Microsoft

Power BI

►Lab 02

Exploring Power Query
in Excel 2013

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About the Author

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Lab Overview

Introduction

In this lab, you will extend the Power Pivot workbook created in **Lab 01** with additional data to enable the analysis of sales per capita. The additional data will consist of population by state, sourced from a web page based on data from the United States Census Bureau.

The principal goal of this lab is to query and transform the web data by using Power Query, and to add the query to the existing workbook data model (created in **Lab 01**). Once added, the query result – in the form of data model table – will be used to extend the data model with new calculated fields to enable the sales per capita analysis.

Finally, you will create a PivotTable report. The final report will look like the following.

	A	B	C	D
1		Calendar	CY2013	
2				
3		**Row Labels**	**Sales**	**Sales per Capita**
4		Delaware	$836,916.00	$0.95
5		North Dakota	$498,343.00	$0.77
6		Vermont	$448,456.00	$0.72
7		Alaska	$460,082.00	$0.66
8		Montana	$638,502.00	$0.65
9		South Dakota	$496,291.00	$0.61
10		Rhode Island	$606,226.00	$0.58
11		Maine	$589,784.00	$0.45
12		West Virginia	$767,962.00	$0.42
13		Idaho	$627,918.00	$0.41
14		New Hampshire	$534,152.00	$0.40
15		Nebraska	$668,060.00	$0.37
16		Arkansas	$917,476.00	$0.32
17		New Mexico	$589,922.00	$0.29
18		Wyoming	$149,363.00	$0.27
19		Kansas	$708,777.00	$0.25

Figure 1

Previewing the PivotTable Report

Objectives

The objectives of this exercise are to:

- Enable the Power Pivot Add-in

- Query and transform web data by using Power Query

- Extend an existing workbook data model with a Power Query query

- Enrich the workbook data model with new calculated fields

- Create a PivotTable report

Exercises

This hands-on lab comprises the following exercise:

1. Exploring Power Query

Estimated time to complete this lab: **30 minutes**

Exercise 1: Exploring Power Query

In this exercise, you will extend the Power Pivot workbook created in **Lab 01** with additional data to enable the analysis of sales per capita.

Task 1 – Opening and Exploring the Excel Workbook

1. To open Excel, on the taskbar, click the **Excel** program shortcut.

2. In Excel, click **Open Other Workbooks** (located at the bottom of the left panel).
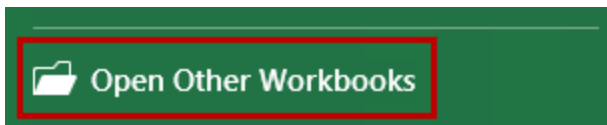
Figure 2
Identifying the Open Other Workbooks Command

3. Select **Computer**, and then click **Browse**.

4. In the **Open** window, navigate to the **D:\PowerBI\Lab02\Starter** folder.

5. Select the **Sales Analysis.xlsx** file, and then click **Open**.

> **Note:** This is the workbook completed in **Lab 01**.

6. If prompted with a security warning, click **Enable Content**.
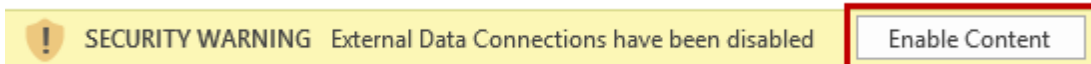
Figure 3
Enabling the Workbook Content

7. On the **File** ribbon tab (also known as the backstage view), select **Save As**, select **Computer**, and then click **Browse**.

8. In the **Save As** window, navigate to the **D:\PowerBI\Lab02** folder.

9. Click **Save**.

Task 2 – Enabling the Power Pivot Add-In

In this task, if necessary, you will enable the Power Pivot Add-in. In Excel 2013, by default, the Power Pivot Add-in is disabled.

1. If the **PowerPivot** ribbon tab is not available, on the **File** ribbon tab, select **Options**.

> **Note:** If the **PowerPivot** ribbon tab is available, there is no need to complete the steps in this task; continue the lab from **Task 3**.
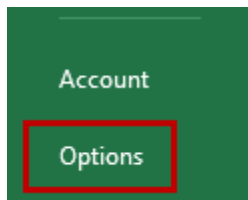
Figure 4
Locating the Options Option

2. In the **Excel Options** window, select the **Add-Ins** page.
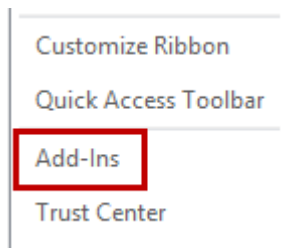
Figure 5
Locating the Add-Ins Page

3. In the **Manage** dropdown list, select **COM Add-Ins**, and then click **Go**.

4. In the **COM Add-Ins** window, select the **Microsoft Office PowerPivot for Excel 2013** add-in, and then click **OK**.

5. Notice the addition of the **PowerPivot** ribbon tab.

Task 3 – Exploring the Power Pivot Data Model

In this task, you will explore the design of the Power Pivot data model created in **Lab 01**.

1. On the **PowerPivot** ribbon tab, click **Manage**.
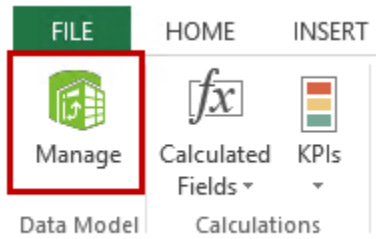
Figure 6
Launching the Power Pivot Window

2. If necessary, maximize the Power Pivot window.

3. To switch to Diagram View, on the **Home** ribbon tab, from inside the **View** group, click **Diagram View**.

4. Review the design of the data model, and in the **State** table, notice the absence of any population data to support the required sales per capita analysis.

5. To close the Power Pivot window, click the X button located at the top right corner.

Task 4 – Exploring Web Data

In this task, you will open a web page consisting of US Census sourced population data by state.

1. To open Internet Explorer, on the taskbar, click the **Internet Explorer** program shortcut.

2. Click the **Favorites** icon (located at the top right corner), and then select **US Resident Population – July 2009**.

Figure 7
Locating the Favorites Icon

3. Review the web page, and notice that it presents a table of US states together with population and rank columns. Notice also that the first row in the table is for the United States and so represents a total of all states.

4. To copy the web page URL to the clipboard, in the **URL** box, right-click the URL, and then select **Copy**.

Task 5 – Creating a Power Query Query

In this task, you will create a Power Query query to source data from the web page. You will then configure a series of steps to shape and filter the query. Finally, you will configure the query to load to the workbook data model.

1. Switch to the Excel.

2. On the **Power Query** ribbon tab, from inside the **Get External Data** group, click **From Web**.
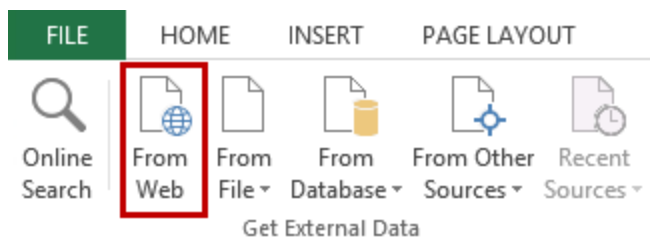
Figure 8
Retrieving Data From the Web

3. In the **From Web** window, to paste in the copied URL, right-click inside the **URL** box, and then select **Paste**.

4. Click **OK**.

5. In the **Navigator** pane, hover over the **Table 0** item to show the peek at the data preview.

> **Note:** The **Document** item represents the entire HTML document, and this can be queried also.

6. To create a Power Query sourced from an item, right-click the **Table 0** item, and then select **Edit**.

7. If necessary, maximize the **Query Editor** window.

8. In the **Query Editor** window, in the **Query Settings** pane (located at the right), in the **Name** box, replace the text with **StatePopulation**.

9. In the **Query Settings** pane, beneath the **Name** box, notice the **Applied Steps** list.

> **Note:** The query already consists of three steps. The first step retrieves the data from the web page source. The second step retrieves the data from the first item (**Table 0**), and the third step uses in-built intelligence to detect and transform data types.

10. In the **Applied Steps** list, notice that the **Changed Type** step is selected.

11. To show the formula bar, on the **View** ribbon tab, check **Formula Bar**.
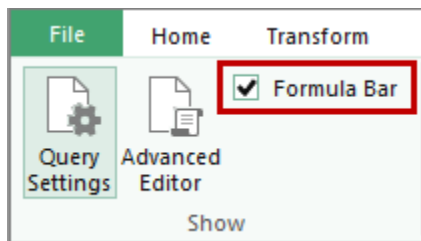
Figure 9
Showing the Formula Bar

12. Notice that the formula bar (located below the ribbon) includes an expression for the selected step to transform the column data types.

> **Note:** It is not important to understand the details of the formula.

13. Notice also that the data is available for data preview.

14. To remove the United States row (representing the total of all states), in the **State** column header, click ▾, and then in the filter box, commence typing the word **United**.

15. When the list reveals the **United States** item, uncheck the item, and then click **OK**.

16. Review the expression in the formula bar, and notice that the number of steps has increased to four.

> **Note:** You will notice that each shaping and filter activity applied to the query will result in a step. You will review and explore the steps in the **Applied Steps** list later in this task.

17. To rename the second column, right-click the **Number** column header, and then select **Rename**.

> **Note:** Transformation commands are also located on the ribbon. You can choose to apply the commands by using the technique that you prefer: From the ribbon, or by using a right-click to open a context-sensitive menu.

18. Replace the column name text with **CensusPopulation**, and then press **Enter**.

19. To remove the third column, right-click the **Rank** column header, and then select **Remove**.

20. In the **Query Settings** pane, review the applied steps.

21. Select the **Source** step, and then review the expression in the formula bar, and the data.

22. Select each subsequent step to review the step expressions and preview of data.

> **Note:** It is possible to delete any step (although, take care not to delete a step that a downstream steps depend on). It is also possible to modify the filters for a **Source** or **Filtered Rows** step.
>
> The steps reinforce that Power Query procedurally filters and shapes data to produce a transformed query result.

23. To close the query, on the **Home** ribbon tab, from inside the **Query** group, click the **Close & Load** dropdown arrow, and then select **Close & Load To**.
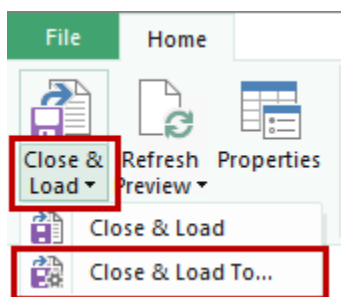

Figure 10
Locating the Close & Load To Command

24. In the **Load To** window, select the **Only Create Connection** option, and then check the **Add this Data to the Data Model** checkbox.
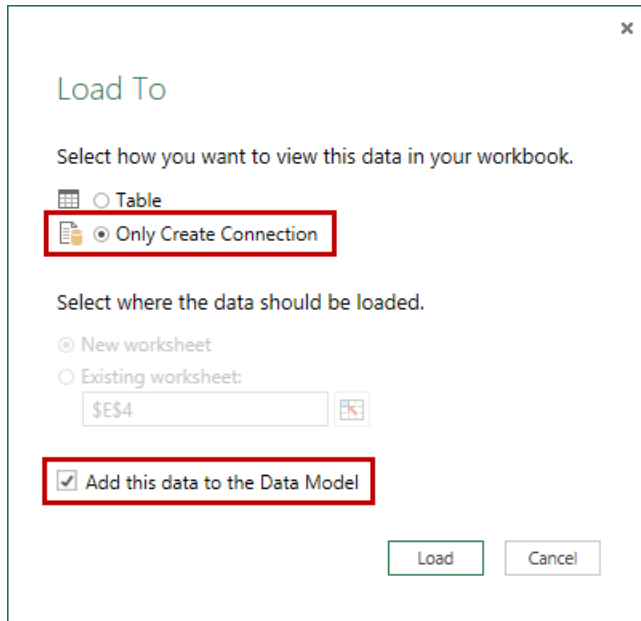

Figure 11
Reviewing the Load Settings

25. Click **Load**.

26. In Excel, in the **Workbook Queries** pane, notice the addition of the **StatePopulation** query, and notice also that 51 rows were loaded (consisting of the 50 states and the District of Columbia).

27. Hover over the **StatePopulation** query to show the peek at the data preview.

28. Review the preview data and notice the last refresh time, load settings and data sources.

Task 6 – Integrating the Power Query Table with the Workbook Data Model

In this task, you will integrate the Power Query **StatePopulation** table data with the **State** table. You will also investigate a data quality issue that will be addressed by using a Power Query transformation in the next task.

1. On the **PowerPivot** ribbon tab, click **Manage**.

2. In the PowerPivot window, to switch to Diagram View, on the **Home** ribbon tab, from inside the **View** group, click **Diagram View**.

3. Notice the addition of the **StatePopulation** table (you may need to scroll to the far right of the diagram).

4. To review the data, right-click the **StatePopulation** table, and then select **Go To**.

5. In the record navigator (located at the bottom left of the window), notice the record count of **51**.

6. In the Power Pivot window, select the **State** table (not the **StatePopulation** table).

| Product | Region | Sales | State | Date | ProductCost | SalesPopulation |

Figure 12
Locating the State Table

7. To add a calculated column, on the **Design** ribbon tab, from inside the **Columns** group, click **Add**.

8. In the formula bar (located above the table grid), enter the following expression.

| ✗ | ✓ | *fx* | |

Figure 13
Locating the Formula Bar

> **Note:** For convenience, the expression can be copied from the
> **D:\PowerBI\Lab02\Assets\Snippets.txt** file.

DAX

```
=LOOKUPVALUE(StatePopulation[CensusPopulation], StatePopulation[State], [StateName])
```

> **Note:** This formula uses the **LOOKUPVALUE** function to retrieve the value in the
> **CensusPopulation** column where the state names match.

9. Press **Enter**.

10. Right-click the header of the new column, and then select **Rename Column**.

11. Replace the column name text with **CensusPopulation**, and then press **Enter**.

12. To filter the table, in the **CensusPopulation** column header, click [▾].

13. Uncheck **(Select All)**, then scroll to the bottom of the item list, and then check the **(Blanks)** item.
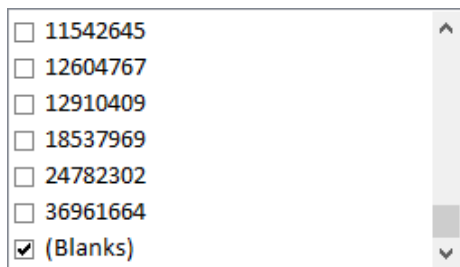

Figure 14

Isolating Records with Missing CensusPopulation Values

14. Click **OK**.

15. Notice that there are 11 records that do not have a census population value.

16. Investigation reveals that the web page source stores state names that consist of more than one word by using non-breaking spaces(represented in HTML as ** **).

Figure 15

Reviewing the HTML Fragment Showing Inconsistent Space Characters

> **Note:** A regular space character is different to a non-breaking space character. The first is represented by the ASCII decimal value 32 (hex 20), and for the non-breaking space it is represented by the ASCII decimal value 160 (hex A0).
>
> The DAX LOOKUPVALUE function can only lookup a value where there is an exact character-for-character match of text values.

Task 7 – Modifying the Power Query Query

In this task, you will add a new step to the Power Query query to address the inconsistent space issue identified in the previous task.

1. Switch to Excel.

2. In the **Workbook Queries** pane, right-click the **StatePopulation** query, and then select **Edit**.

3. In the **Query Editor** window, select the **State** column header.

4. On the **Home** ribbon, from inside the **Transform** group, click **Replace Values**.
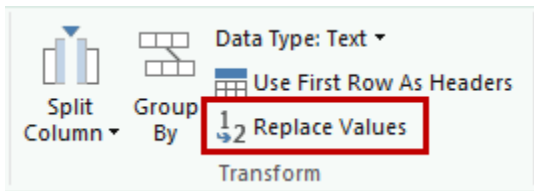

Figure 16
Locating the Replace Values Command

5. In the **Replace Values** window, in the **Value To Find** box, enter **#(00A0)**. (All 0's are zeros).

   Note: 00A0 is the hexadecimal ASCII character code for a non-breaking space.

6. In the **Replace With** box, enter a single space.

7. Click **OK**.

8. Review the expression in the formula bar, and notice that the entered hexadecimal value has been altered.

   Note: This behavior occurs by design. The value you entered was escaped with the # symbol.

9. In the formula bar, edit the formula to remove the inserted three characters **(#)**, and then press **Enter**.

10. Ensure that the expression is the same as the following.

Power Query Formula Language

```
=Table.ReplaceValue(#"Removed Columns","#(00A0)"," ",Replacer.ReplaceText,{"State"})
```

11. On the **Home** ribbon, from inside the **Query** group, click the **Close & Load** dropdown arrow, and then select **Close & Load**.

> **Note:** The Power Query query is refreshed and the corresponding table in the workbook data model is also be refreshed.

12. Switch to the Power Pivot window, and then review the data in the **State** table.

13. Notice that no records are visible in the **State** table, because all records now have a census population value.

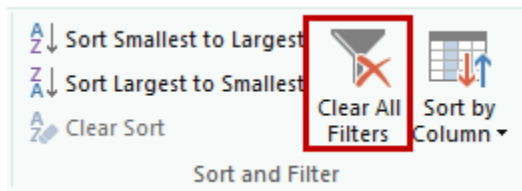14. On the **Home** ribbon tab, from inside the **Sort and Filter** group, click **Clear All Filters**.

Figure 17
Clearing All Filters

Task 8 – Completing the Data Model Enhancements

In this task, you will add two calculated fields and then hide a column and the Power Query table.

1. To add a calculated field based on the **CensusPopulation** column, select the **CensusPopulation** column header, and then on the **Home** ribbon tab, from inside the **Calculations** group, click the **AutoSum** dropdown arrow.
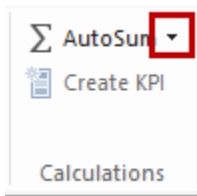

Figure 18
Locating the AutoSum Dropdown Arrow

2. In the dropdown list, select **Sum**.

3. In the calculation area (located at the bottom of the table grid), notice the calculated field. You may need to widen the **CensusPopulation** column to fully view the cell content, which consists of the calculated field name and value (based on the sum aggregation of the table rows).

4. In the formula bar, notice the DAX expression that was automatically generated.

5. To rename the calculated field to **Population**, in the formula bar, modify the first portion of the expression as follows.

DAX
```
Population:=SUM([CensusPopulation])
```

6. Press **Enter**.

7. To format the calculated field, in the calculation area, right-click the calculated field, and then select **Format**.

8. In the **Formatting** window, in the **Category** list, select **Number**.

9. In the **Format** dropdown list, select **Whole Number**.
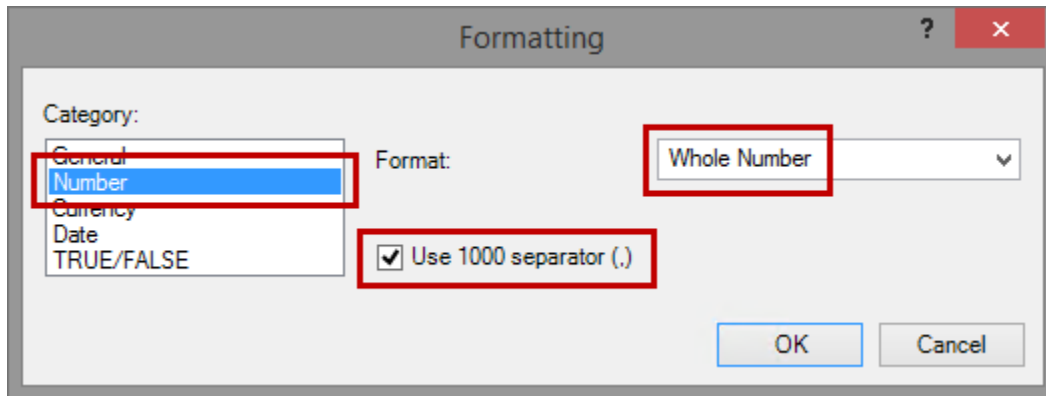
10. Check the **Use 1000 Separator** checkbox.

Figure 19
Reviewing the Calculated Field Formatting

11. Click **OK**.

12. Notice the formatting applied to the calculated field value.

13. To hide the **CensusPopulation** column, right-click the **CensusPopulation** column header, and then select **Hide From Client Tools**.
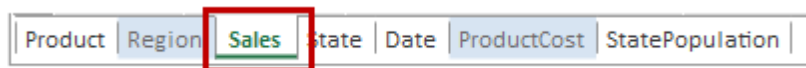
14. Select the **Sales** table.

Figure 20
Locating the Sales Table

15. In the calculation area, select the cell directly beneath the **Sales** calculated field.

16. In the formula bar, enter the following expression.

> **Note:** For convenience, the expression can be copied from the
> **D:\PowerBI\Lab02\Assets\Snippets.txt** file.

DAX
```
Sales per Capita:=DIVIDE([Sales], [Population])
```

> **Note:** The **DIVIDE** function divides two expressions, providing that the second
> argument results in a non-zero number. If the second expression results in zero or
> blank (missing), then the function will return blank.

17. Format the calculated field by using the **Currency** category (with default symbol and decimal places).

18. To hide the **StatePopulation** table, right-click the **StatePopulation** table tab, and then select **Hide From Client Tools**.

Task 9 – Creating a PivotTable Report

In this task, you will add and configure a PivotTable report to the workbook.

1. In the Power Pivot window, on the **Home** ribbon tab, click the arrow beneath **PivotTable**, and then select **PivotTable**.
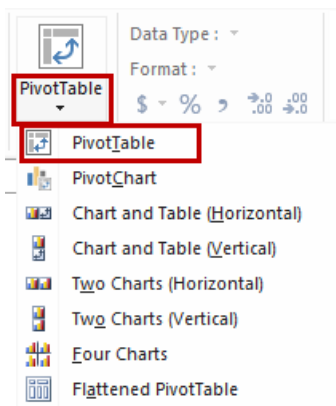

Figure 21
Adding a Single PivotTable

2. In the **Create PivotTable** window, to create a new worksheet, click **OK**.

3. Notice that a PivotTable has been added to an Excel worksheet, and that the **PivotTable Fields** pane is open (located at the right).

4. To close the **Workbook Queries** pane, on the **Power Query** ribbon tab, from inside the **Manage** group, click **Workbook Queries**.

5. To rename the worksheet, right-click the **Sheet1** worksheet tab, and then select **Rename**.

6. Rename the worksheet to **Sales per Capita**, and then press **Enter**.

7. To add a report filter, in the **PivotTable Fields** pane, expand the **Date** group, and then drag the **Calendar** hierarchy into the **Filters** drop zone.
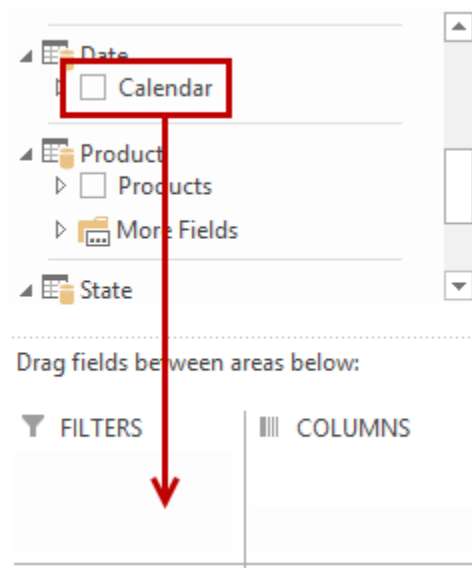

Figure 22
Adding the Calendar Hierarchy to the PivotTable Filters

8. In the PivotTable report filter (cell **C1**), click [image], expand the **All** member, select **CY2013**, and then click **OK**.

9. In the **PivotTable Fields** pane, expand the **Sales** group, and then check the **Sales** and **Sales per Capita** fields.

10. To introduce row labels, in the **PivotTable Fields** pane, expand the **State** group, expand the **More Fields** folder, and then check the **StateName** field.

11. To sort the states in descending order of sales per capita, in the PivotTable, right-click any cell in the **Sales per Capita** column, and then select **Sort | Sort Largest to Smallest**.

12. To apply conditional formatting, select any **Sales per Capita** value cell.

13. On the **Home** ribbon tab, from inside the **Styles** group, click **Conditional Formatting**, select **Data Bars**, and then select any of the gradient fill data bar styles.

14. Click the smart tag that appears to the right of the formatted cell, and then select **All Cells Showing "Sales per Capita" Values for "StateName"**.
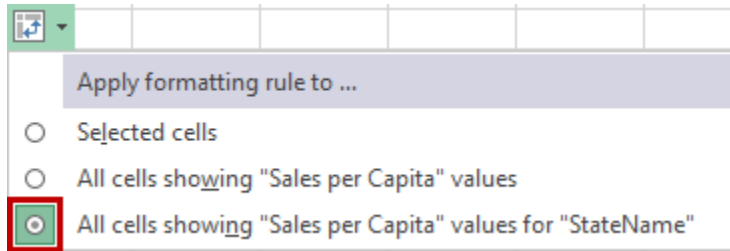

Figure 23

Applying Conditional Formatting to All Sales per Capita Cells

Task 10 – Finishing Up

In this task, you will finish up by closing Excel.

1. To save the workbook, on the **File** ribbon tab, click **Save**.

2. To close Excel, click the X button located at the top right corner.

3. Close the Internet Explorer window.

Summary

In this lab, you extended the Power Pivot workbook created in **Lab 01** with a Power Query query to enable the analysis of sales per capita. The additional data consisted of population by state, sourced from a web page based on data from the United States Census Bureau.