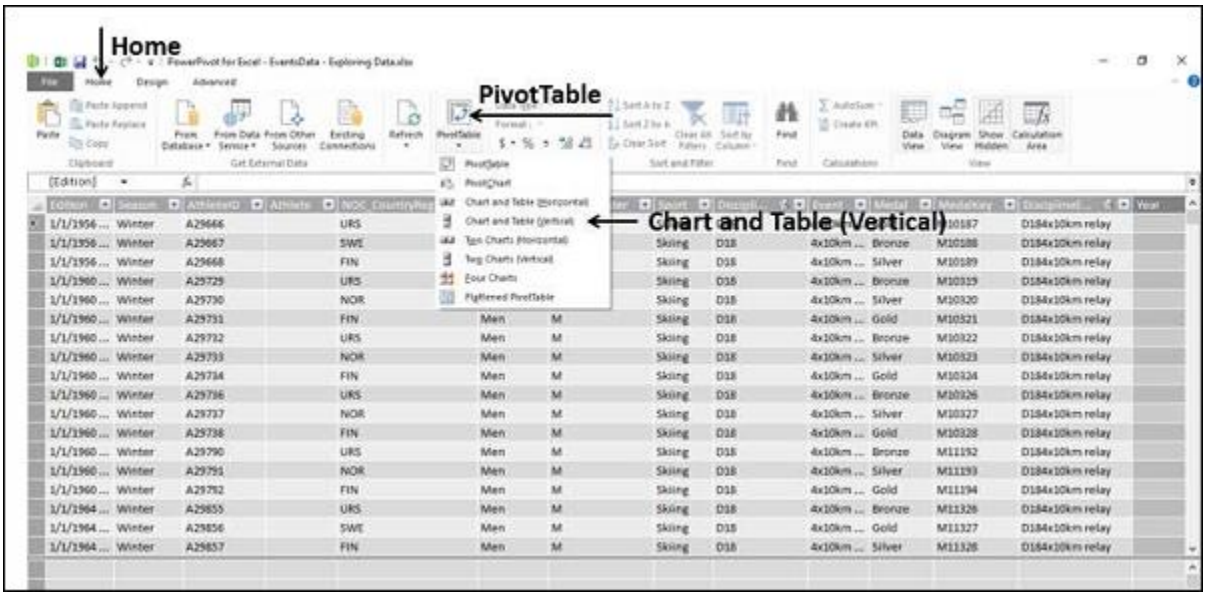


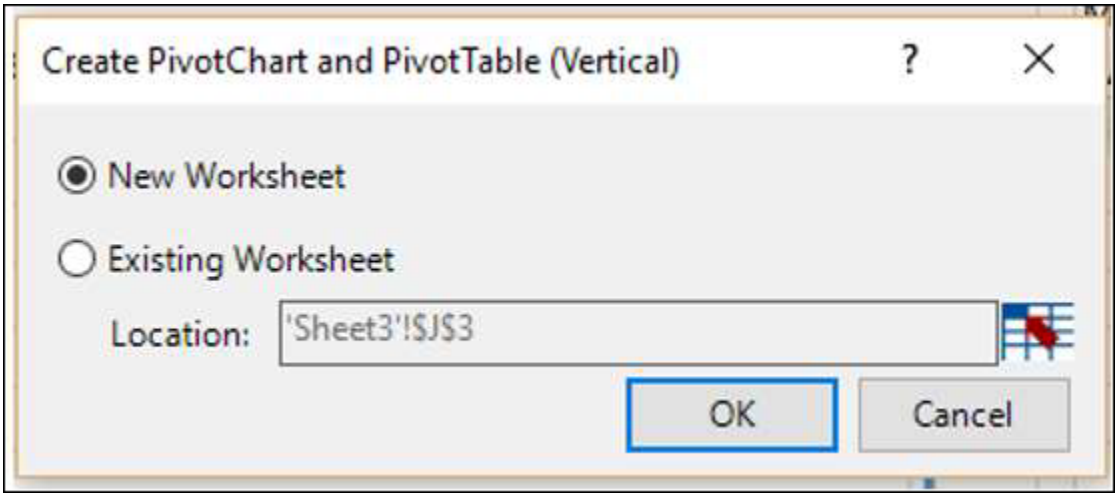
Chart and Table (Vertical)

With this option, you can create a Power PivotChart and a Power PivotTable, one below another vertically in the same worksheet.

- Click the Home tab in Power Pivot window.
- Click PivotTable.
- Select Chart and Table (Vertical) from the dropdown list.



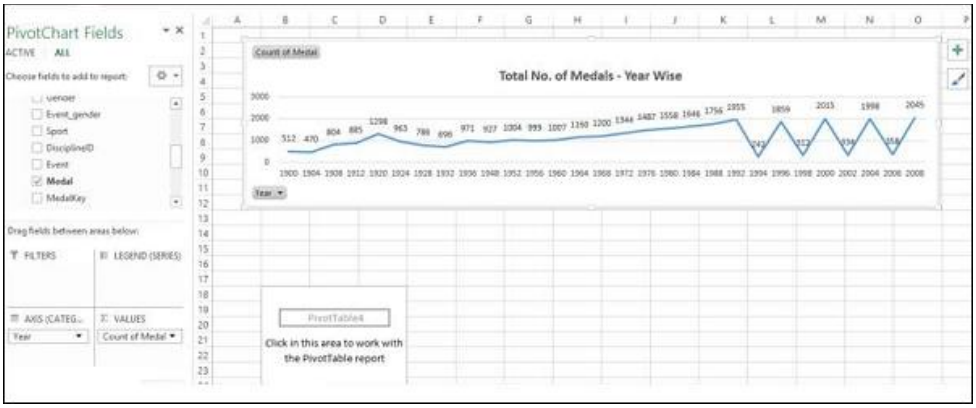
The **Create PivotChart and PivotTable (Vertical)** dialog box appears. Select New Worksheet and click OK.



An empty PivotChart and an empty PivotTable appear vertically on a new worksheet.

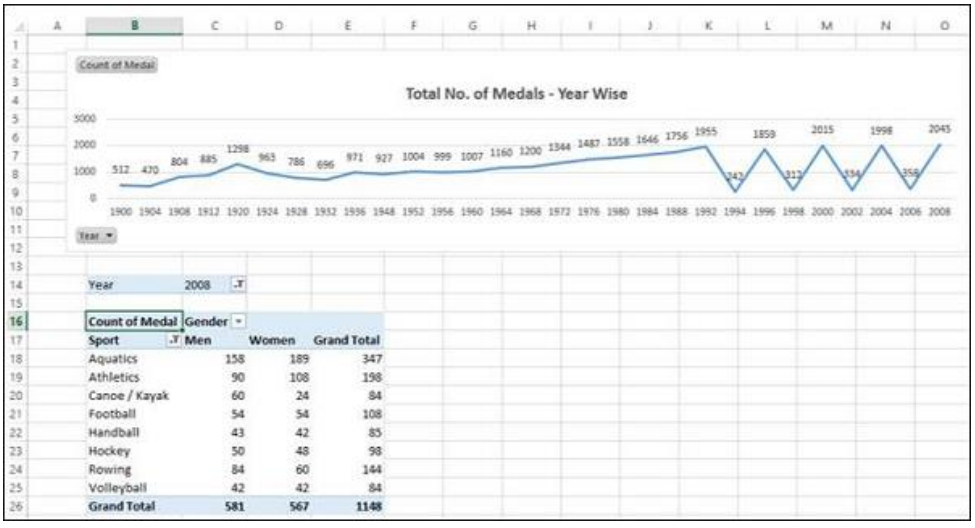
- Click on the PivotChart.
- Drag Year from the Medals table to AXIS area.

- Drag Medal from the Medals table to ∑ VALUES area.
- Right click on the Chart and select Change Chart Type from the dropdown list.
- Select Line Chart.
- Check the box Data Labels in the Chart Elements.
- Change the Chart Title to **Total No. of Medals – Year Wise**.



As you can observe, year 2008 has the highest number of Medals (2450).

- Click on the PivotTable.
- Drag Sport from the Sports table to the ROWS area.
- Drag Gender from the Medals table to the ROWS area.
- Drag Medal from the Medals table to the ∑ VALUES area.
- Drag Year from the Medals table to the FILTERS area.
- Filter the Year field to the value 2008.
- Change the Report Layout of PivotTable to Outline Form.
- Filter the field Sport with Value Filters to Greater than or equal to 80.

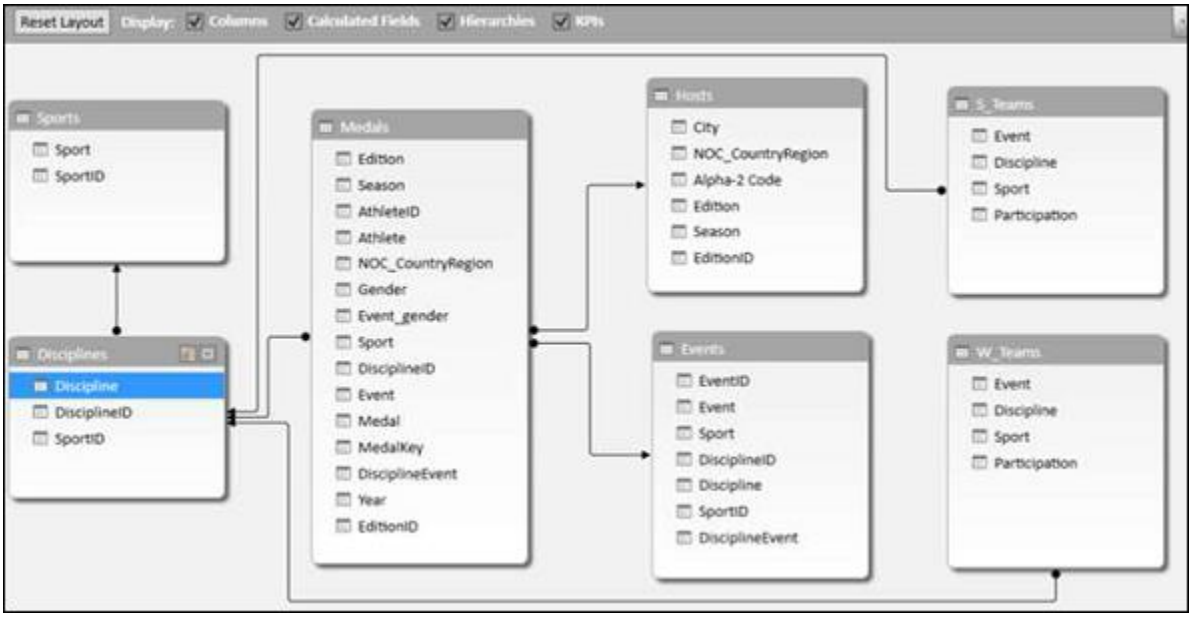


Hierarchies

A hierarchy in Data Model is a list of nested columns in a data table that are considered as a single item when used in a Power PivotTable. For example, if you have the columns − Country, State, City in a data table, a hierarchy can be defined to combine the three columns into one field.

In the Power PivotTable Fields list, the hierarchy appears as one field. So, you can add just one field to the PivotTable, instead of the three fields in the hierarchy. Further, it enables you to move up or down the nested levels in a meaningful way.

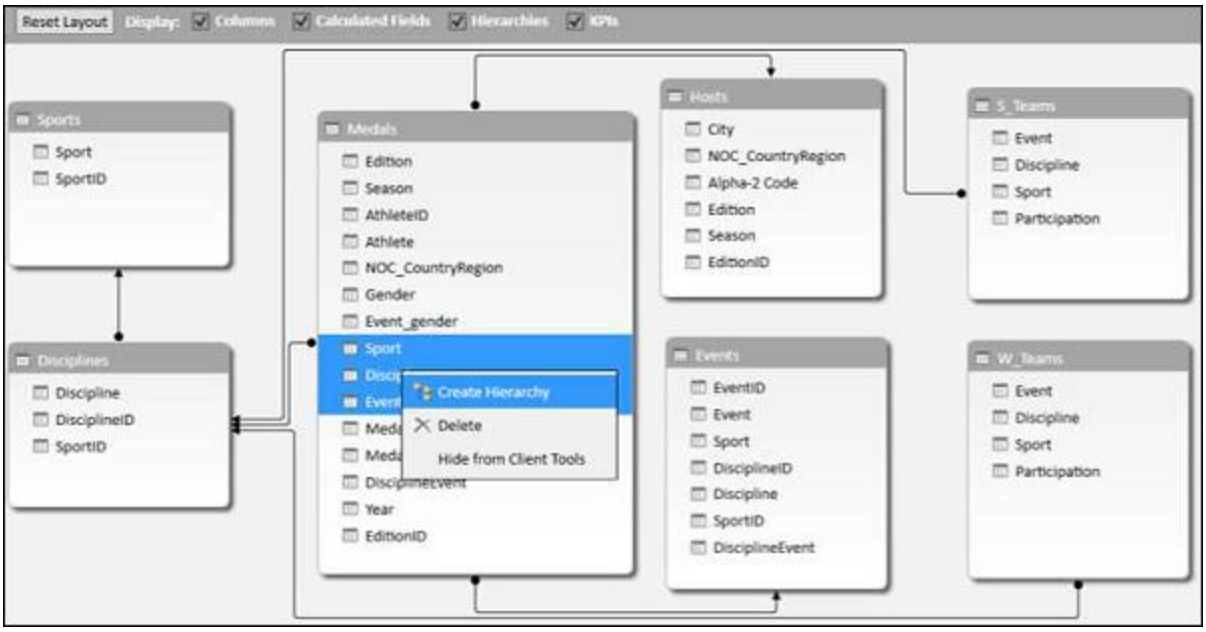
Consider the following Data Model for illustrations in this module.



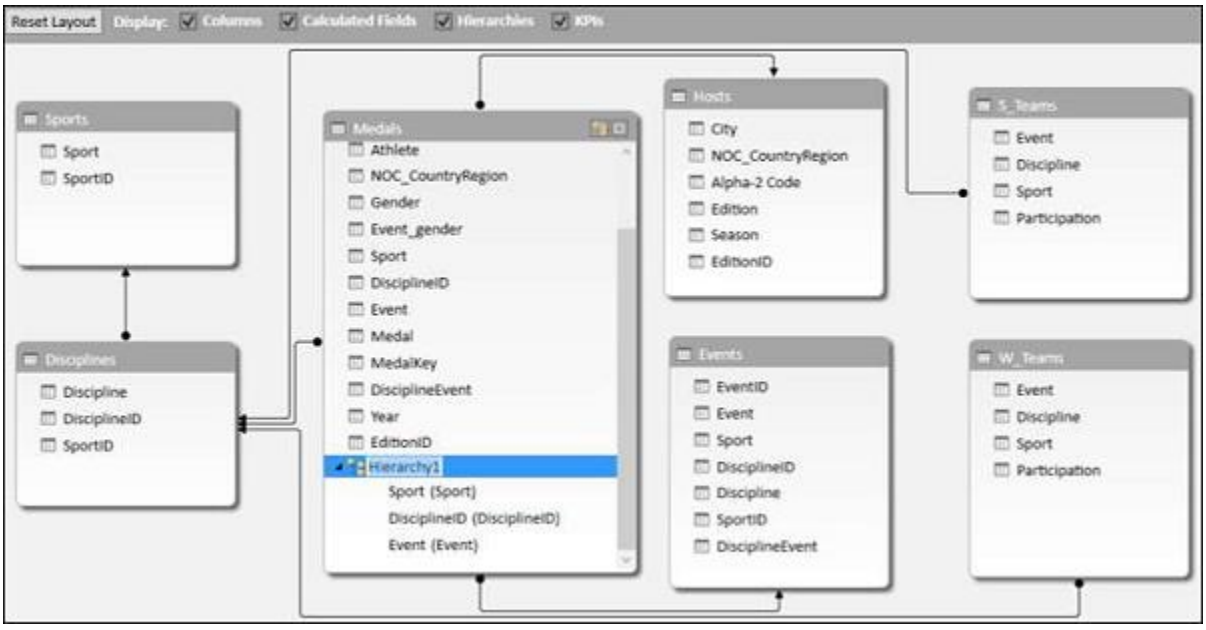
Creating a Hierarchy

You can create Hierarchies in the diagram view of the Data Model. Note that you can create a hierarchy based on a single data table only.

- Click on the columns − Sport, DisciplineID and Event in the data table Medal in that order. Remember that the order is important to create a meaningful hierarchy.
- Right-click on the selection.
- Select Create Hierarchy from the dropdown list.



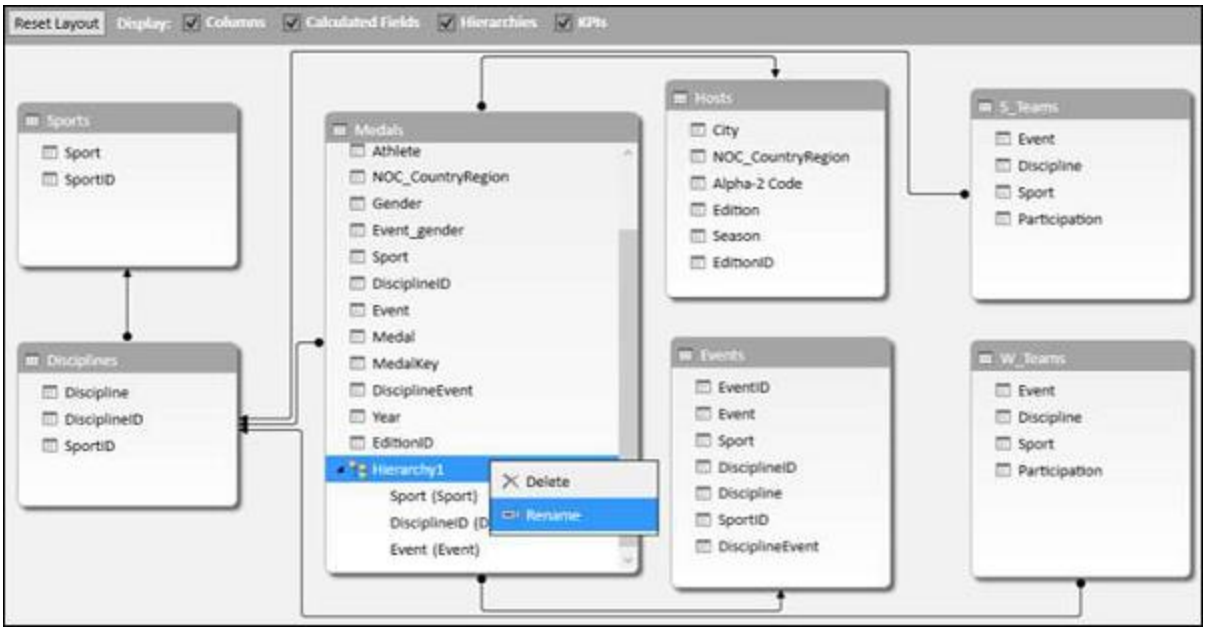
The hierarchy field with the three selected fields as the child levels gets created.



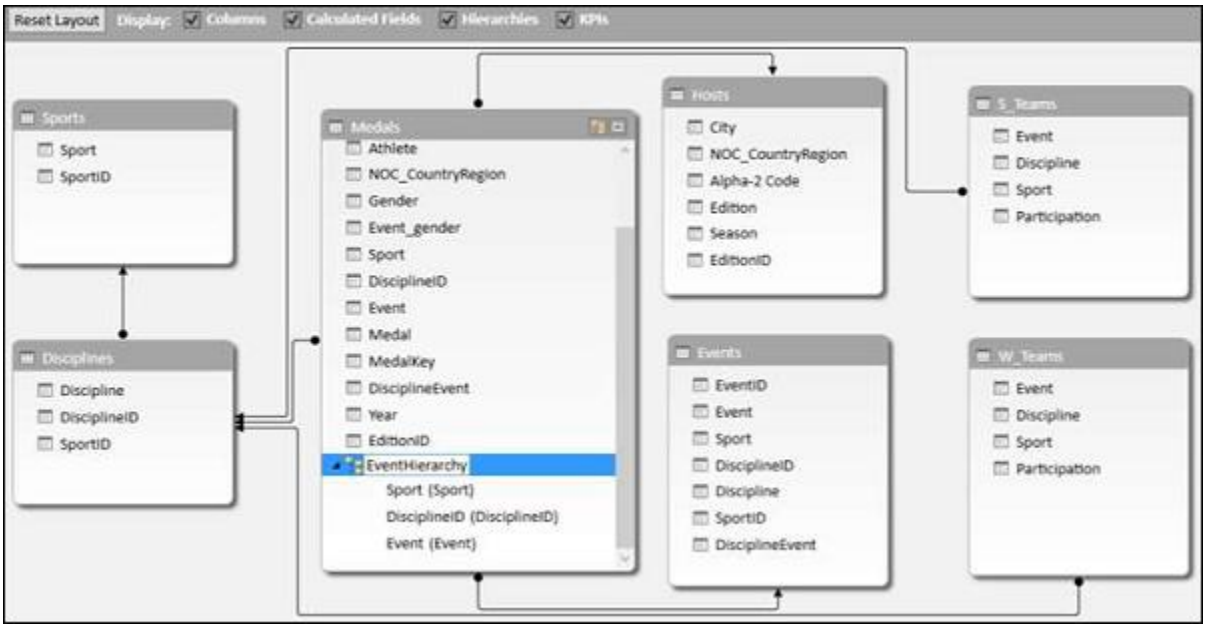
Renaming a Hierarchy

To rename the hierarchy field, do the following:

- Right click on Hierarchy1.
- Select Rename from the dropdown list.



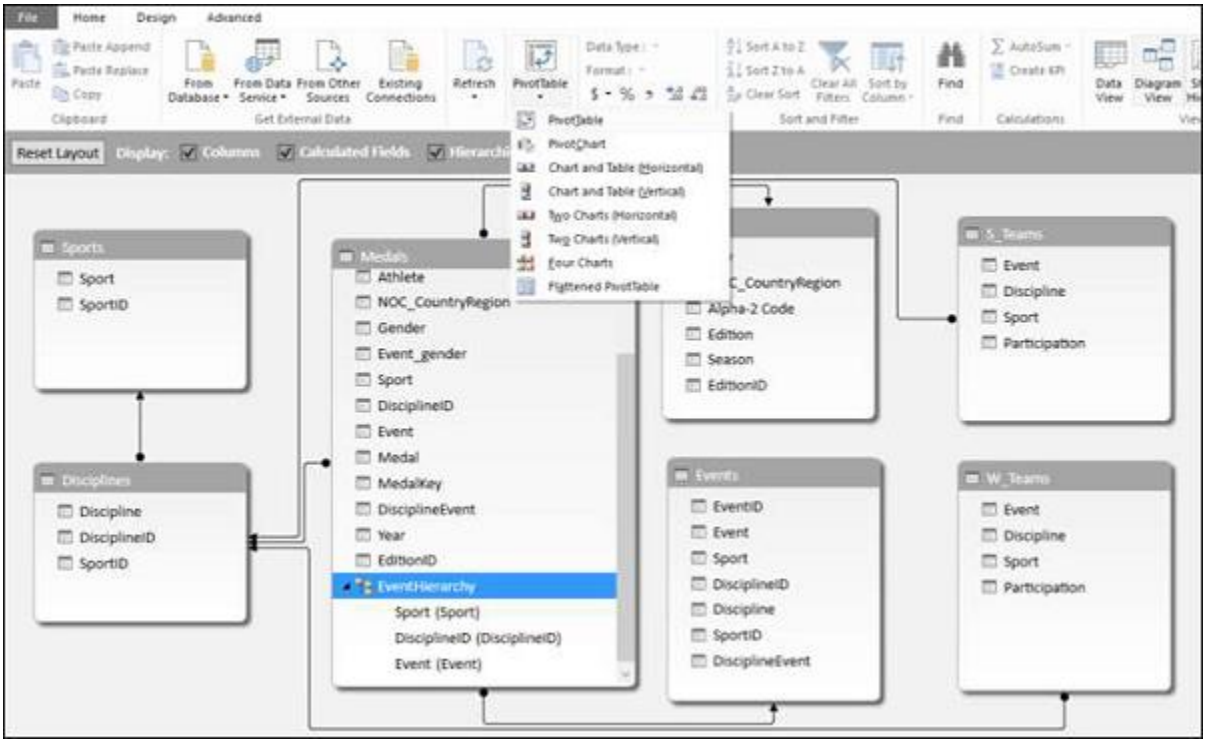
Type **EventHierarchy**.



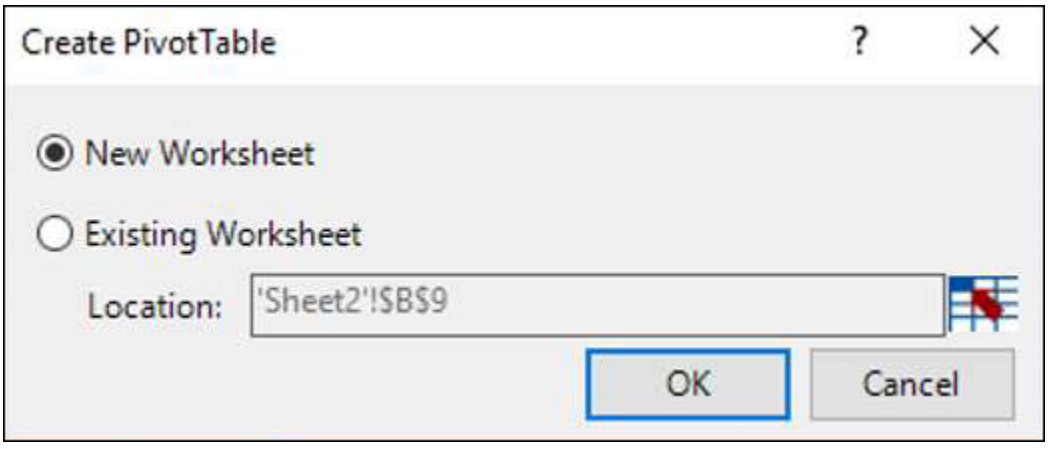
Creating a PivotTable with a Hierarchy in Data Model

You can create a Power PivotTable using the hierarchy that you created in the Data Model.

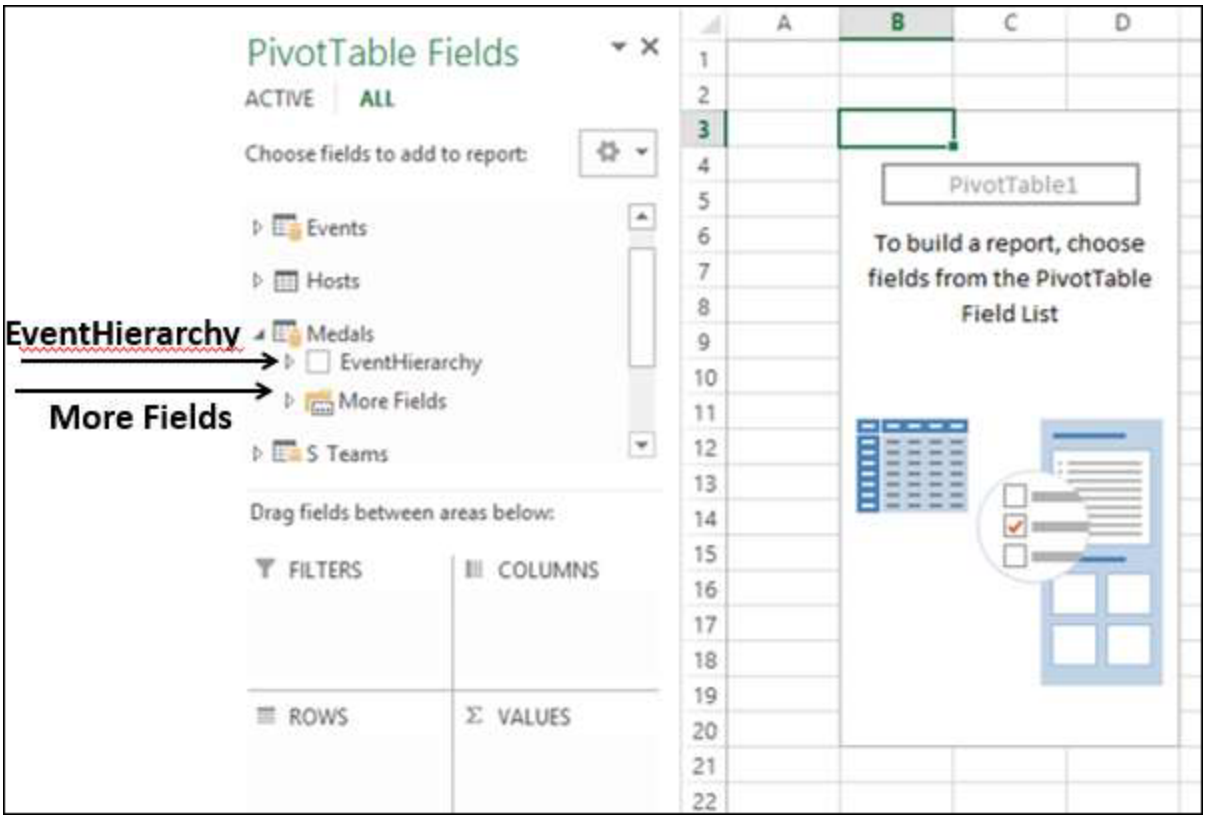
- Click the PivotTable tab on the Ribbon in the Power Pivot window.
- Click PivotTable on the Ribbon.



The **Create PivotTable** dialog box appears. Select New Worksheet and click OK.



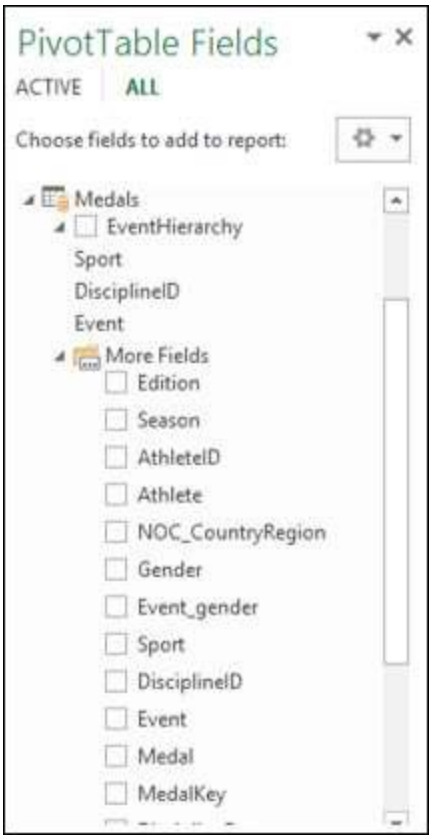
An empty PivotTable is created in a new worksheet.



In the PivotTable Fields list, **EventHierarchy** appears as a field in Medals table. The other fields in the Medals table are collapsed and shown as More Fields.

- Click on the arrow ▷ in front of EventHierarchy.
- Click on the arrow ▷ in front of More Fields.

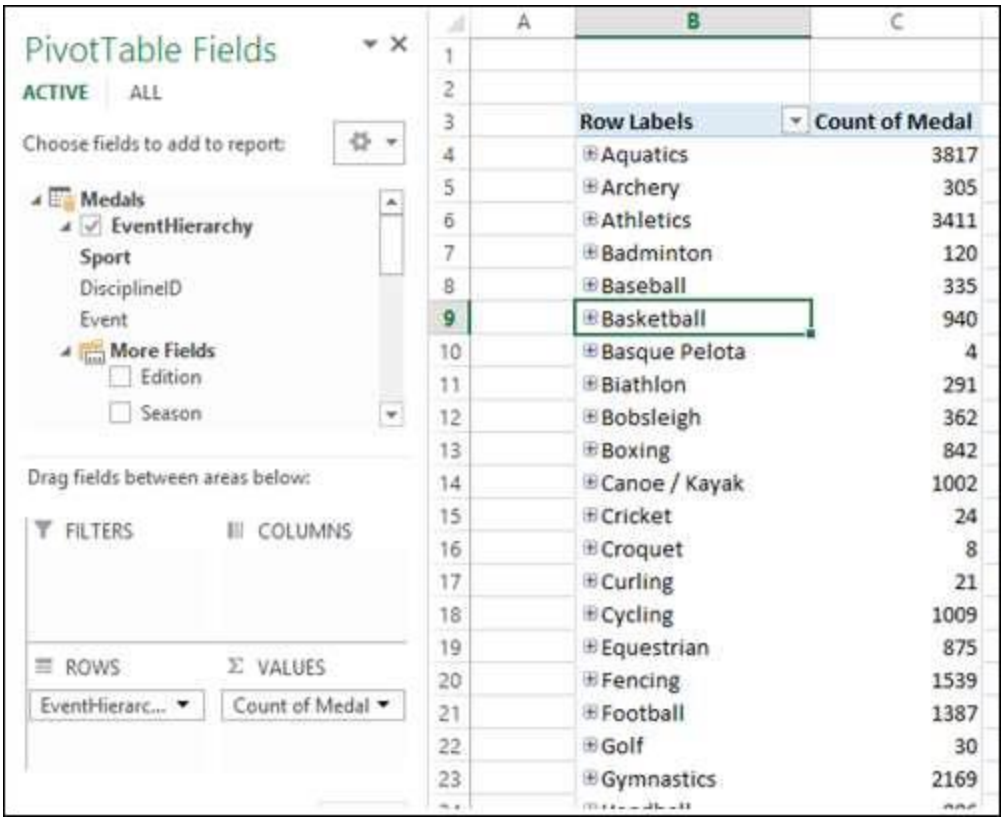
The fields under EventHierarchy will be displayed. All the fields in the Medals table will be displayed under More Fields.



As you can observe, the three fields that you added to the hierarchy also appear under **More Fields** with check boxes. If you do not want them to appear in the PivotTable Fields list under **More Fields**, you have to hide the columns in the data table – Medals in data view in Power Pivot Window. You can always unhide them whenever you want.

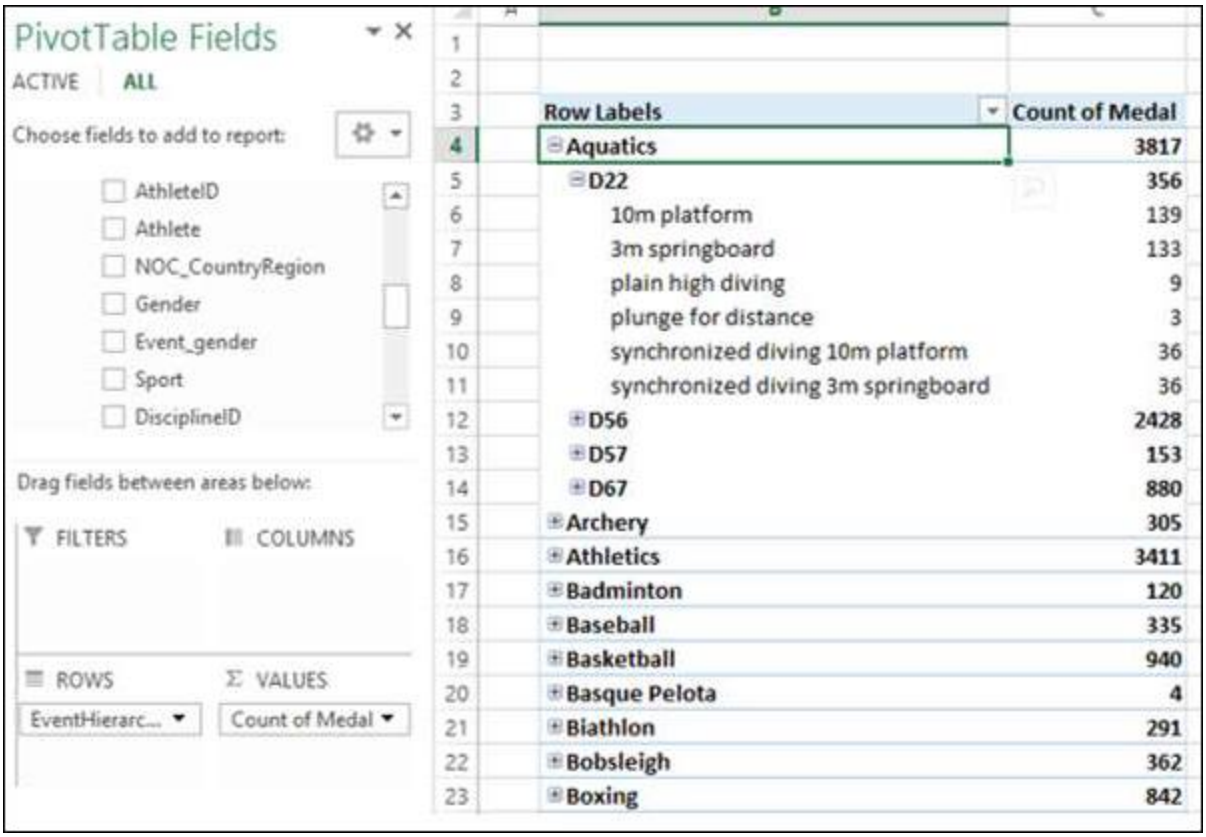
Add fields to the PivotTable as follows:

- Drag **EventHierarchy** to ROWS area.
- Drag Medal to ∑ VALUES area.



The values of Sport field appear in the PivotTable with a + sign in front of them. The medal count for each sport is displayed.

- Click on the + sign before Aquatics. The DisciplineID field values under Aquatics will be displayed.
- Click on the child D22 that appears. The Event field values under D22 will be displayed.



As you can observe, medal count is given for the Events, that get summed up at the parent level − **DisciplineID**, that get further summed up at the parent level − Sport.

Creating a Hierarchy based on Multiple Tables

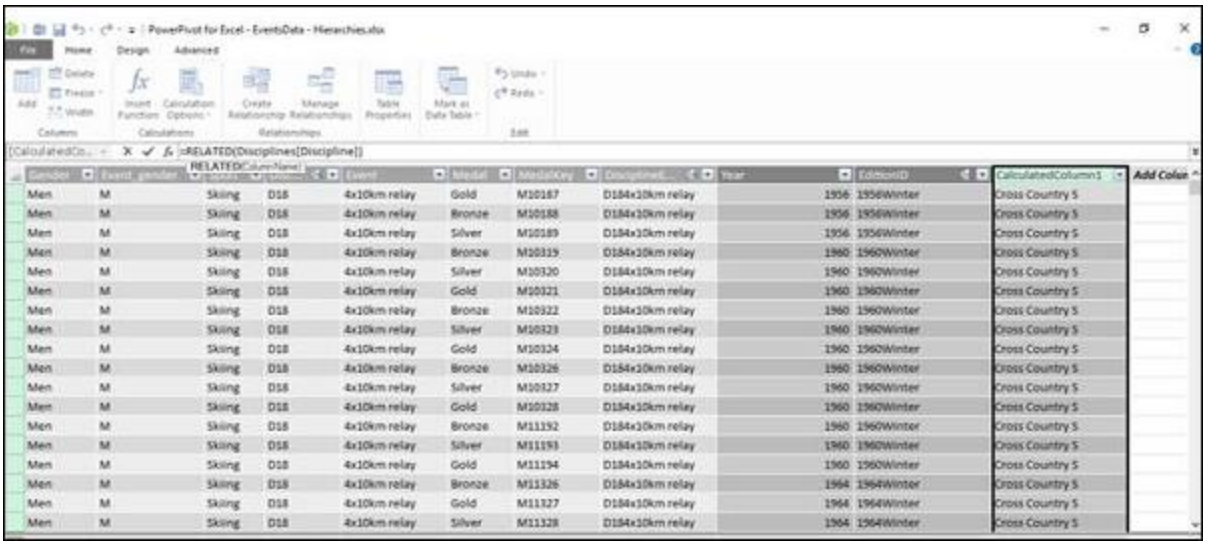
Suppose you want to display the Disciplines in the PivotTable rather than DisciplineIDs to make it a more readable and understandable summarization. In order to do this, you need to have the field Discipline in Medals table that as you know is not. Discipline field is in Disciplines data table, but you cannot create a hierarchy with fields from more than one table. But, there is a way to obtain the required field from the other table.

As you are aware, the tables − Medals and Disciplines are related. You can add the field Discipline from Disciplines table to the Medals table, by creating a column using the relationship with DAX.

- Click data view in Power Pivot window.
- Click the Design tab on the Ribbon.
- Click Add.

The column − Add Column on the right side of the table is highlighted.

Type = **RELATED (Disciplines [Discipline])** in the formula bar. A new column − **CalculatedColumn1** is created with the values as Discipline field values in the Disciplines table.

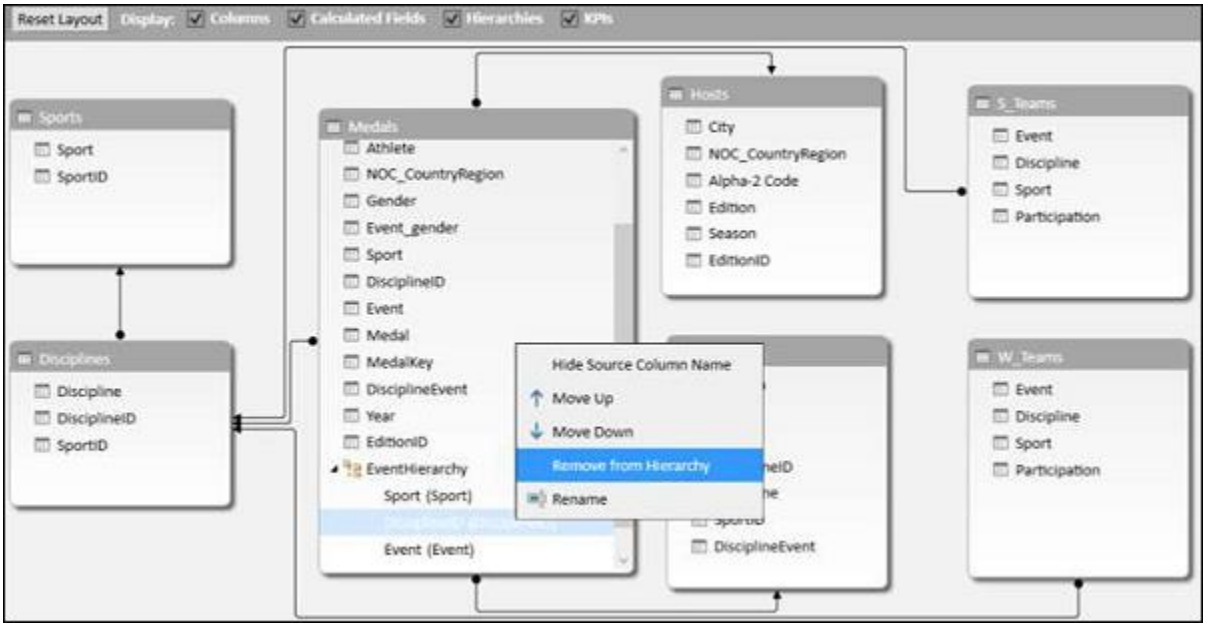


Rename the new column thus obtained in the Medals table as Discipline. Next, you have to remove DisciplineID from the Hierarchy and add Discipline, which you will learn in the following sections.

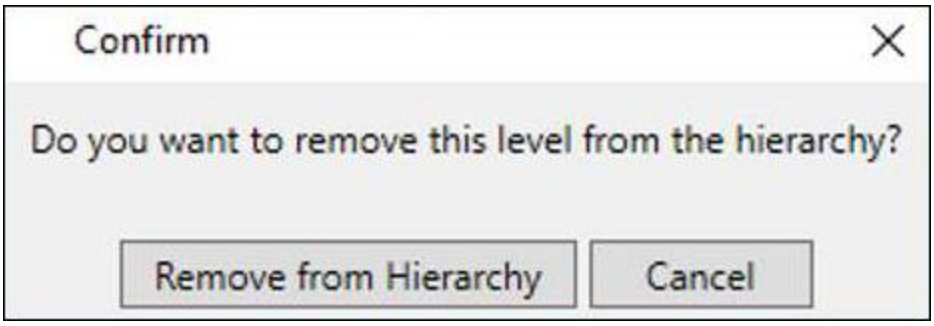
Removing a Child Level from a Hierarchy

As you can observe, the hierarchy is visible in the diagram view only, and not in the data view. Hence, you can edit a hierarchy in the diagram view only.

- Click on the diagram view in the Power Pivot window.
- Right click DisciplineID in EventHierarchy.
- Select **Remove from Hierarchy** from the dropdown list.



The Confirm dialog box appears. Click **Remove from Hierarchy**.



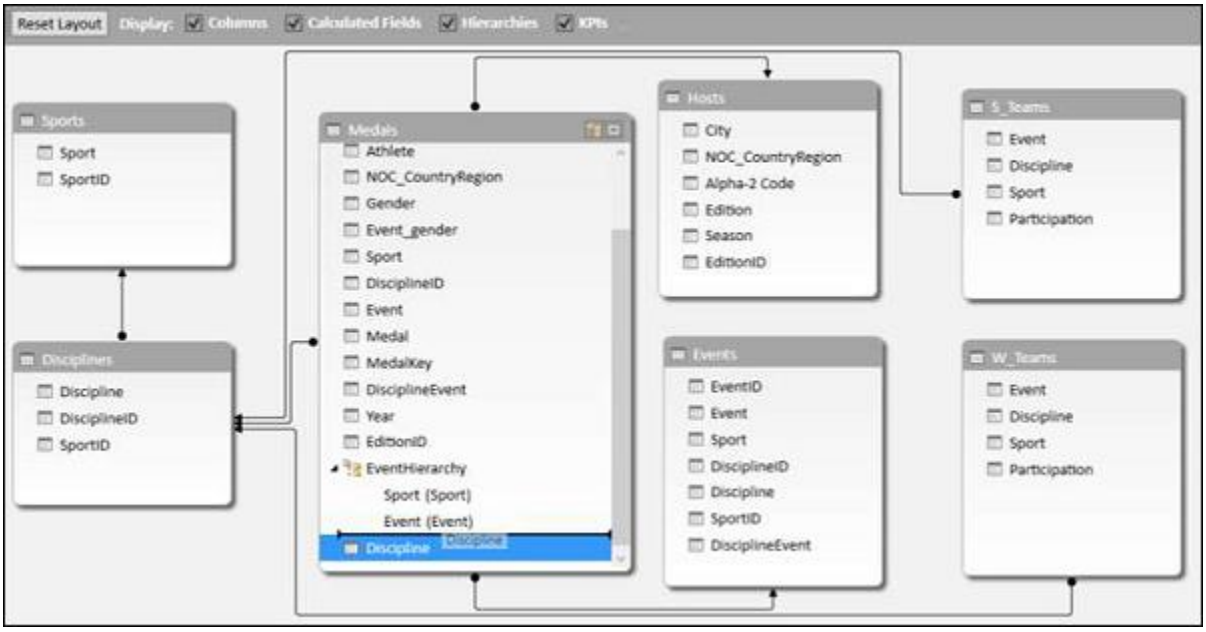
The field DisciplineID gets deleted from the hierarchy. Remember that you have removed the field from hierarchy, but the source field still exists in the data table.

Next, you need to add Discipline field to EventHierarchy.

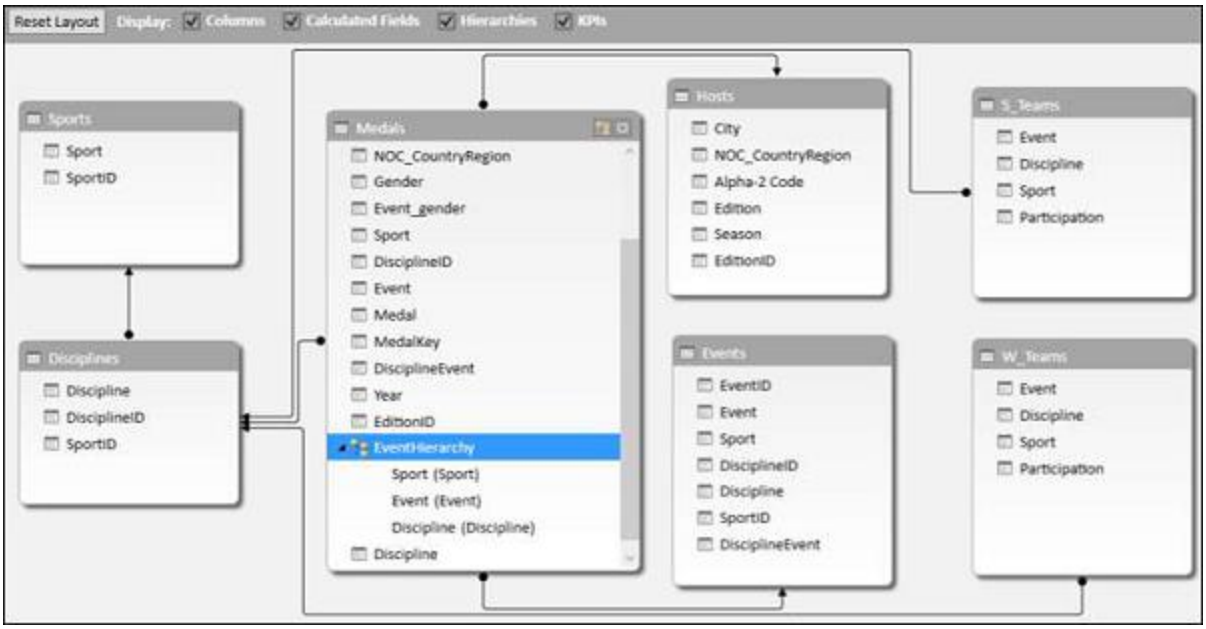
Adding a Child Level to a Hierarchy

You can add the field Discipline to the existing hierarchy - EventHierarchy as follows:

- Click on the field in Medals table.
- Drag it to the Events field below in the EventHierarchy.



The Discipline field gets added to EventHierarchy.

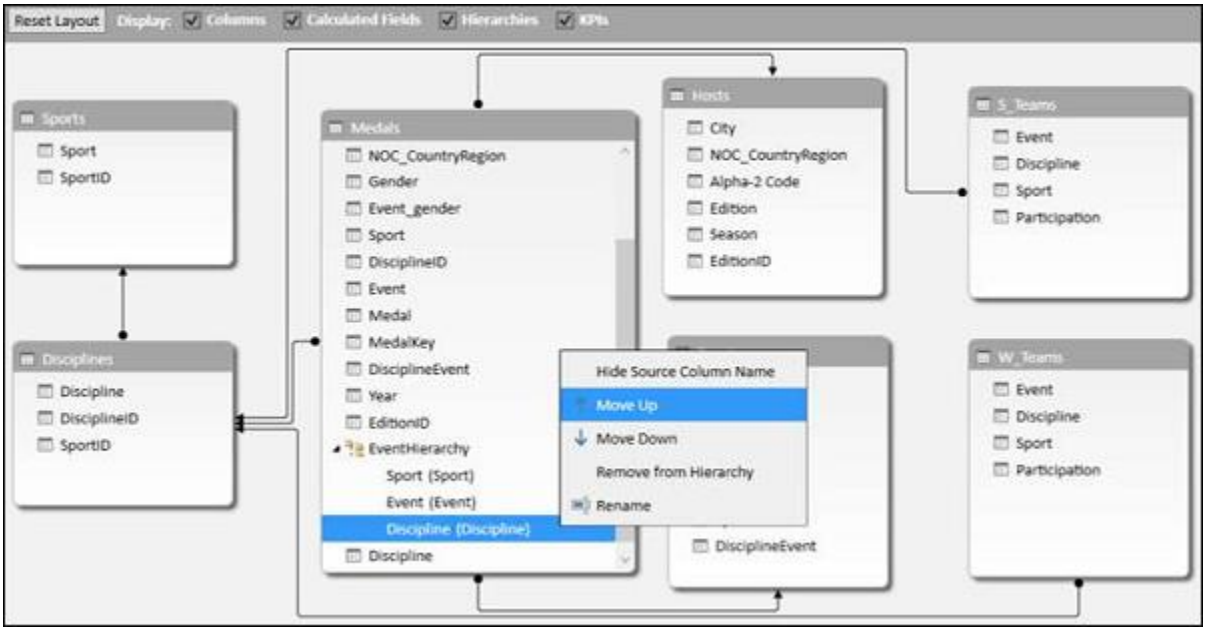


As you can observe, the order of the fields in EventHierarchy is Sport–Event–Discipline. But, as you are aware it has to be Sport–Discipline-Event. Hence, you need to change the order of the fields.

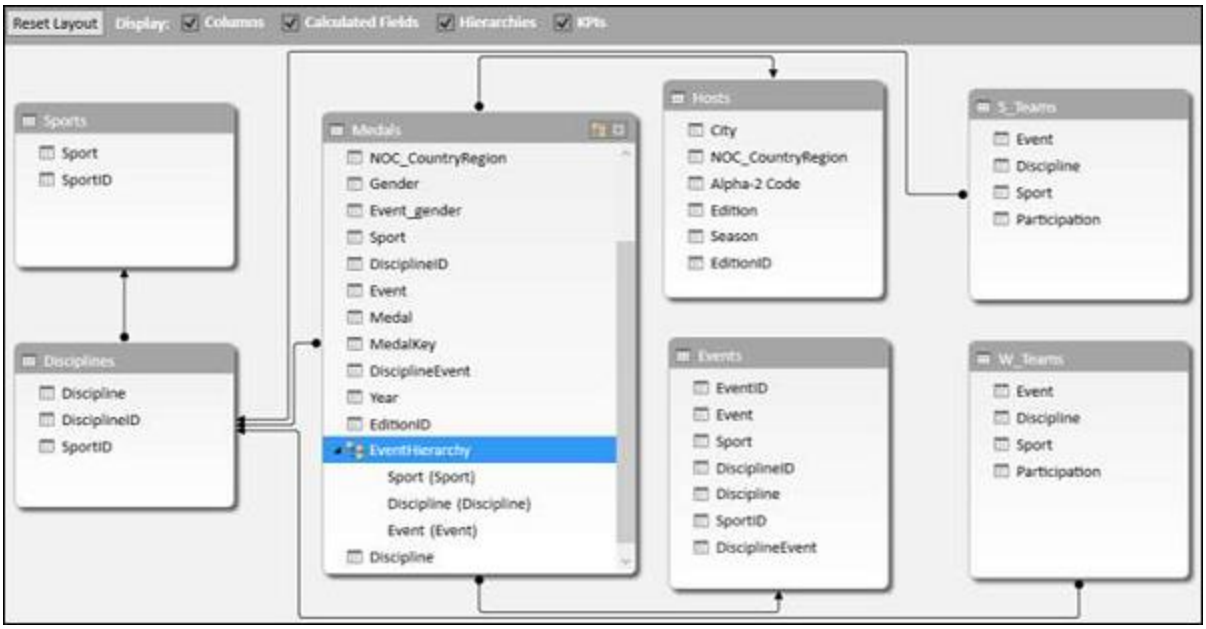
Changing the Order of a Child Level in a Hierarchy

To move the field Discipline to the position after the field Sport, do the following:

- Right click on the field Discipline in EventHierarchy.
- Select Move Up from the dropdown list.



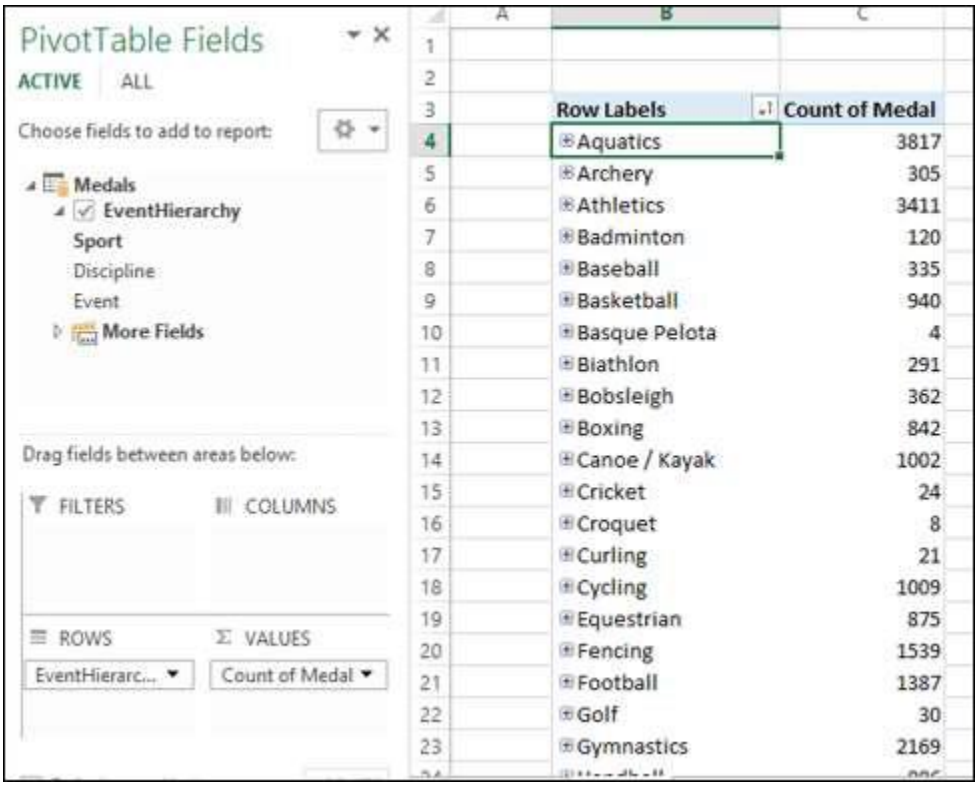
The order of the fields changes to Sport-Discipline-Event.



PivotTable with Changes in Hierarchy

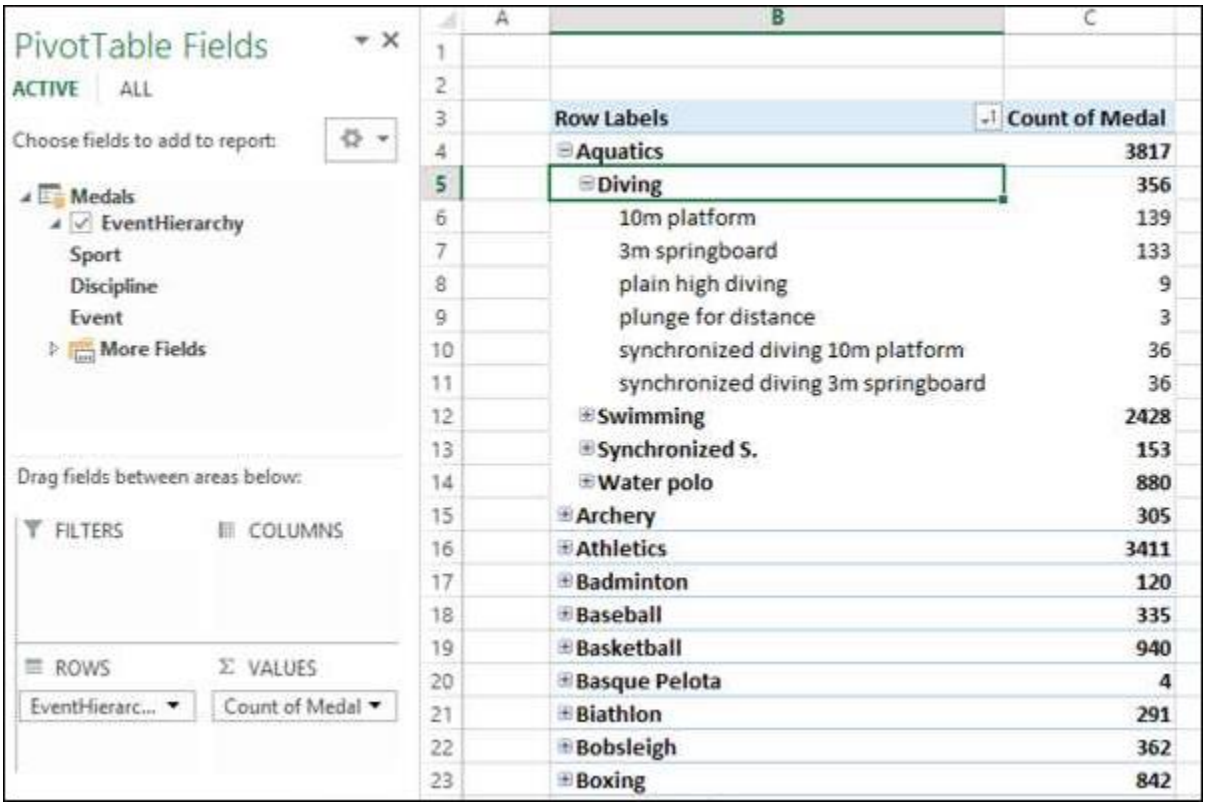
To view the changes that you made in EventHierarchy in the PivotTable, you need not create a new PivotTable. You can view them in the existing PivotTable itself.

Click on the worksheet with the PivotTable in Excel window.



As you can observe, in the PivotTable Fields list, the child levels in the EventHierarchy reflect the changes you made in the Hierarchy in Data Model. The same changes also get reflected in the PivotTable accordingly.

Click the + sign in front of Aquatics in the PivotTable. The child levels appear as values of the field Discipline.

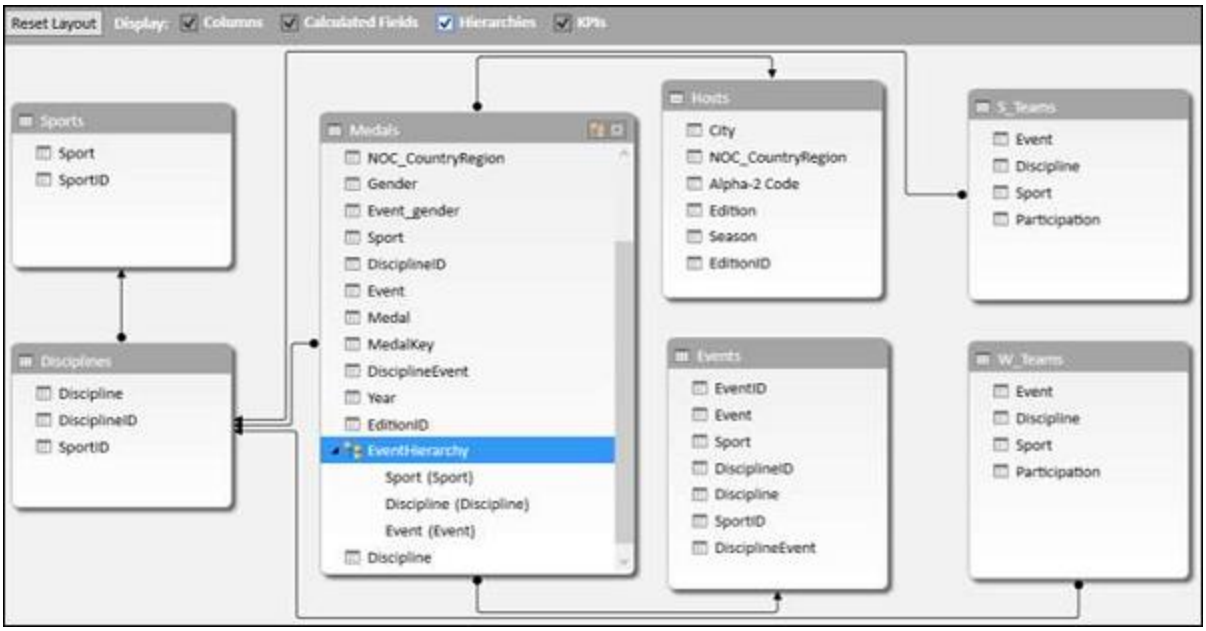


Row Labels	Count of Medal
Aquatics	3817
Diving	356
10m platform	139
3m springboard	133
plain high diving	9
plunge for distance	3
synchronized diving 10m platform	36
synchronized diving 3m springboard	36
Swimming	2428
Synchronized S.	153
Water polo	880
Archery	305
Athletics	3411
Badminton	120
Baseball	335
Basketball	940
Basque Pelota	4
Biathlon	291
Bobsleigh	362
Boxing	842

Hiding and Showing Hierarchies

You can choose to hide the Hierarchies and show them whenever you want.

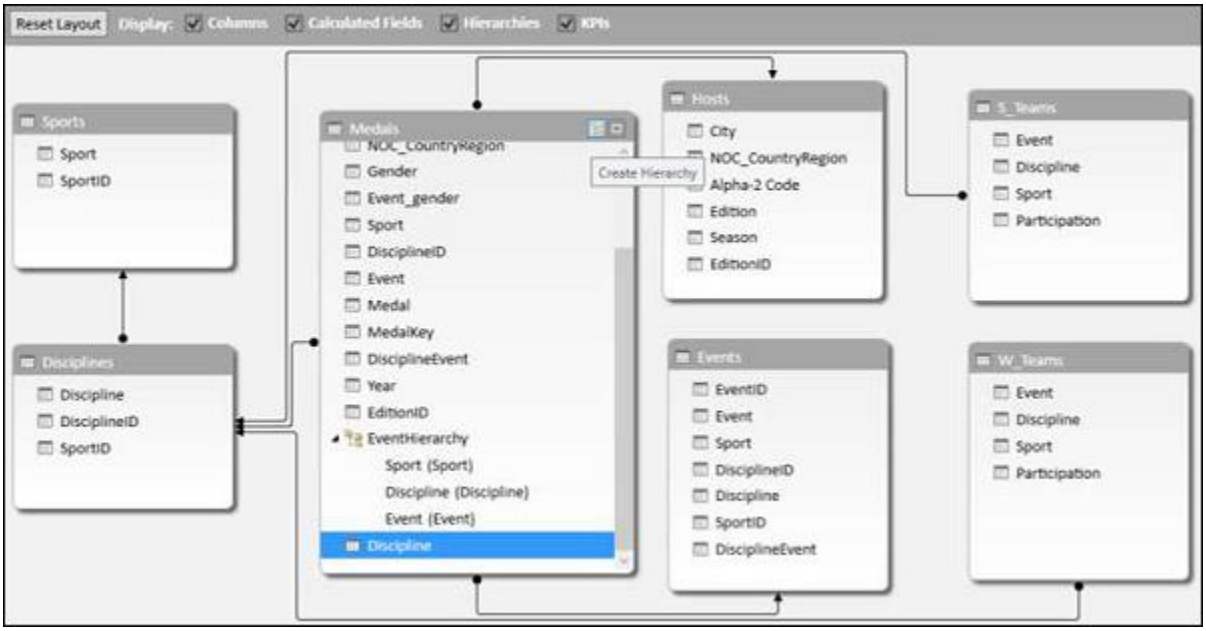
- Uncheck the box Hierarchies in the top menu of diagram view to hide the hierarchies.
- Check the box Hierarchies to show the hierarchies.



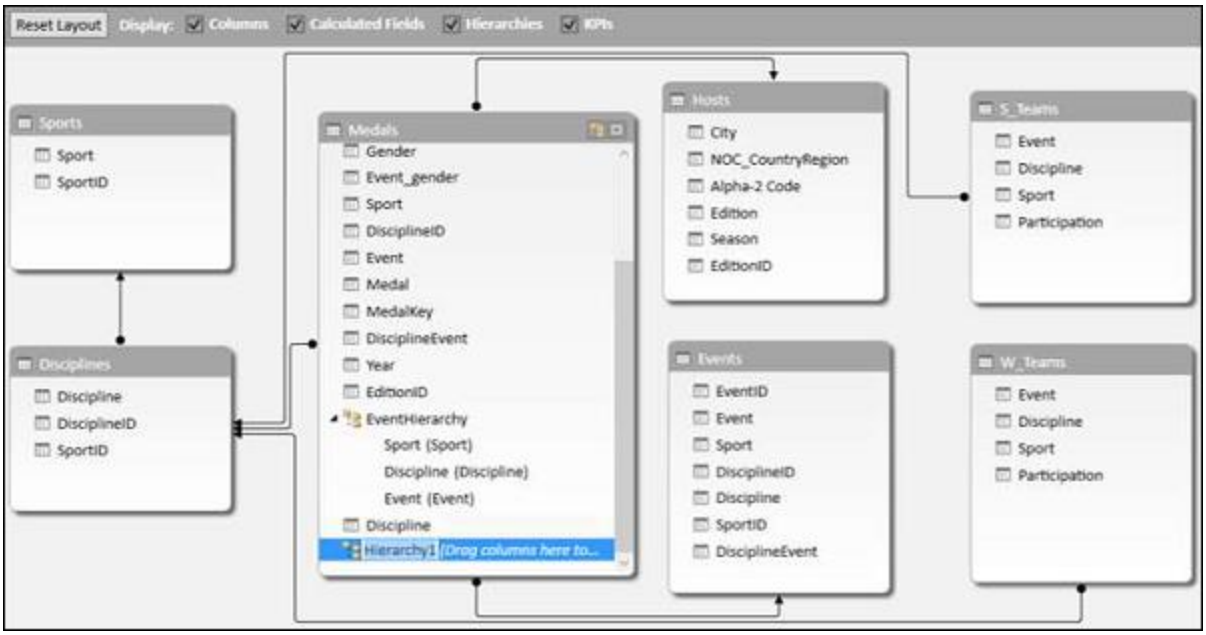
Creating a Hierarchy in Other Ways

In addition to the way you created hierarchy in the previous sections, you can create a hierarchy in another two ways.

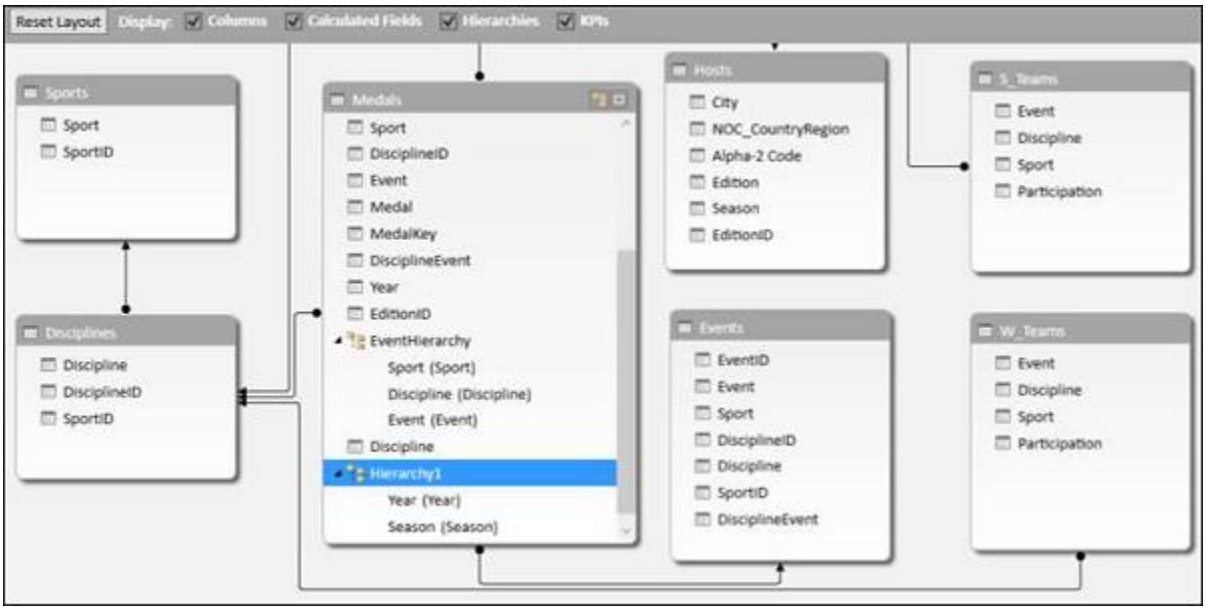
1. Click the Create Hierarchy button on the top right corner of the Medals data table in diagram view.



A new hierarchy gets created in the table without any fields in it.

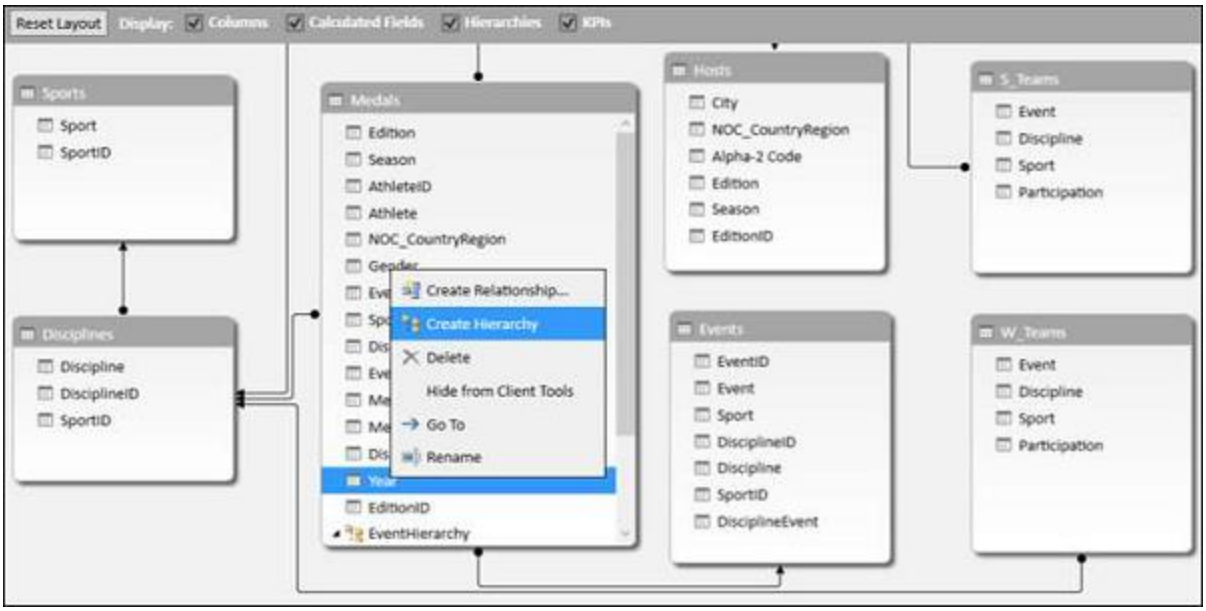


Drag the fields Year and Season, in that order to the new hierarchy. The hierarchy shows the child levels.

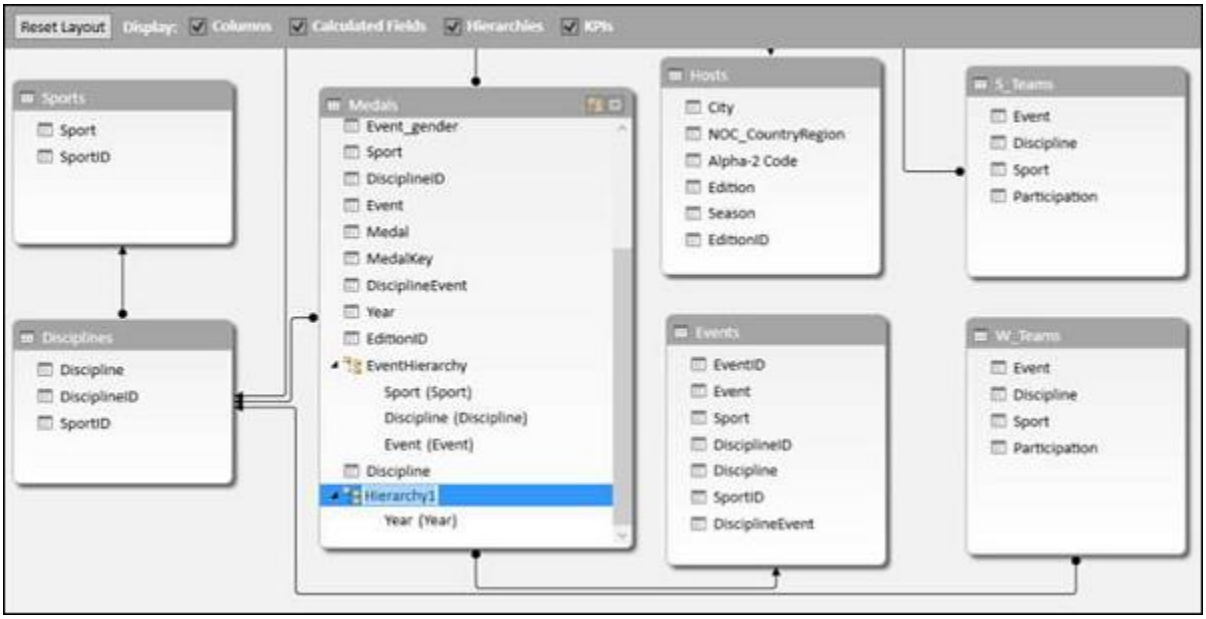


2. Another way of creating the same hierarchy is as follows:

- Right click on the field Year in the Medals data table in diagram view.
- Select Create Hierarchy from the dropdown list.



A new hierarchy is created in table with Year as a child field.



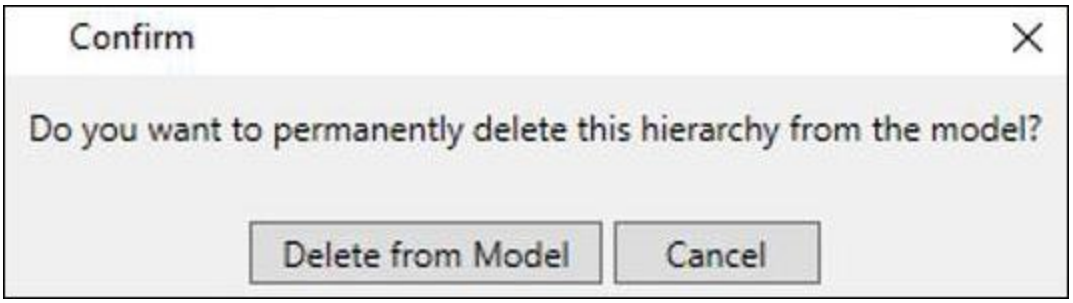
Drag the field season to the hierarchy. The hierarchy shows the child levels.

Deleting a Hierarchy

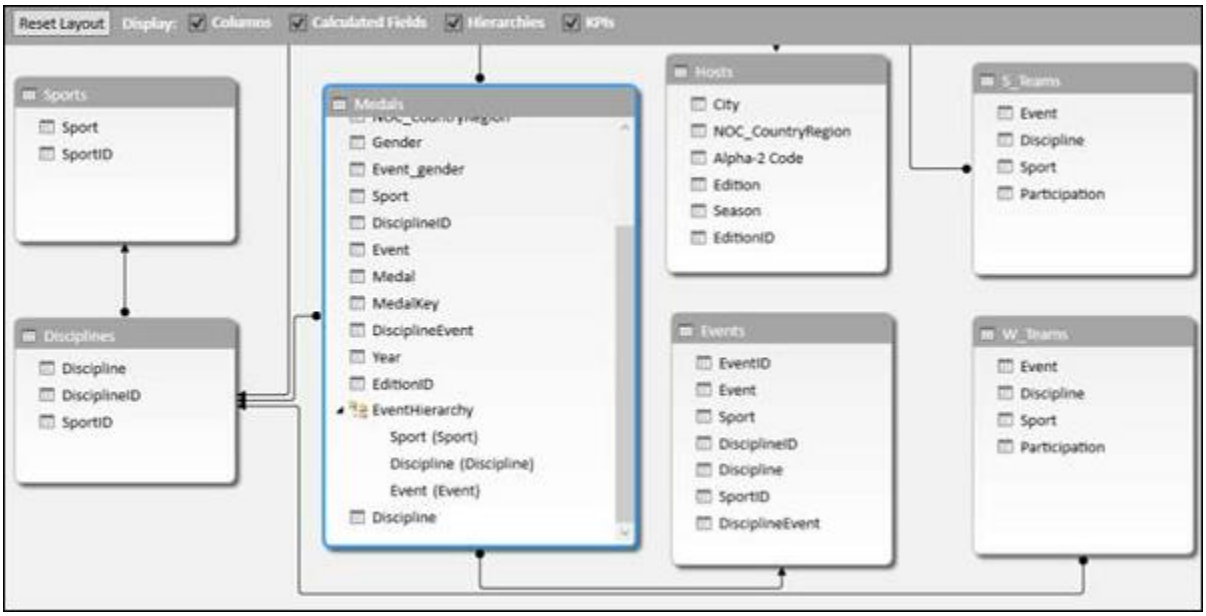
You can delete a hierarchy from the Data Model as follows:

- Right click on the hierarchy.
- Select Delete from the dropdown list.

The **Confirm** dialog box appears. Click **Delete from Model**.



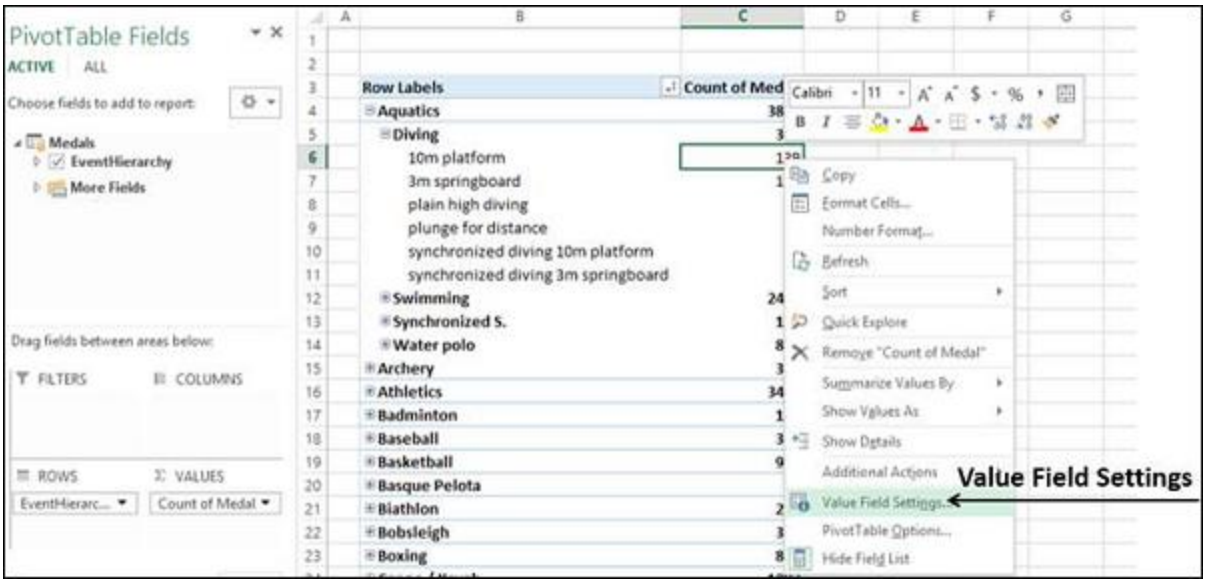
The hierarchy gets deleted.



Calculations Using Hierarchy

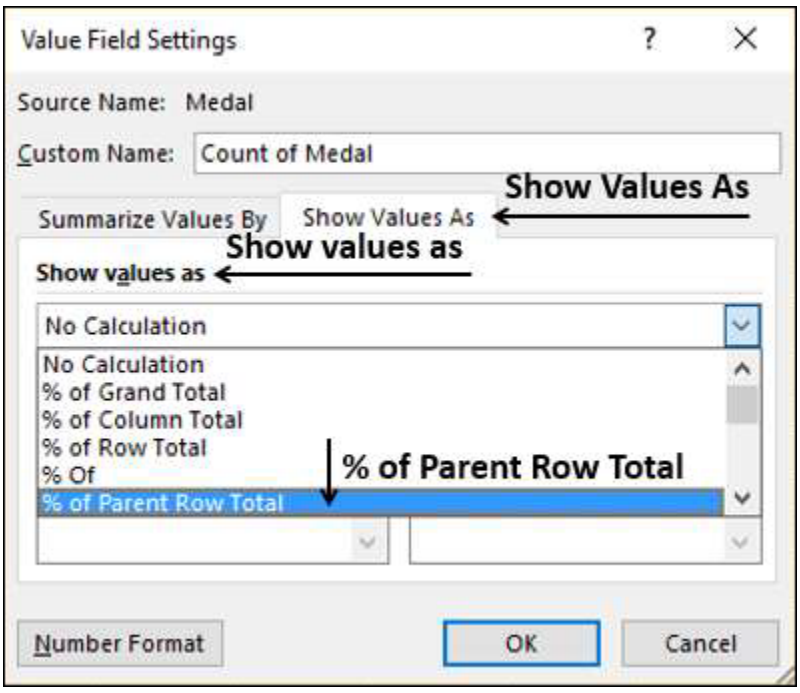
You can create calculations using a hierarchy. In the EventsHierarchy, you can display the number of medals at a child level as a percentage of the number of medals at its parent level as follows:

- Right click on a Count of Medal value of an Event.
- Select Value Field Settings from the dropdown list.

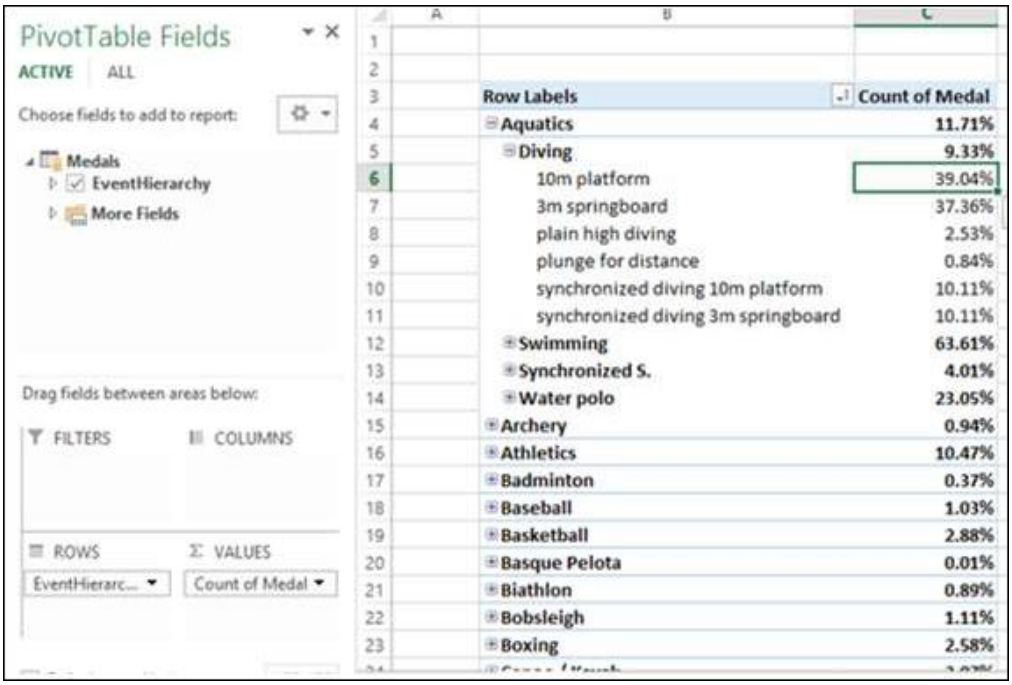


Value Field Settings dialog box appears.

- Click the **Show Values As** tab.
- Select % of Parent Row Total from the list and click OK.



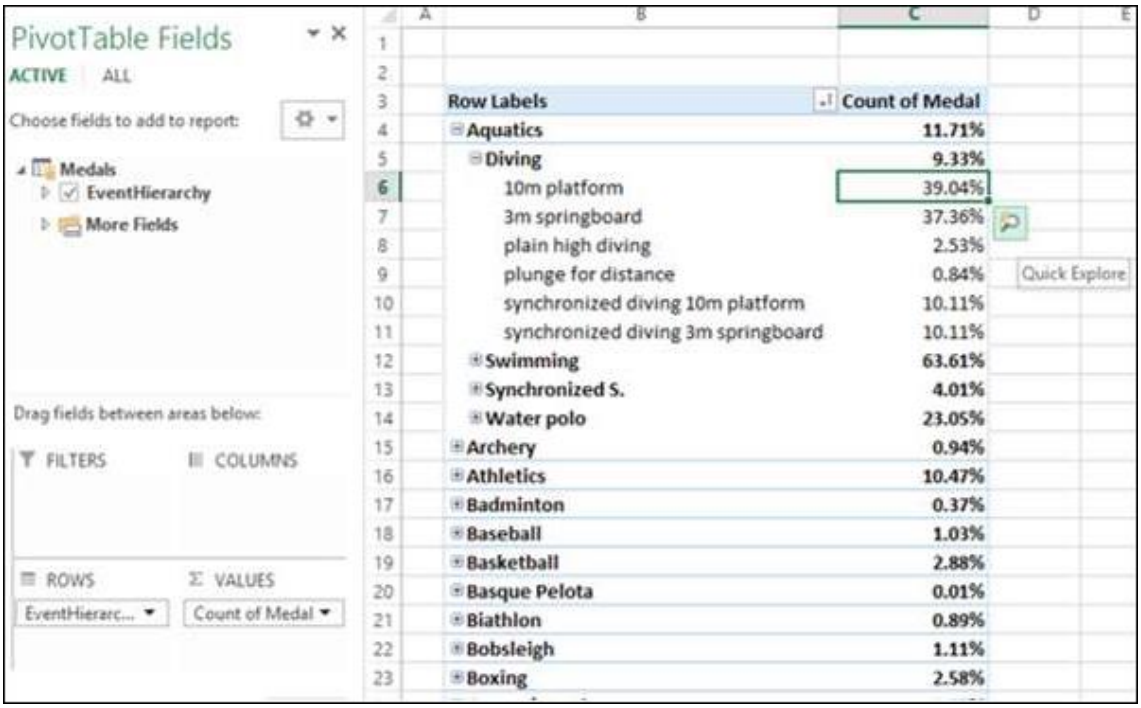
The child levels are displayed as the percentage of the Parent Totals. You can verify this by summing up the percentage values of the child level of a parent. The sum would be 100%.



Drilling Up and Drilling Down a Hierarchy

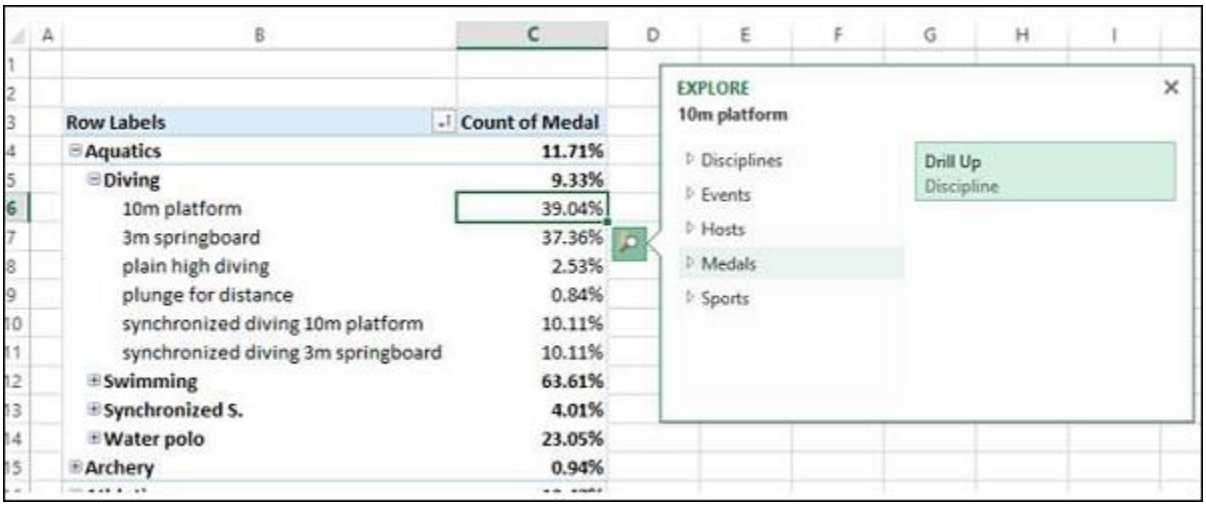
You can quickly drill up and drill down across the levels in a hierarchy using Quick Explore tool.

- Click on a value of Event field in the PivotTable.
- Click the Quick Explore tool - that appears at the bottom right corner of the cell containing the selected value.

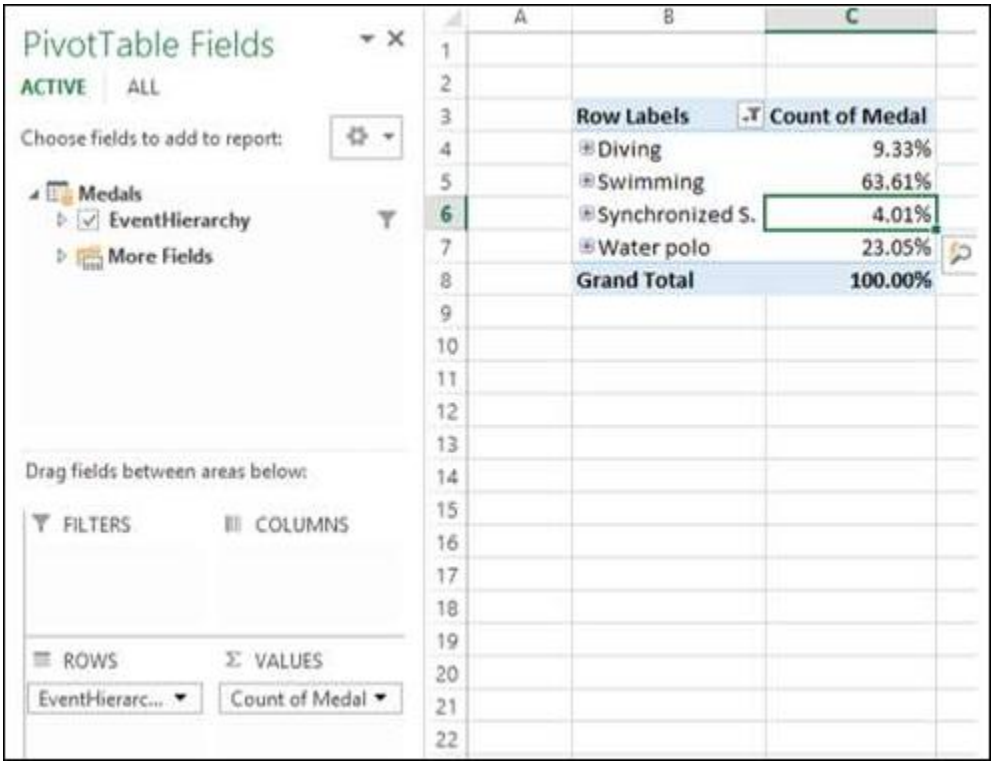


The **Explore box with Drill Up** option appears. This is because from Event you can only drill up as there are no child levels under it.

Click **Drill Up**.

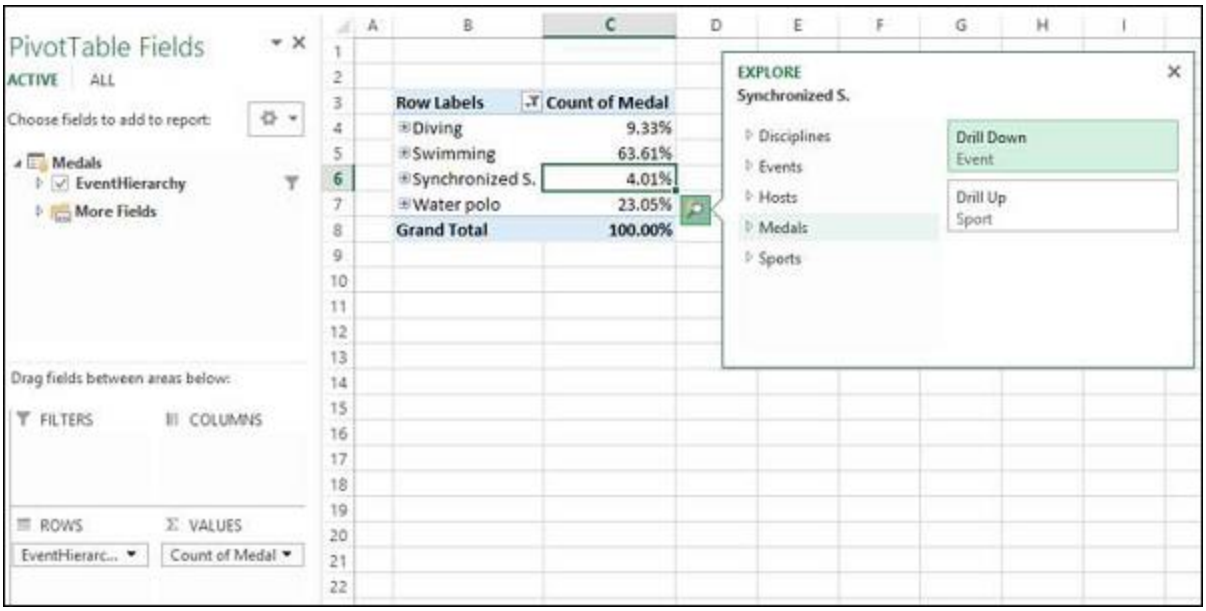


PivotTable data is drilled up to Discipline.



Click on the Quick Explore tool - that appears at the bottom right corner of the cell containing a value.

Explore box appears with Drill Up and Drill Down options displayed. This is because from Discipline you can drill up to Sport or drill down to Event.



This way you can quickly move up and down the hierarchy.

Aesthetic Reports

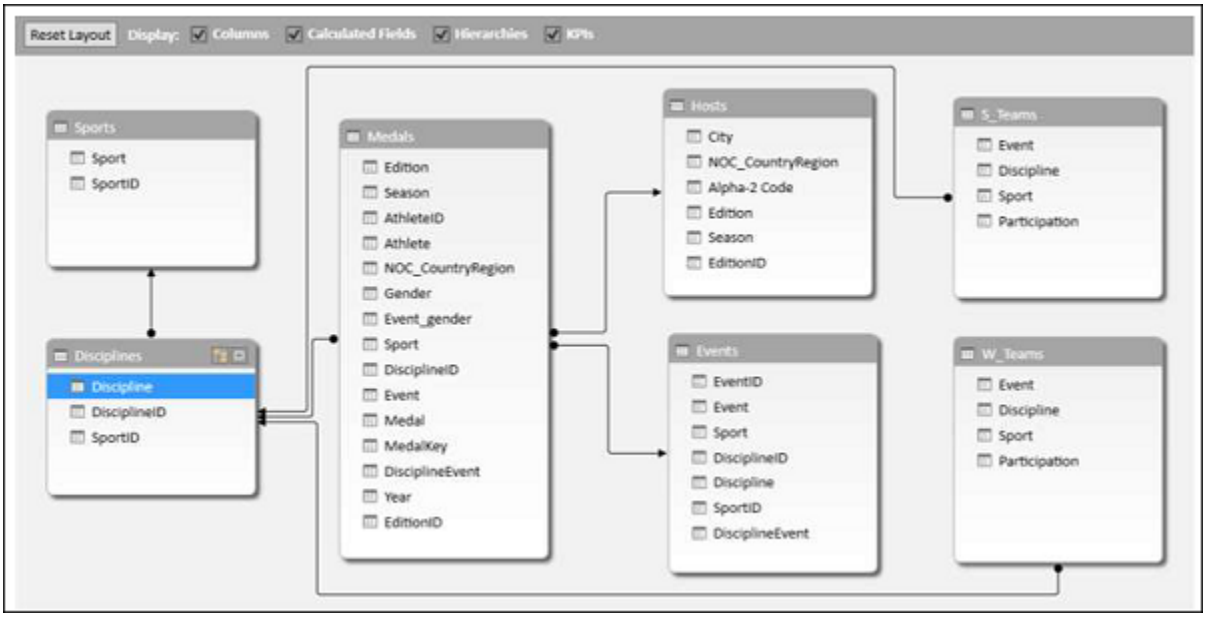
You can create aesthetic reports of your data analysis with Power Pivot Data that is in Data Model.

The important features are −

- You can use PivotCharts to produce visual reports of your data. You can use Report Layouts to structure your PivotTables to make them easily readable.
- You can insert Slicers for filtering data in the report.
- You can use a common Slicer for both the PivotChart and the PivotTable that are in the same report.
- Once your final report is ready, you can choose to hide the Slicers form the display.

You will learn how to get reports with the options that are available in Power Pivot in this module.

Consider the following Data Model for illustrations in this module.



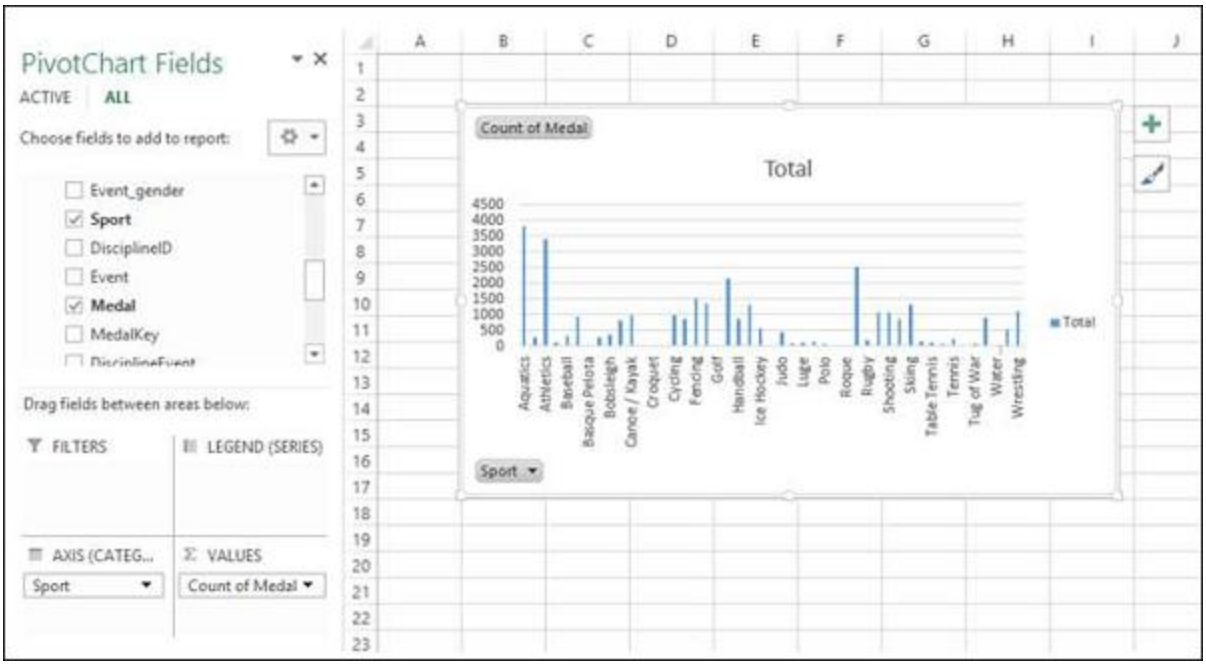
Reports based on Power PivotChart

Create a Power PivotChart as follows:

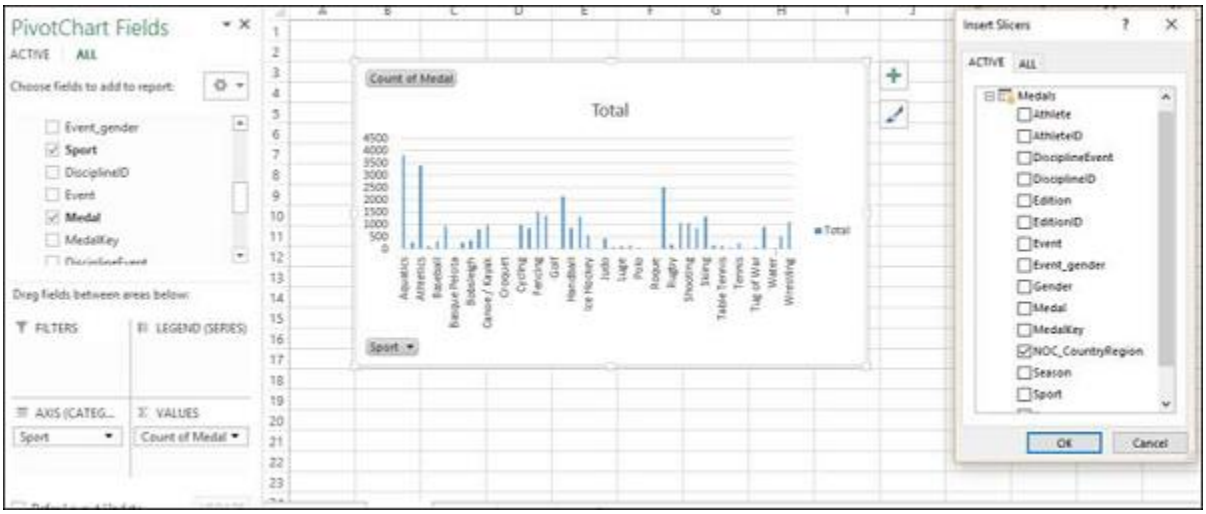
- Click the Home tab on the Ribbon in PowerPivot window.
- Click PivotTable.
- Select PivotChart from the dropdown list.
- Click **New Worksheet** in the Create PivotChart dialog box.

An empty PivotChart is created in a new worksheet in Excel window.

- Drag Sport from Medals table to Axis area.
- Drag Medal from Medals Table to ∑ VALUES area.

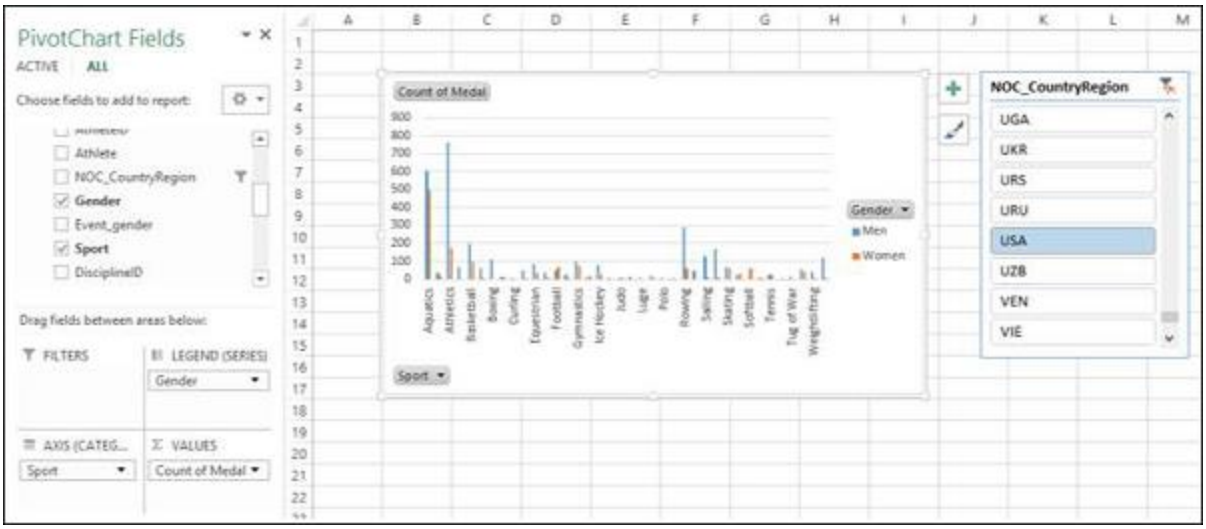


- Click the ANALYZE tab in PIVOTTABLE TOOLS on the Ribbon.
- Click Insert Slicer in the Filter Group. The Inset Slicers dialog box appears.
- Click the field **NOC_CountryRegion** in the Medals table.
- Click OK.

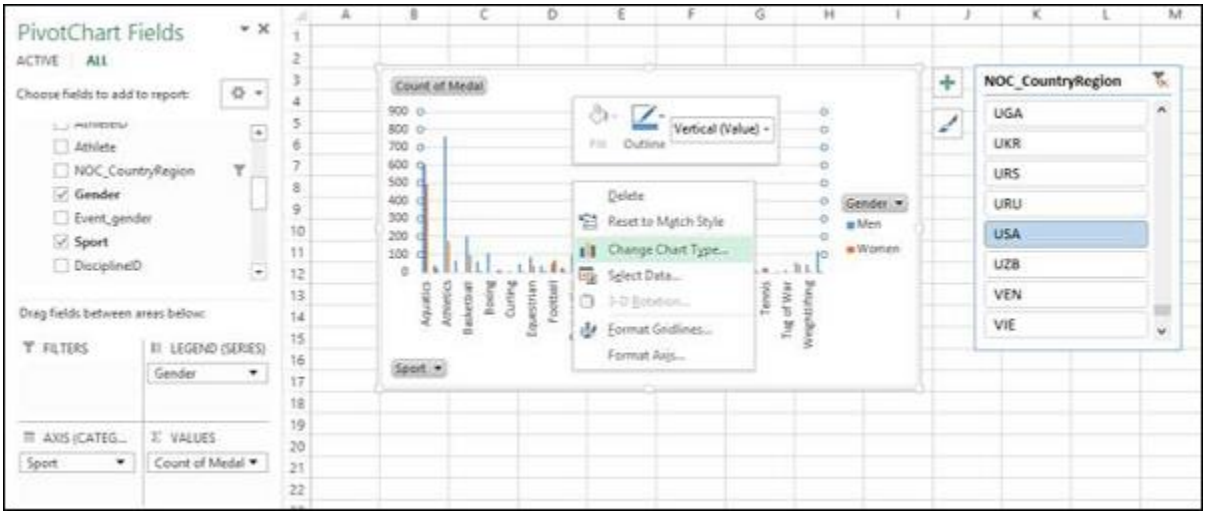


The Slicer NOC_CountryRegion appears.

- Select USA.
- Drag Gender from Medals table to GENDER area.

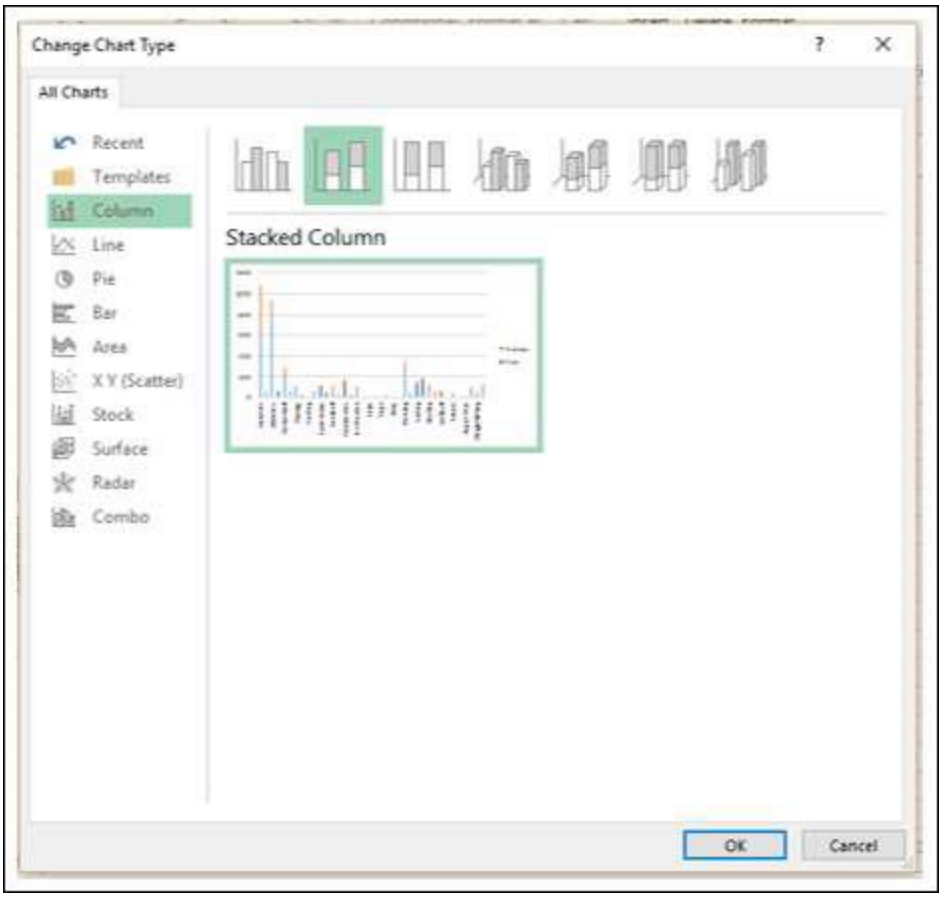


- Right click on the PivotChart.
- Select Change Chart Type from the dropdown list.

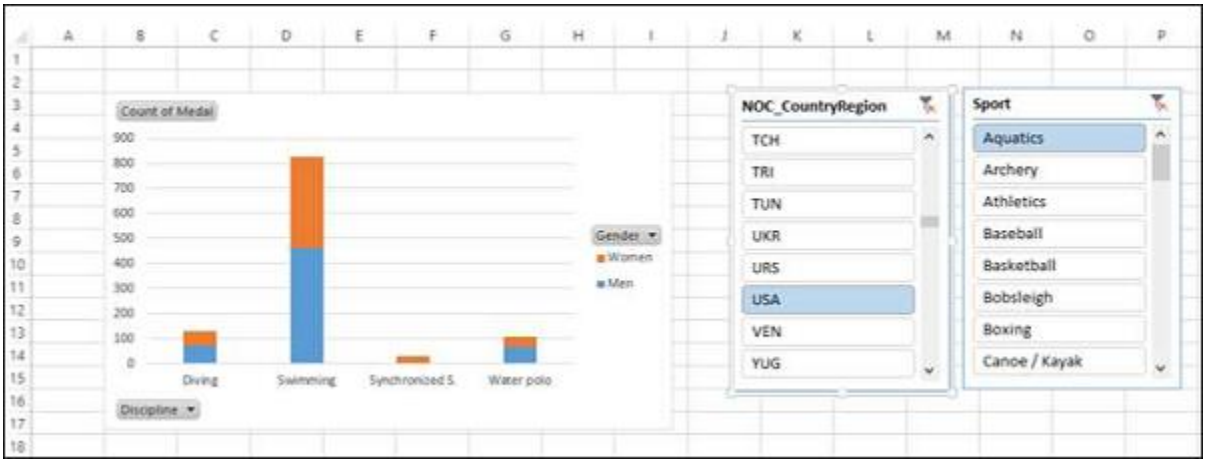


The Change Chart Type dialog box appears.

Click on Stacked Column.



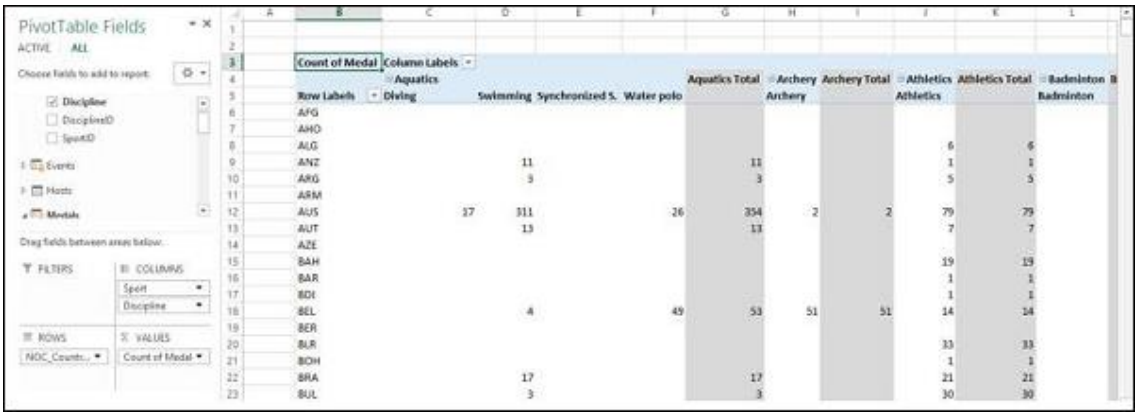
- Insert Slicer for Sport field.
- Drag Discipline from Disciplines table to AXIS area.
- Remove the field Sport from AXIS area.
- Select Aquatics in the Slicer – Sport.



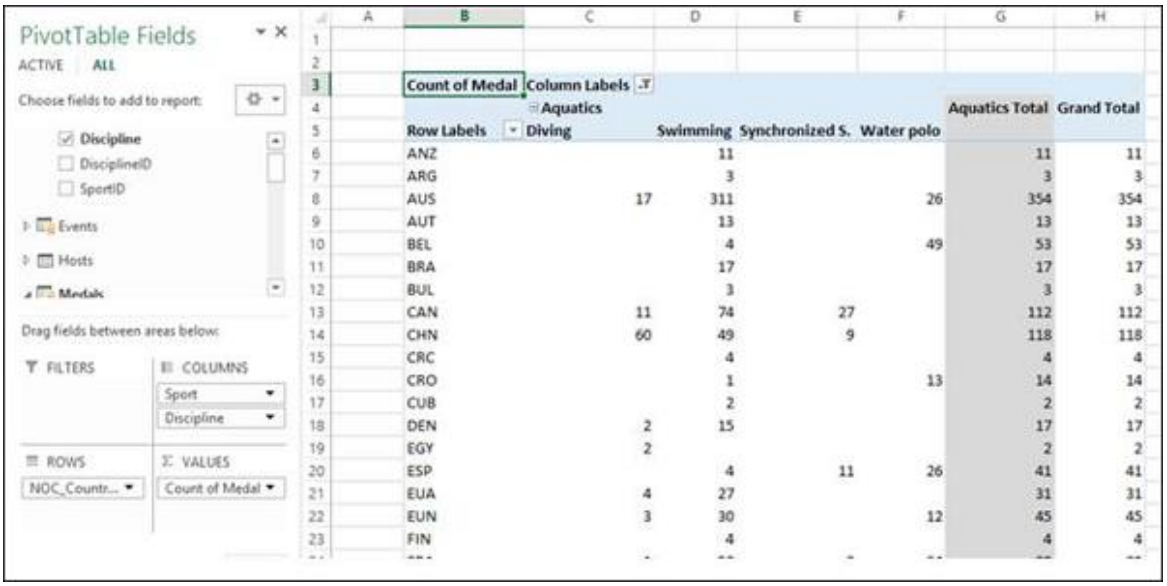
Report Layout

Create PivotTable as follows:

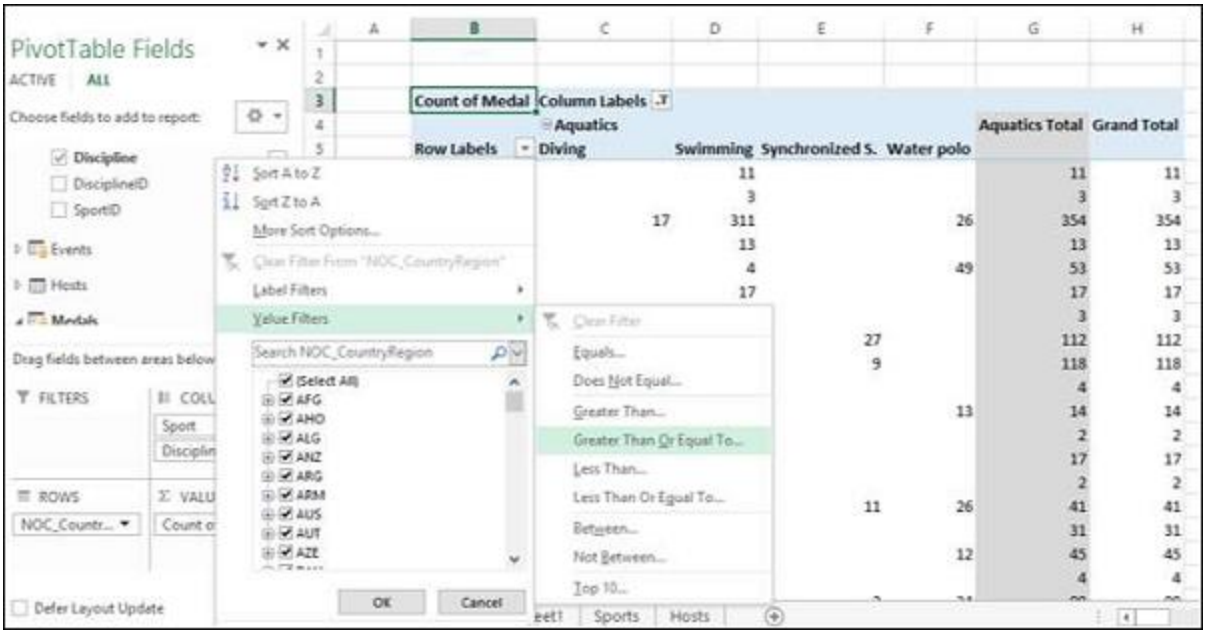
- Click on Home tab on the Ribbon in PowerPivot window.
- Click on PivotTable.
- Click on PivotTable in the dropdown list. The Create PivotTable dialog box appears.
- Click on New Worksheet and click Ok. An empty PivotTable gets created in a new worksheet.
- Drag NOC_CountryRegion from Medals table to AXIS area.
- Drag Sport from Medals table to COLUMNS area.
- Drag Discipline from Disciplines table to COLUMNS area.
- Drag Medal to ∑ VALUES area.



Click on the arrow button next to Column Labels and select Aquatics.



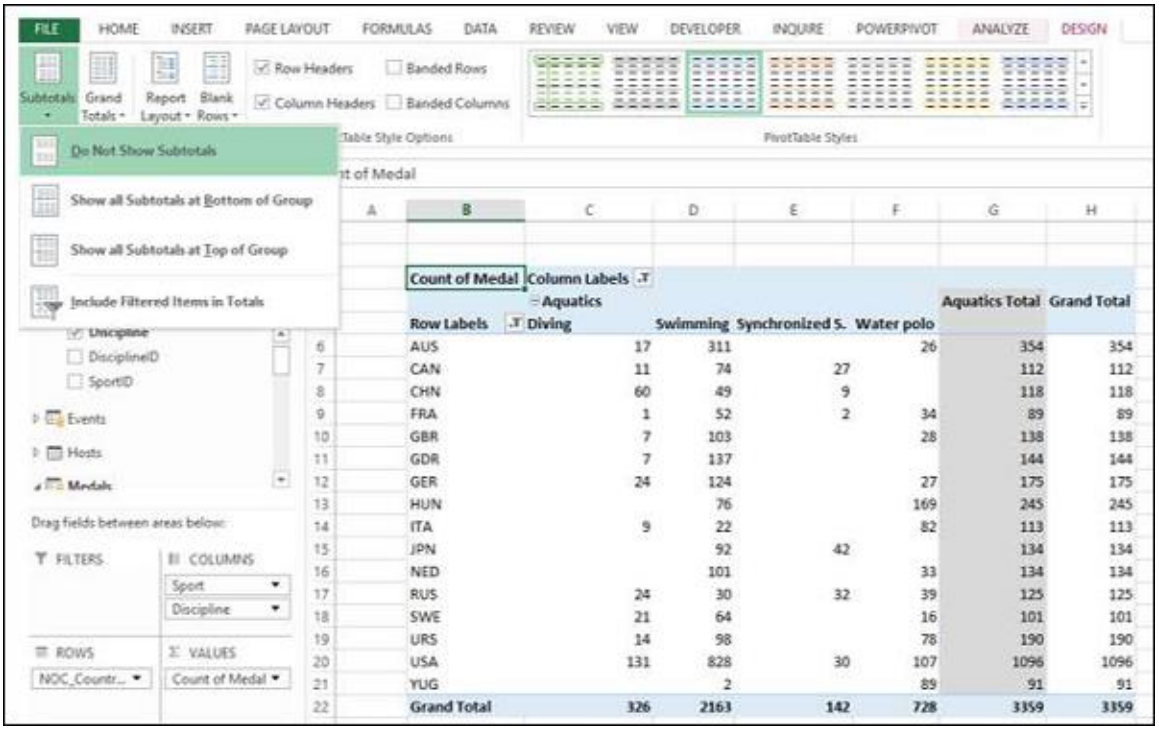
- Click on the arrow button next to Row Labels.
- Select Value Filters from the dropdown list.
- Select Greater Than Or Equal To from the second dropdown list.



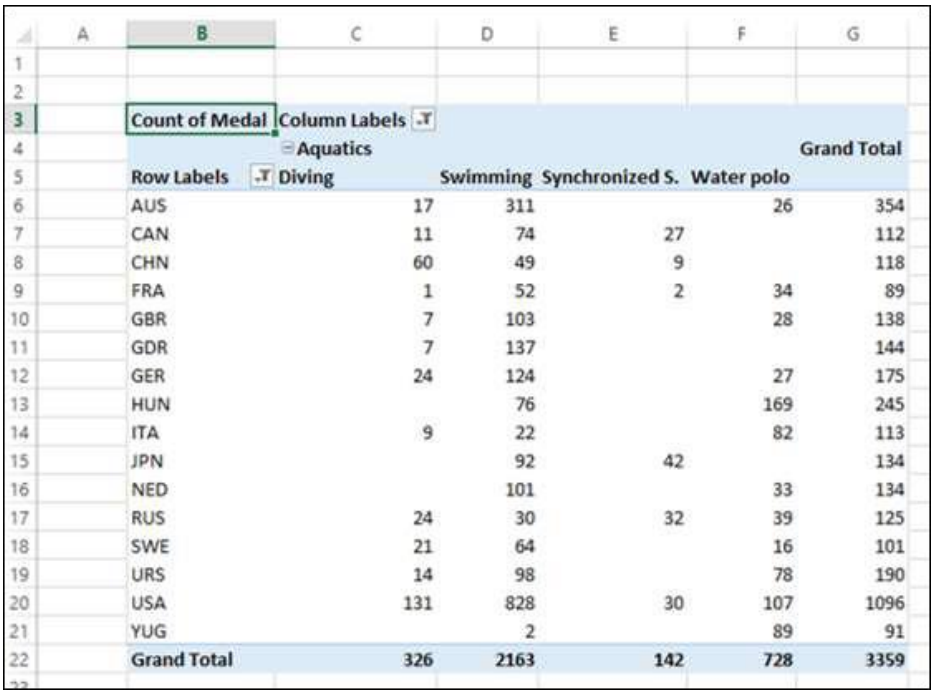
Type 80 in the box next to Count of Medal is greater than or equal to in the Value Filter dialog box.

Count of Medal	Column Labels					
	Aquatics				Aquatics Total	Grand Total
Row Labels	Diving	Swimming	Synchronized S.	Water polo		
AUS	17	311		26	354	354
CAN	11	74	27		112	112
CHN	60	49	9		118	118
FRA	1	52	2	34	89	89
GBR	7	103		28	138	138
GDR	7	137			144	144
GER	24	124		27	175	175
HUN		76		169	245	245
ITA	9	22		82	113	113
JPN		92	42		134	134
NED		101		33	134	134
RUS	24	30	32	39	125	125
SWE	21	64		16	101	101
URS	14	98		78	190	190
USA	131	828	30	107	1096	1096
YUG		2		89	91	91
Grand Total	**326**	**2163**	**142**	**728**	**3359**	**3359**

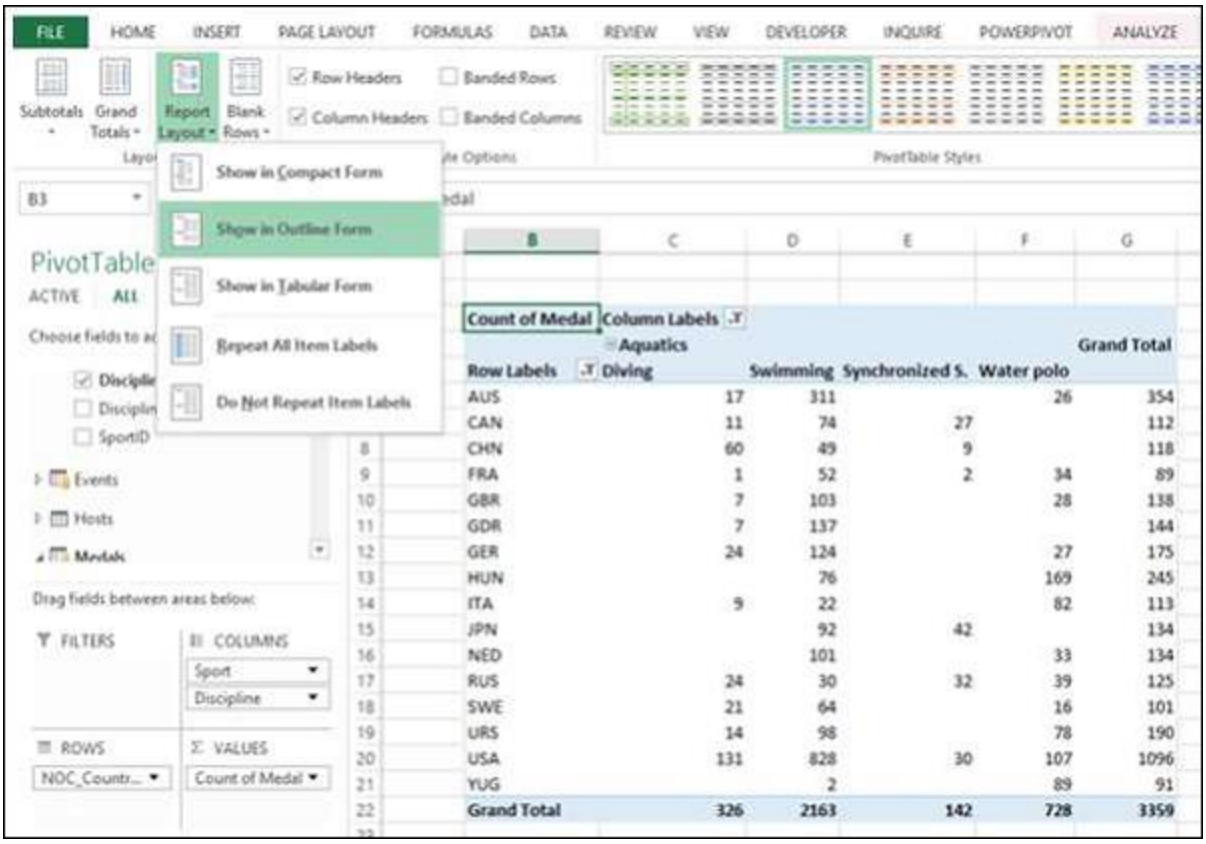
- Click the DESIGN tab in PIVOTTABLE TOOLS on the Ribbon.
- Click on Subtotals.
- Select **Do Not Show Subtotals** fromn the dropdown list.



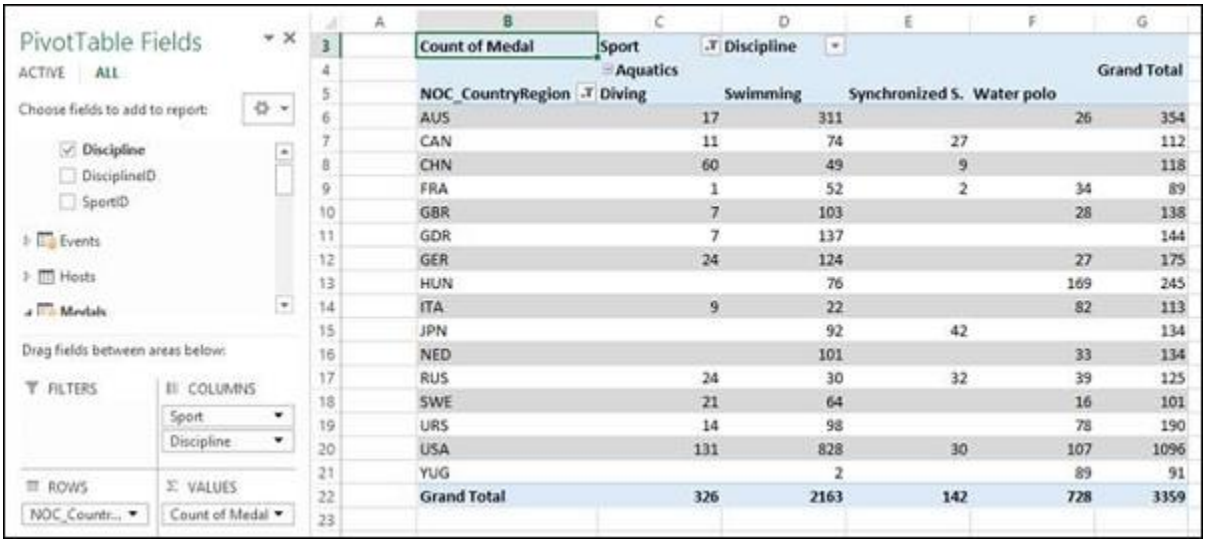
The Subtotals column – Aquatics Total gets removed.



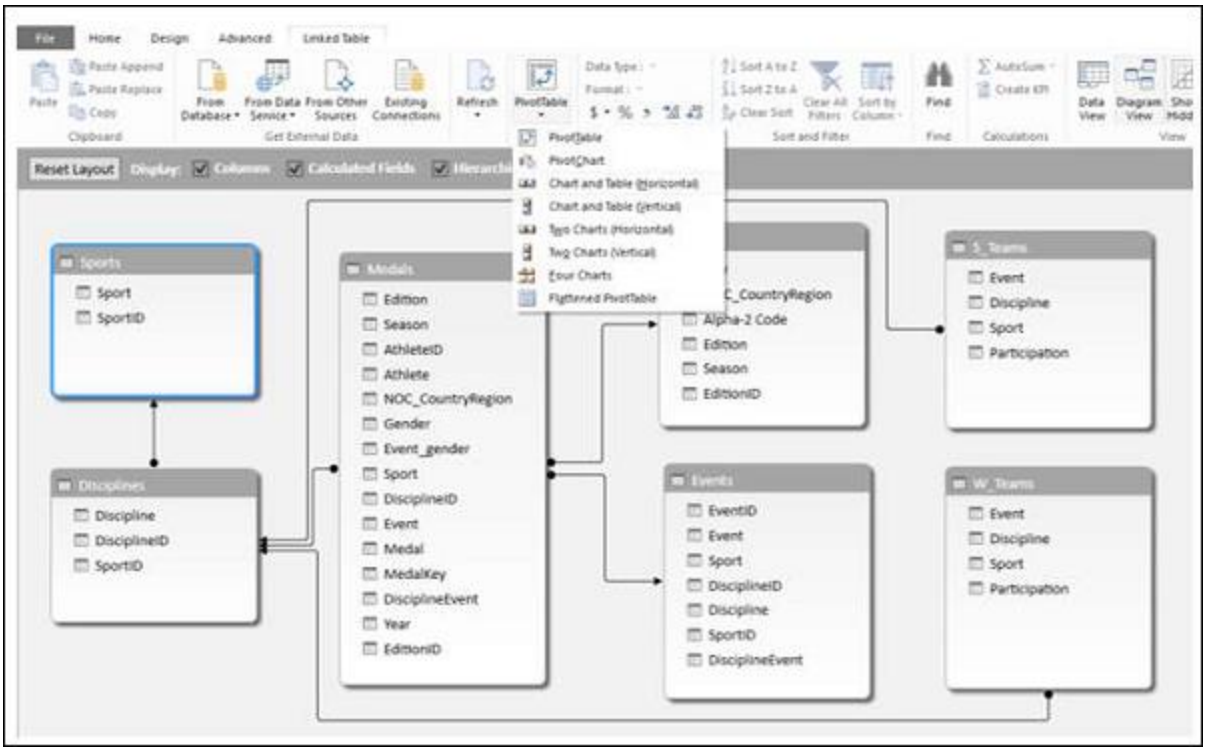
Click Report Layout and select **Show in Outline Form** from the dropdown list.



Check the box Banded Rows.



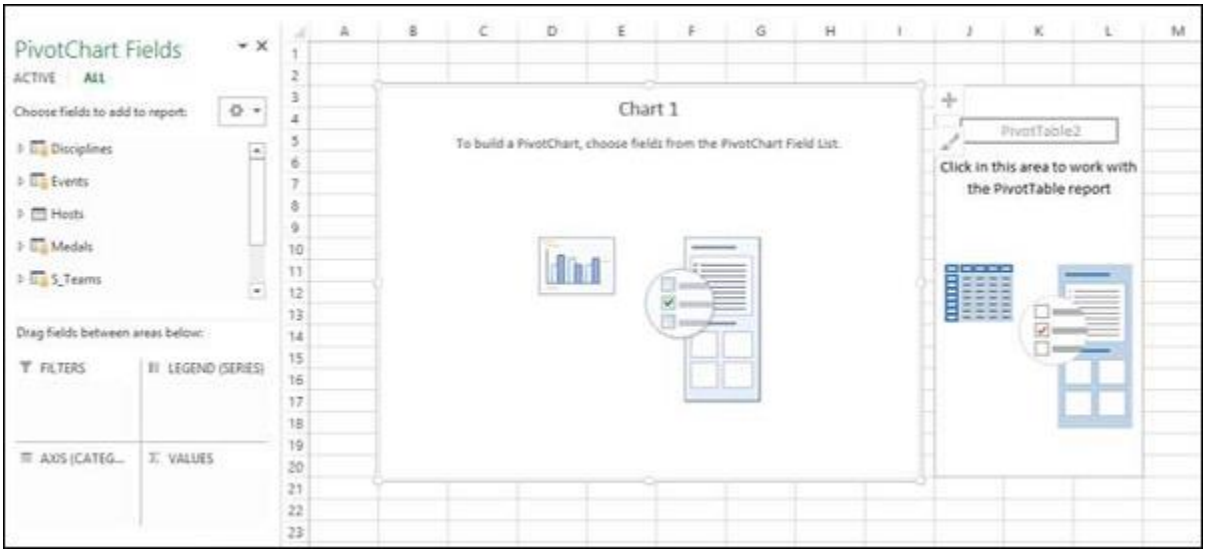
The field names appear in place of Row Labels and Column Labels and the report looks self-explanatory.



Using a Common Slicer

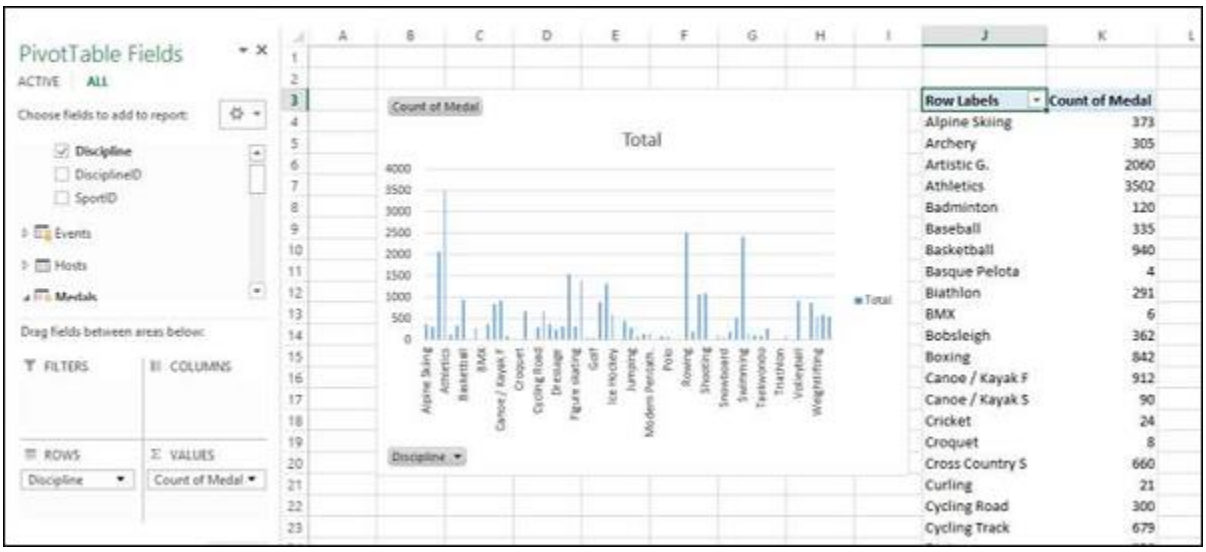
Create a PivotChart and PivotTable next to each other.

- Click the Home tab on the Ribbon in PowerPivot tab.
- Click PivotTable.
- Select Chart and Table (Horizontal) from the dropdown list.

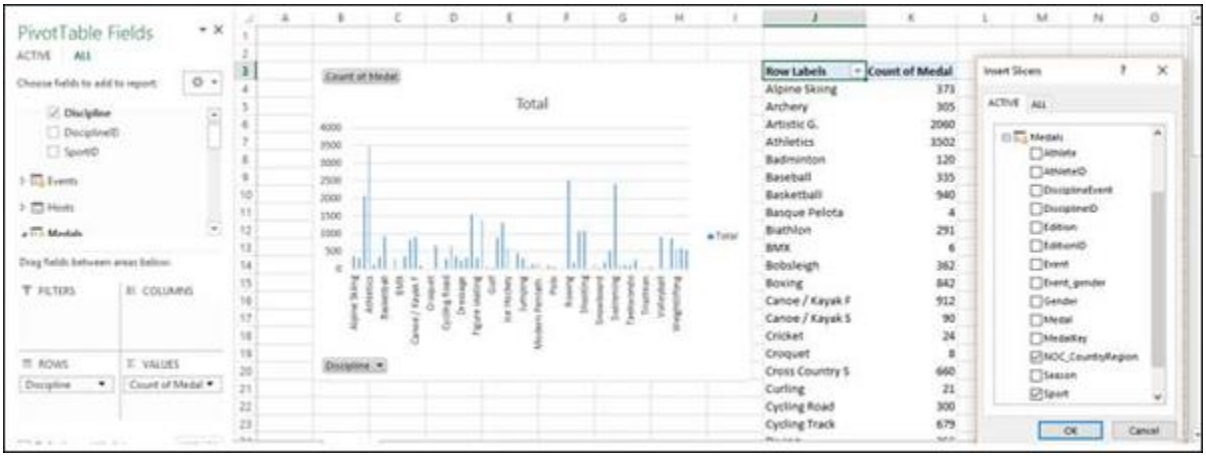


The Create PivotChart and PivotTable (Horizontal) dialog box appears.

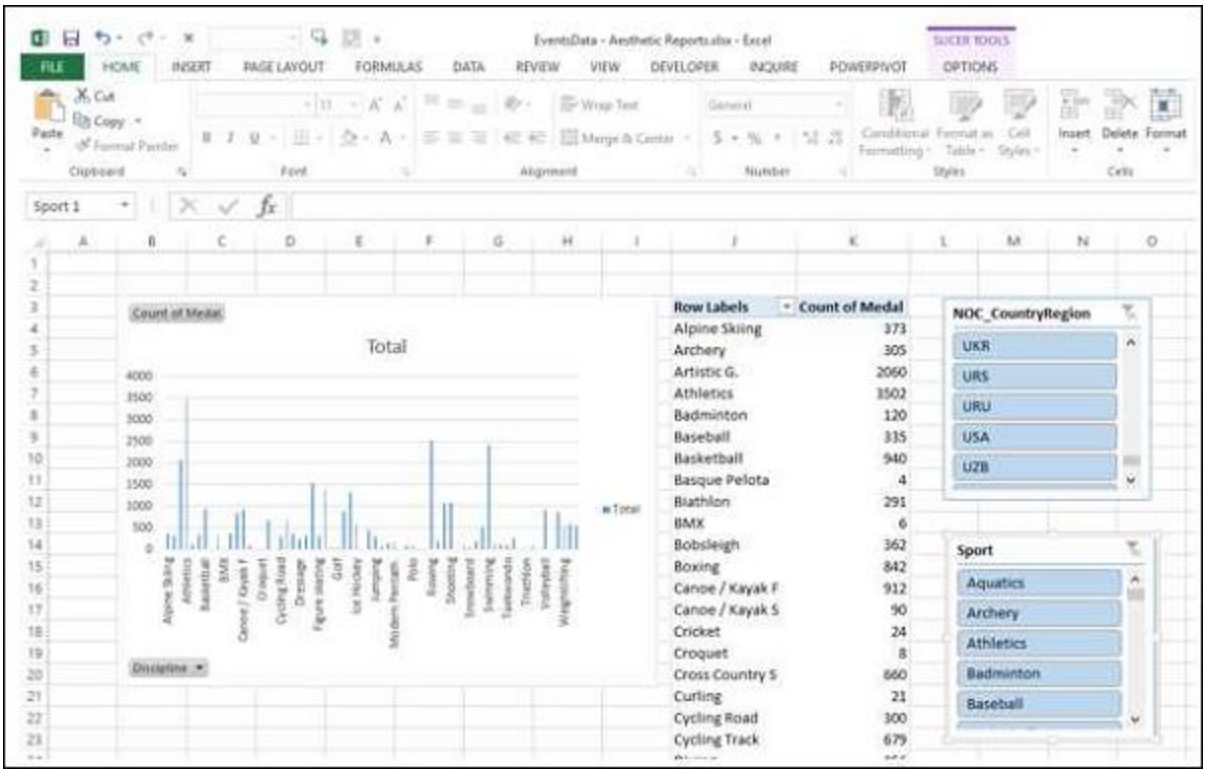
Select New Worksheet and click OK. An Empty PivotChart and an empty PivotTable appear next to each other in a new worksheet.



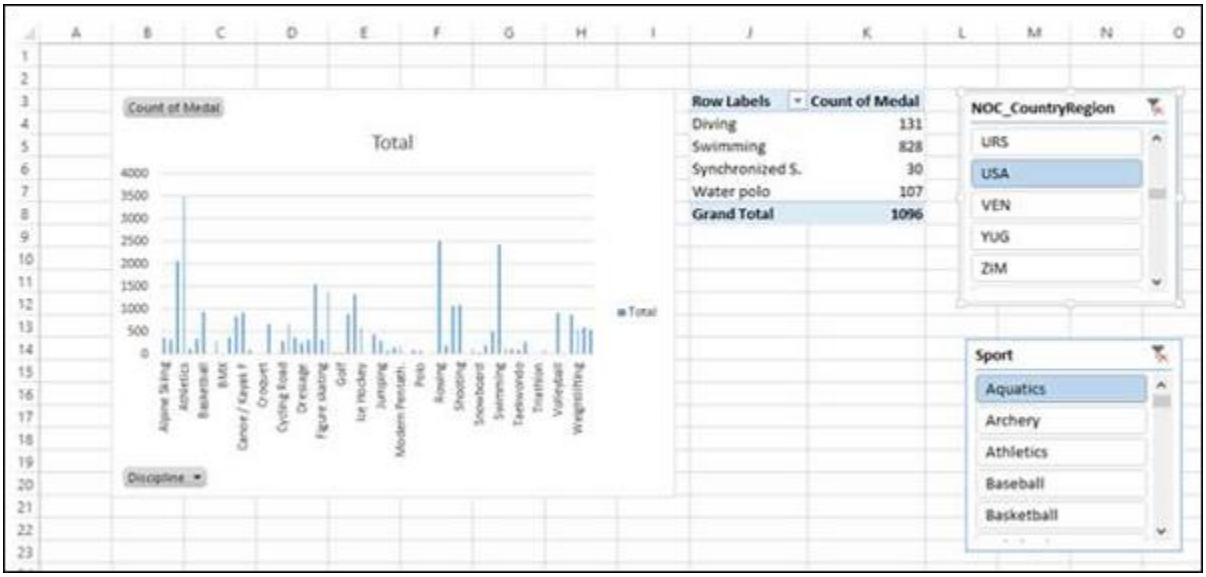
- Click PivotChart.
- Drag Discipline from Disciplines table to AXIS area.
- Drag Medal from Medals table to ∑ VALUES area.
- Click PivotTable.
- Drag Discipline from Disciplines table to ROWS area.
- Drag Medal from Medals table to ∑ VALUES area.



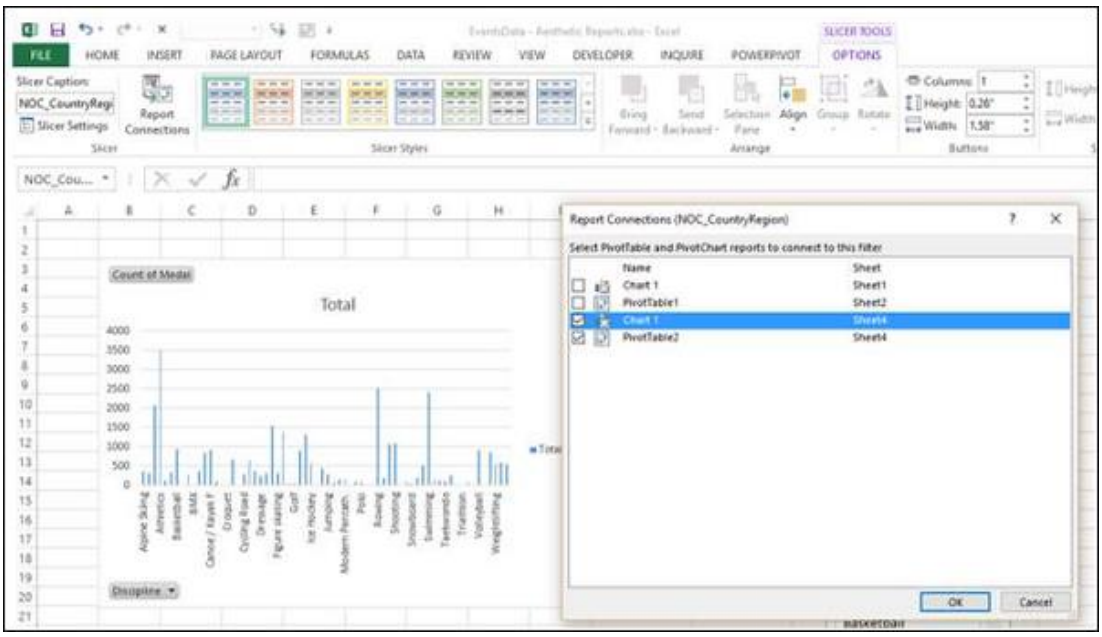
- Click the ANALYZE tab in PIVOTTABLE TOOLS on the Ribbon.
- Click Insert Slicer. The Insert Slicers dialog box appears.
- Click on NOC_CountryRegion and Sport in Medals table.
- Click OK.



Two Slicers – NOC_CountryRegion and Sport appear. Arrange and size them to align properly next to the PivotTable.

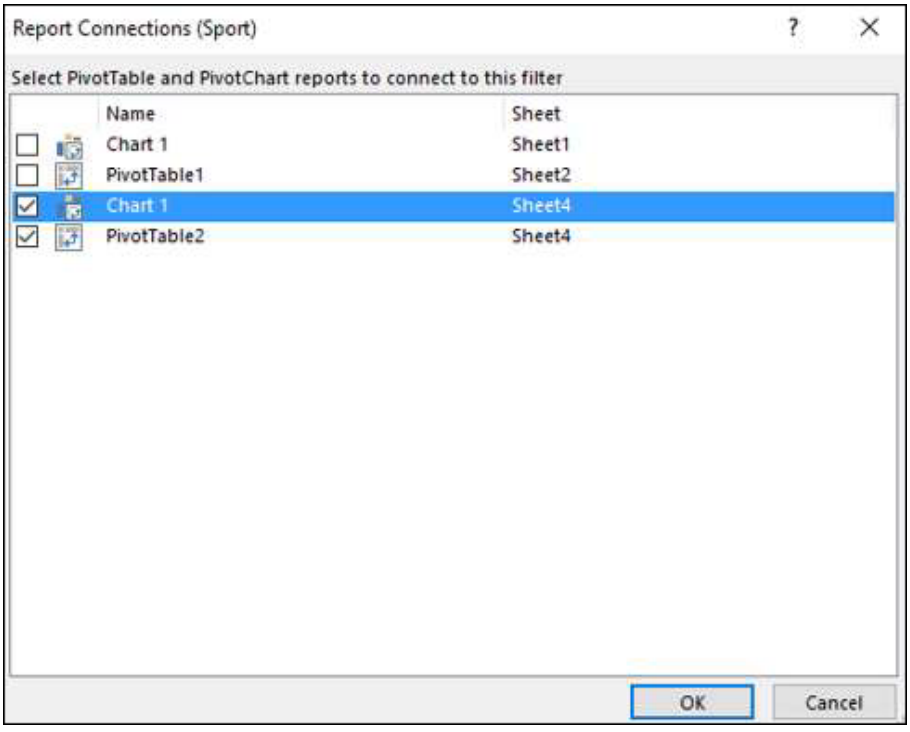


- Select USA in the NOC_CountryRegion Slicer.
- Select Aquatics in the Sport Slicer. The PivotTable is filtered to the selected values.



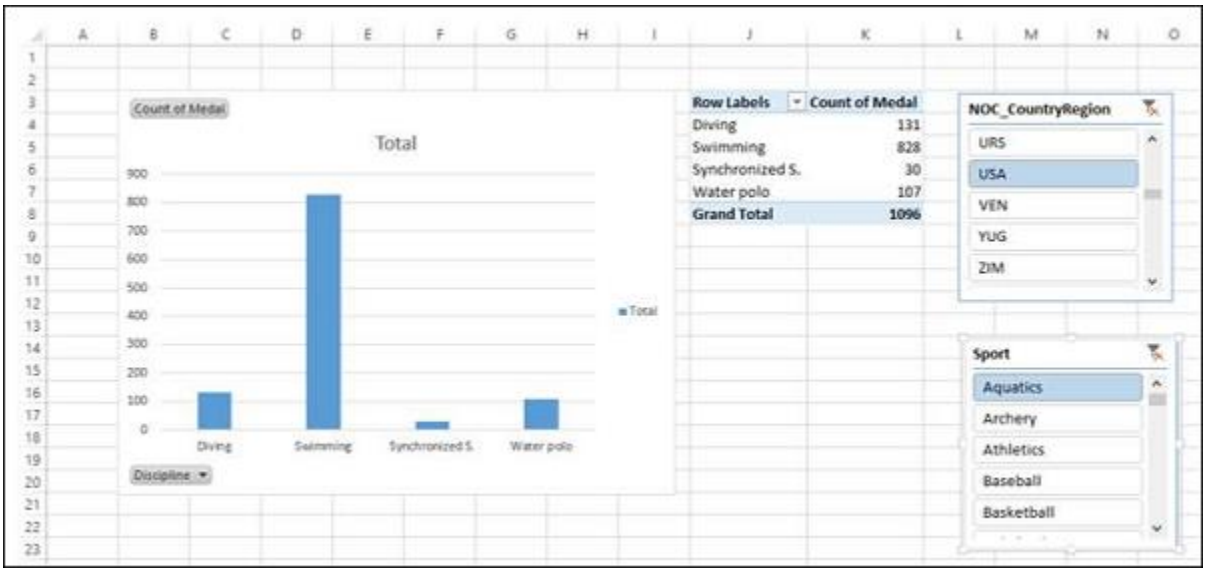
As you can observe, the PivotChart is not filtered. To filter PivotChart with the same filters, you need not insert Slicers again for PivotChart. You can use the same Slicers that you have used for the PivotTable.

- Click on **NOC_CountryRegion** Slicer.
- Click the **OPTIONS** tab in **SLICER TOOLS** on the Ribbon.
- Click **Report Connections** in the Slicer group. The **Report Connections** dialog box appears for the NOC_CountryRegion Slicer.

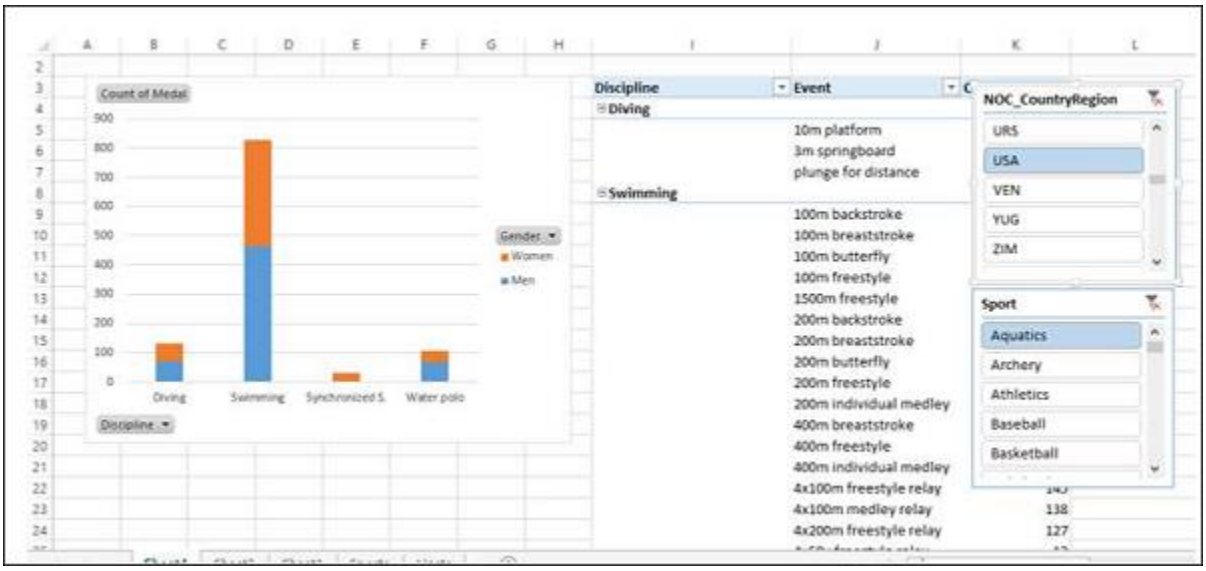


You can see that all the PivotTables and PivotCharts in the workbook are listed in the dialog box.

- Click on the PivotChart that is in the same worksheet as the selected PivotTable and click OK.
- Repeat for Sport Slicer.



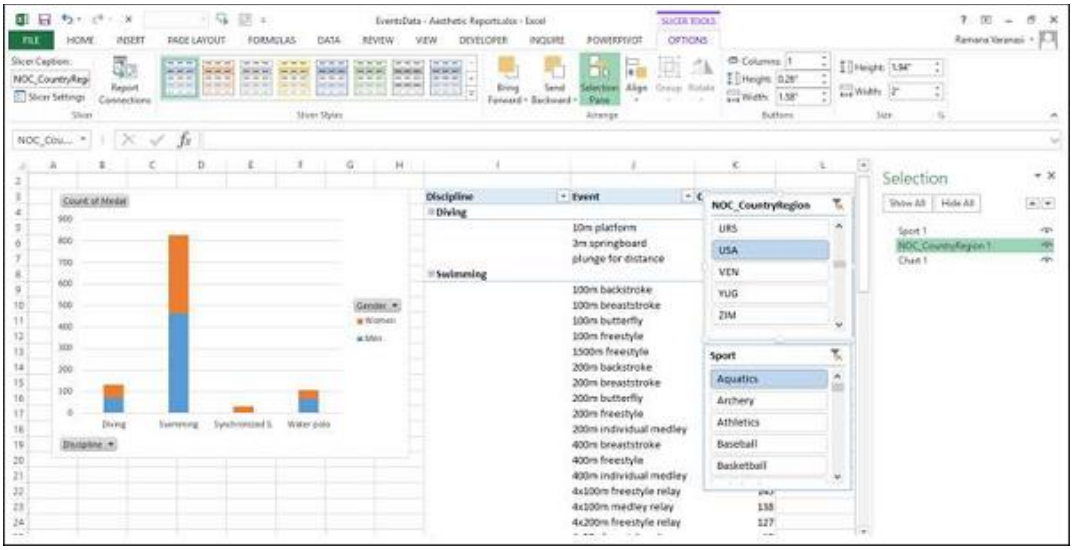
The PivotChart is also filtered to the values selected in the two Slicers.



Next, you can add details to the PivotChart and PivotTable.

- Click the PivotChart.
- Drag Gender to LEGEND area.
- Right click on the PivotChart.

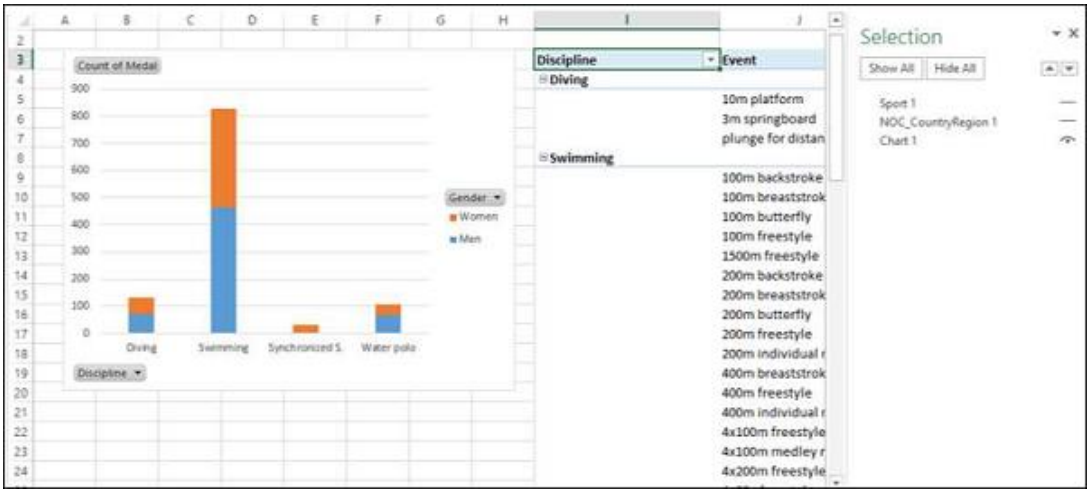
- Select Change Chart Type.
- Select Stacked Column in the Change Chart Type dialog box.
- Click on the PivotTable.
- Drag Event to ROWS area.
- Click the DESIGN tab in PIVOTTABLE TOOLS on the Ribbon.
- Click Report Layout.
- Select Outline Form from the dropdown list.



Selecting Objects for Display in the Report

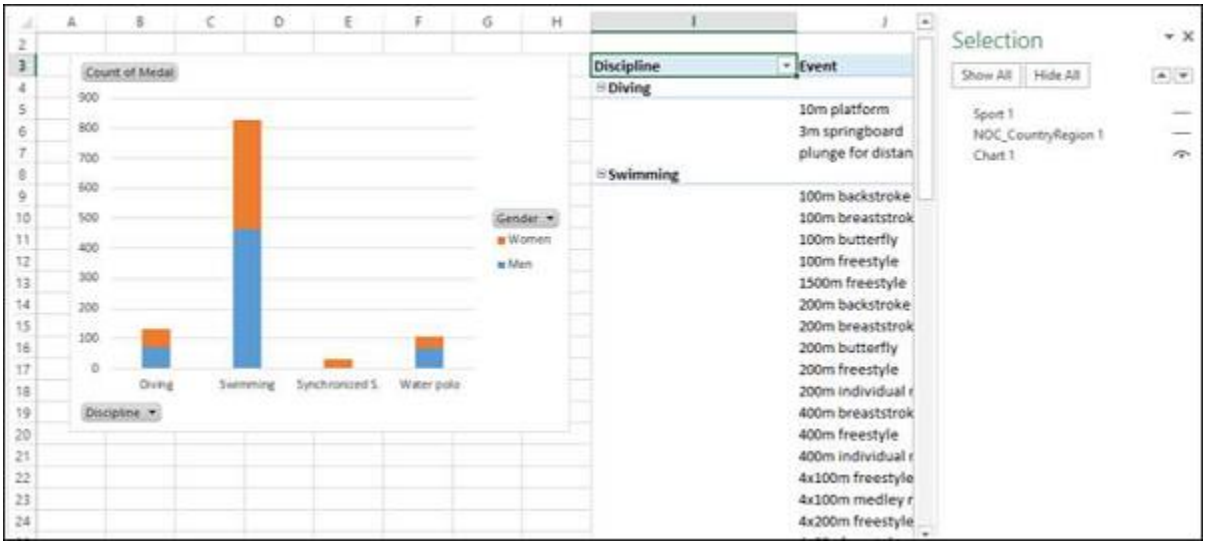
You can choose not to display the Slicers on the final Report.

- Click the **OPTIONS** tab in **SLICER TOOLS** on the Ribbon.
- Click Selection Pane in Arrange group. The Selection Pane appears on the right side of the window.

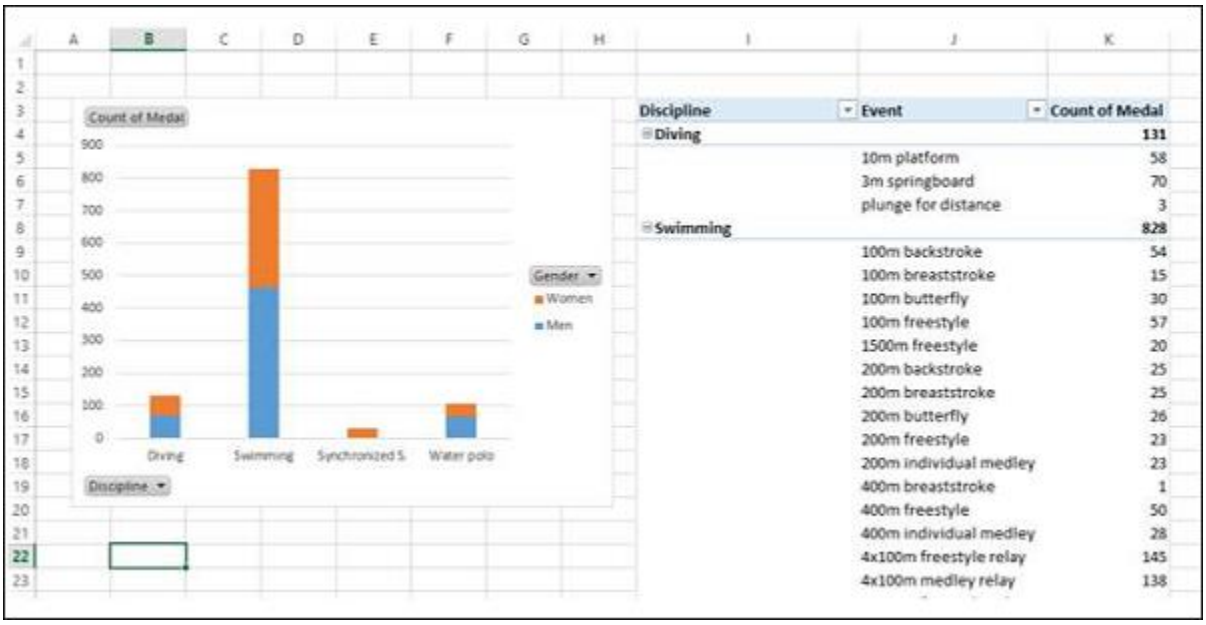


As you can observe, the symbol appears next to the objects in the Selection Pane. This means those objects are visible.

- Click on symbol next to NOC_CountryRegion.
- Click on symbol next to Sport. The symbol is changed to for both. This means the visibility for the two Slicers is off.



Close the Selection Pane.



You can see that the two Slicers are not visible in the Report.