PolicyViz

# A Step-by-Step Guide to Advanced Data Visualization

Excel 2016 / Office 365

Jon Schwabish
POLICYVIZ.COM

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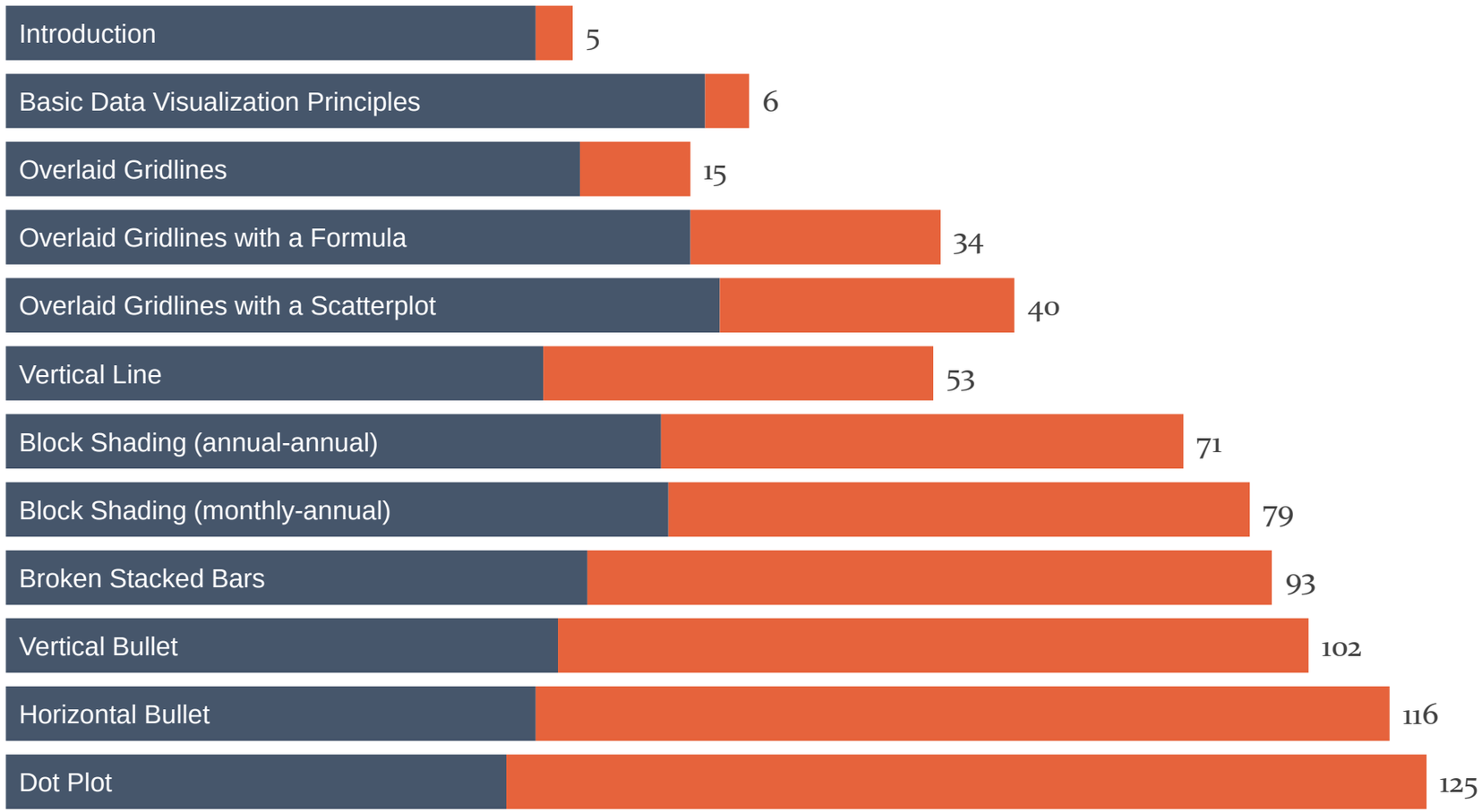

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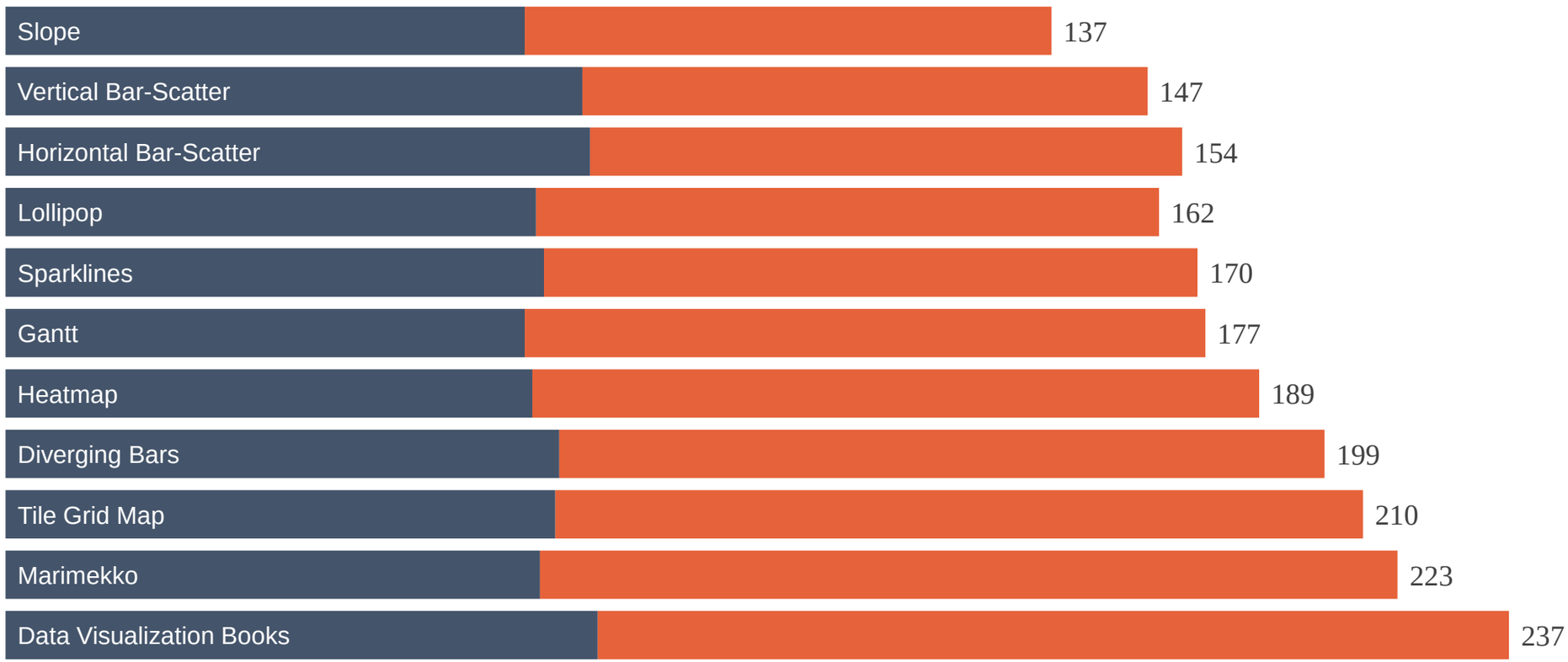


## Acknowledgments

This guide would not have been possible without the support and help of a number of people. Ebook design and tech-editing could not have been done without the superb help of Glenna Shaw at GlennaShaw.com. A number of other people in the Excel communities have been inspirational to this and much of my other work including Jon Acampora at ExcelCampus.com, Dave Bruns at ExcelJet.net, Jorge Camoes at ExcelCharts.com, and Jon Peltier at PeltierTech.com. I encourage you to visit their websites to extend your Excel abilities even further.

I also owe a debt of gratitude to many in the data visualization communities who have either helped develop some of the visualization types shown below and best practices to visualizing data (not exclusively in Excel) including Alberto Cairo, Ann Emery, Cole Nussbaumer Knaflic, Andy Kirk, and Robert Kosara. There are many, many others, so please forgive me for not including all of them. I encourage you to read the books, blogs and other writings and materials from these and many others in the data visualization field.

## Licensing Agreement

# Introduction

There is an increased recognition that effectively visualizing data is important to anyone who works with and analyzes data. To that end, there has been an explosion in data analysis and data visualization tools over the past few years. For many people, however, Microsoft Excel continues to the be the workhorse for their data visualization needs. If you are an Excel user, the default chart types in do not need to limit your data visualization capabilities; extending the tool to create other chart types is indeed possible.

In this step-by-step guide to data visualization in Excel, you will learn how to create nearly 20 new graphs in Excel 2016/Office 365 (O365). Each tutorial will lead you through the steps to create each chart type (instructions and images use the 2016 version of Excel on PCs, but are very similar to those on the Mac). Some basic, working knowledge of Excel, how to create basic graphs, adding different data series, and combining graph types will be useful. There are certainly different strategies to creating some of these graphs, but the approach I present here allow you to not only create those graphs, but also give you the techniques you can use elsewhere to create your own graphs. Along with this guide you will also receive an Excel file that you can use to recreate the graphs on your own or to use as templates for your own work.

Should you have questions or need clarifications, please contact me using the Contact form at PolicyViz.com (https://policyviz.com/about/contact/).

Thanks,

Jon Schwabish

# Basic Data Visualization Principles

This guide is not intended to be an introductory guide to best practices in data visualization. Instead, it is intended to show you how to extend the capabilities of Microsoft Excel so that you can create more and better visualizations. Yet, three basic principles seem especially useful to guide your creation of better, more effective visualizations.

## 1. Show the Data

People read will read the graphs in your report, article, or blog post to better understand your argument. The data are the most important part of the graph and should be presented in the clearest way possible. But that does not mean that *all* of the data must be shown—indeed, many graphs show too much.

## 2. Reduce the Clutter

Cart clutter, the use of unnecessary or distracting visual elements, tends to reduce effectiveness of the graph. Clutter comes in many forms: dark or heavy gridlines; unnecessary tick marks, labels, or text; unnecessary icons or pictures; ornamental shading and gradients; and unnecessary dimensions. Too many graphs use textured or filled gradients when simple shades of a color can accomplish the same task.

## 3. Integrate the Text and the Graph

As a first, simple step, legends that define or explain a series on a graph are often placed far away from the content—off to the right or below the graph. Integrated legends—either right below the title or directly on the chart—are more accessible.

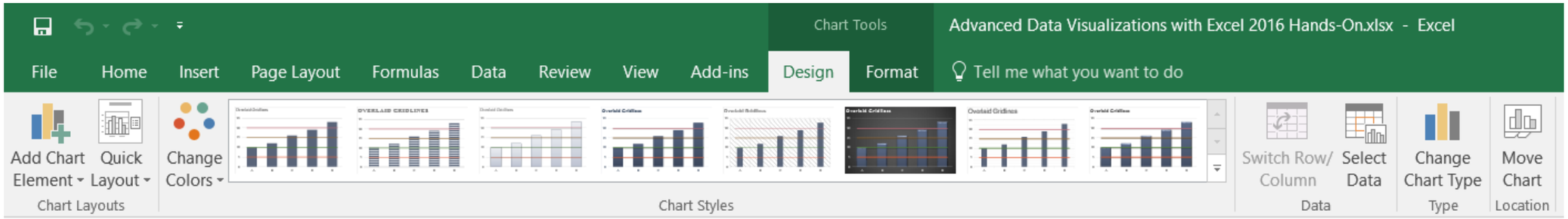
These three principles embody the idea that the graph creator should support the reader's acquisition of information quickly and easily. By stripping out unnecessary clutter and emphasizing the data, your graphs can more clearly and more effectively communicate information. However, default graph options in many graphing and statistical programs tend to add clutter and to separate text and graphs.

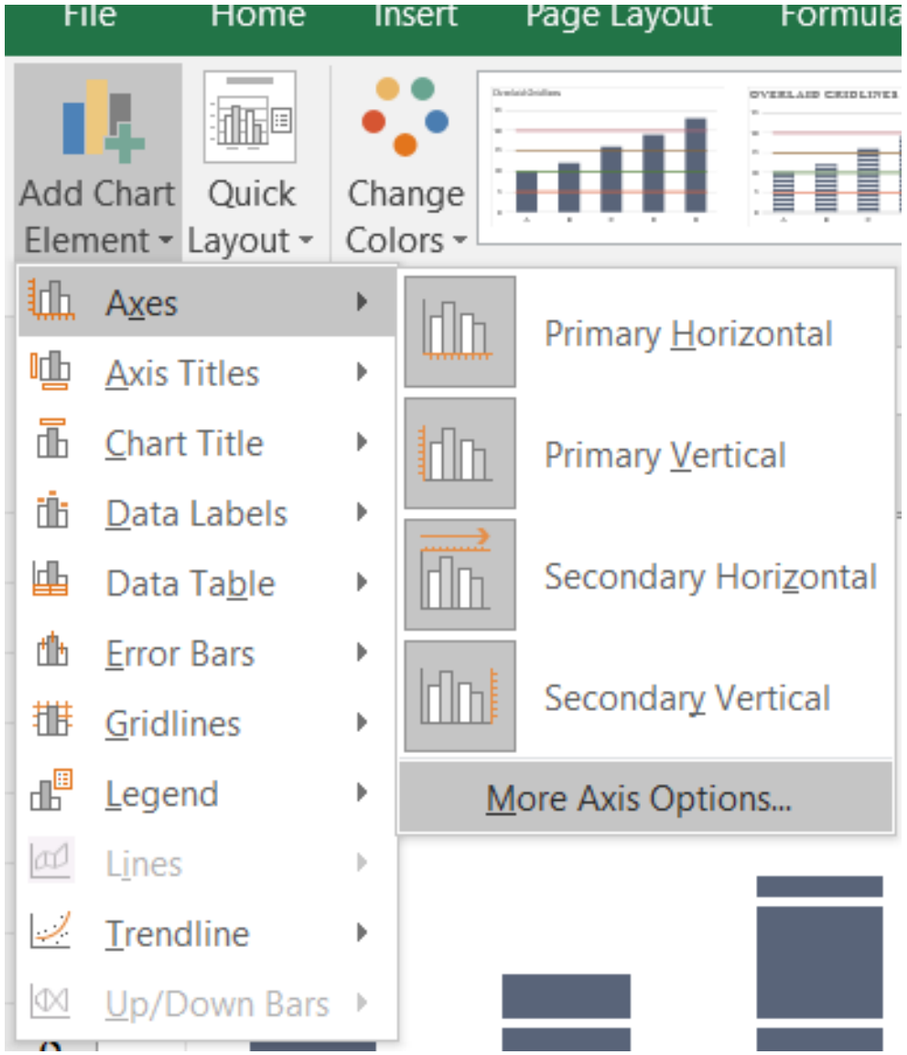
## Chart Tools Quick Tour

This guide will help you change many of those defaults in Excel 2016/O365, so a quick tour through the basic graph layout options seems appropriate. The Excel graphing engine is quite powerful and allows you to control a wide variety of formatting options for your graphs. That being said, the goal of this step-by-step guide is to give you the tools and strategies for pushing past the standard graph types.

## Design Tab

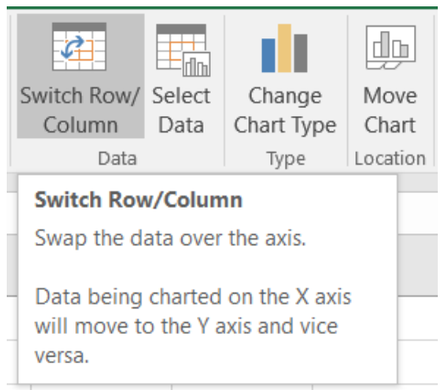
Once you've created a graph and selected it, a Chart Tools tab will appear at the top of your ribbon consisting of two tabs: *Design and Format*. The Design tab contains options that allow you to apply different default 'Chart Layouts' and 'Chart Styles'. The options available under the 'Add Chart Element' button replaces the *Layout* tab on previous versions of Excel and allows you to modify the appearance of axes, titles, gridlines, and more.

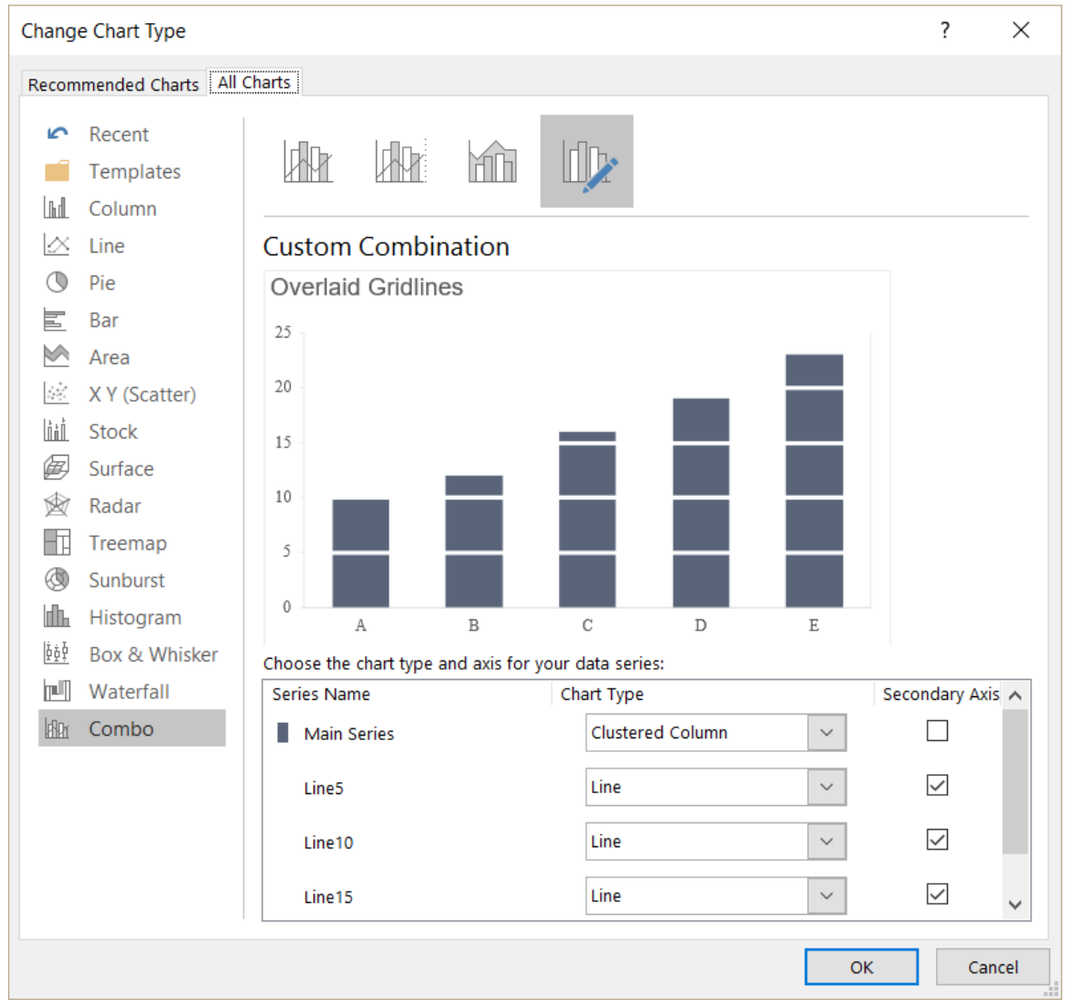





Each of the options in the 'Add Chart Element' menu allows you to choose from a set of pre-populated options, or to open a menu with more options. The image at left shows the options available under the *Axes* button—here, I will usually select the "More Axis Options" to offer as many options as possible.

For purposes of this guide, the ‘Change Chart Type’ button (second-to-last button on the right) and the ‘Switch Row/Column’ button (fourth-to-last button on the right) will be used regularly. The ‘Change Chart Type’ button will allow you to change the type of chart for all the data on the chart, or a selected series. One of the new features in Excel 2016/O365 is the series of dropdown menus in this menu that allows you to change the chart type for each series within a single menu. In previous versions of Excel, you would need to do this one series at a time.

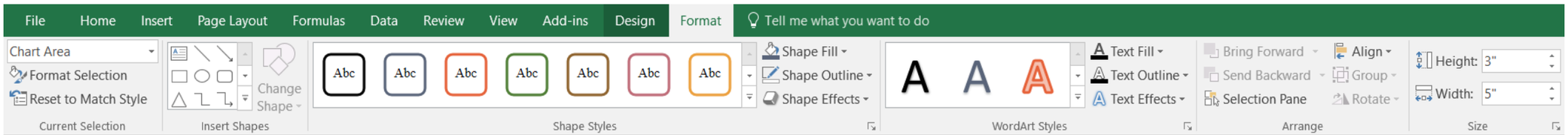


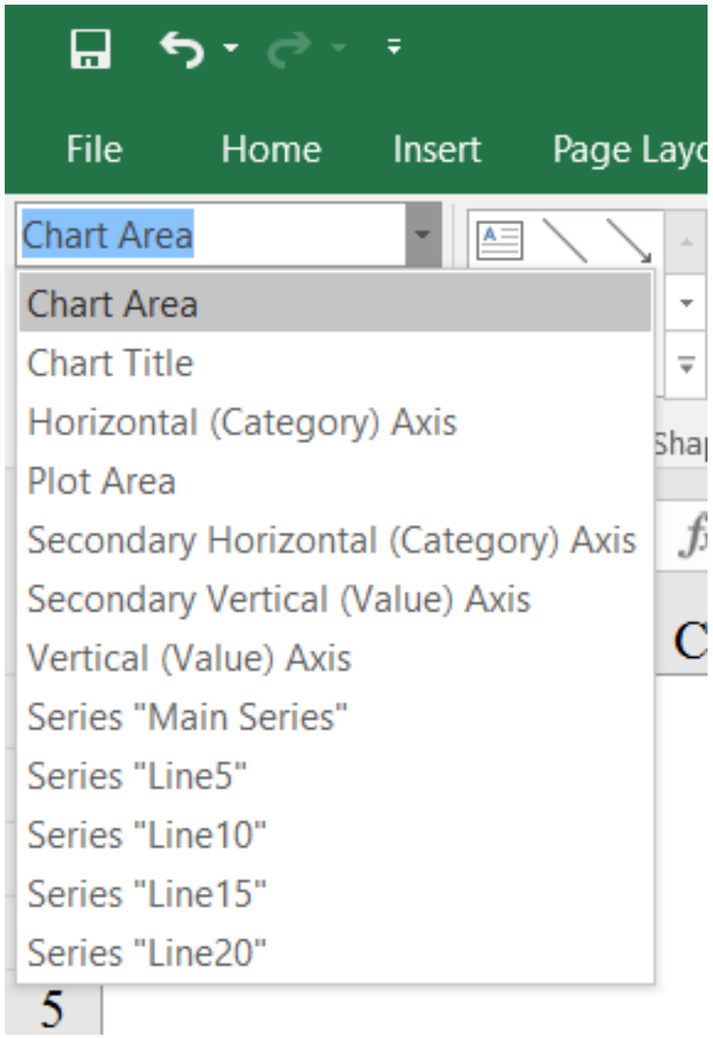



## Format Tab

The *Format* tab contains the standard outline and fill color options.

There is also a *Size* section of the menu from which you can select the size of your graph.



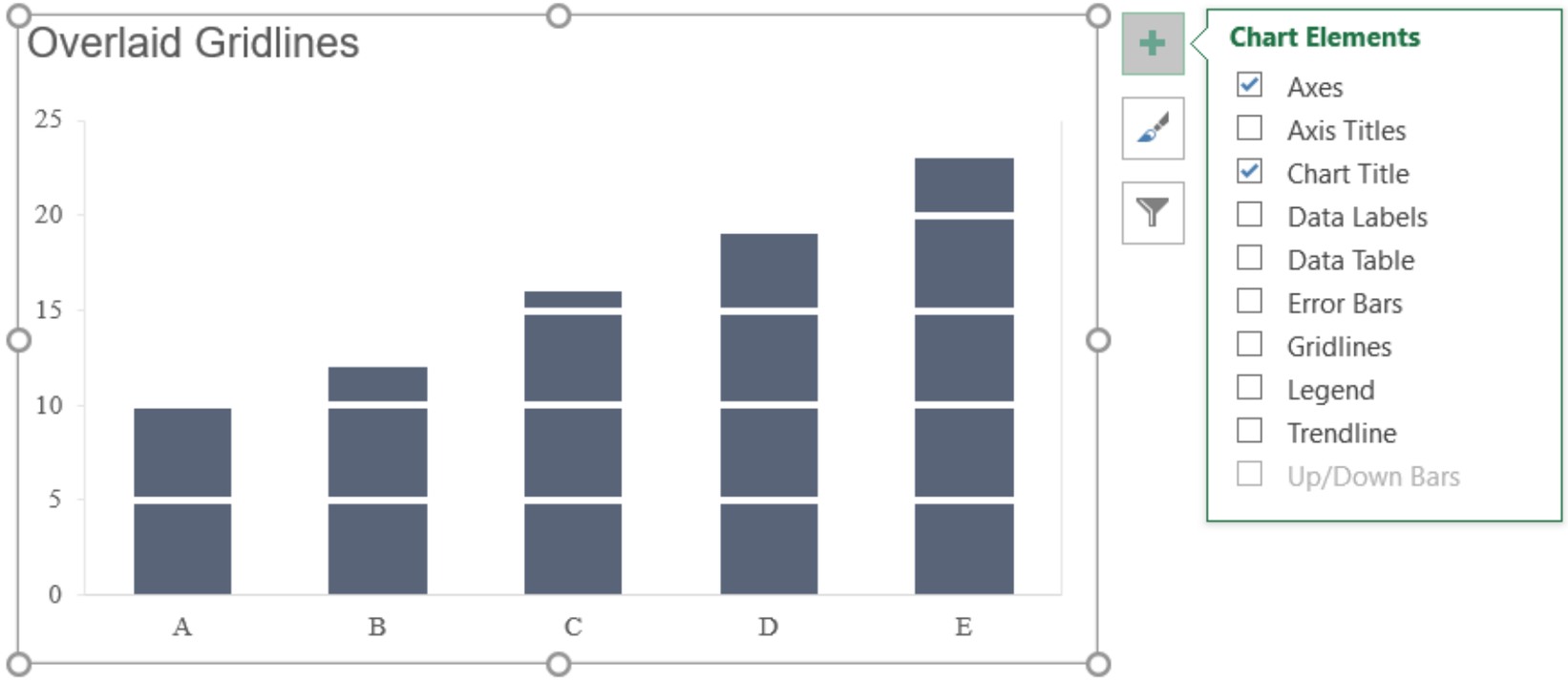



In the very top-left section of the *Format* tab is the 'Chart Elements' drop-down menu. The list in this drop-down menu consists of everything in your chart including titles, axes, error bars, and every series. If you have a lot of objects on your chart, this drop-down menu will help you to easily find and select what you need.

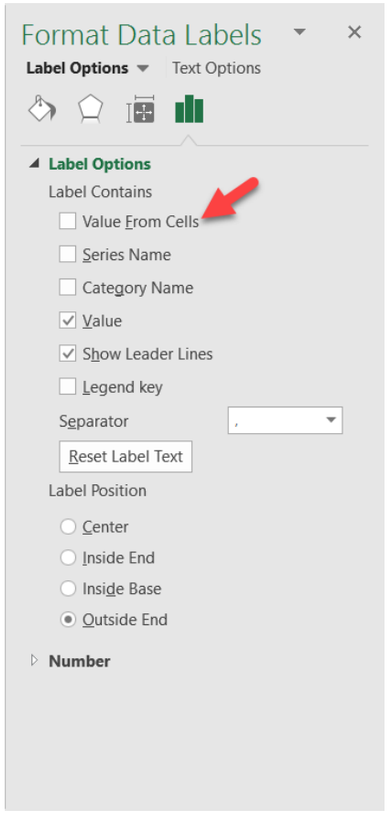
## Chart Elements Menu

One of the new features in Excel 2016/O365 is the 'Chart Elements Menu' that appears just outside the top-right part of the chart when you select it. Appearing as a 'plus' symbol, the menu is identical to the 'Add Chart Elements' button in the *Design* tab.

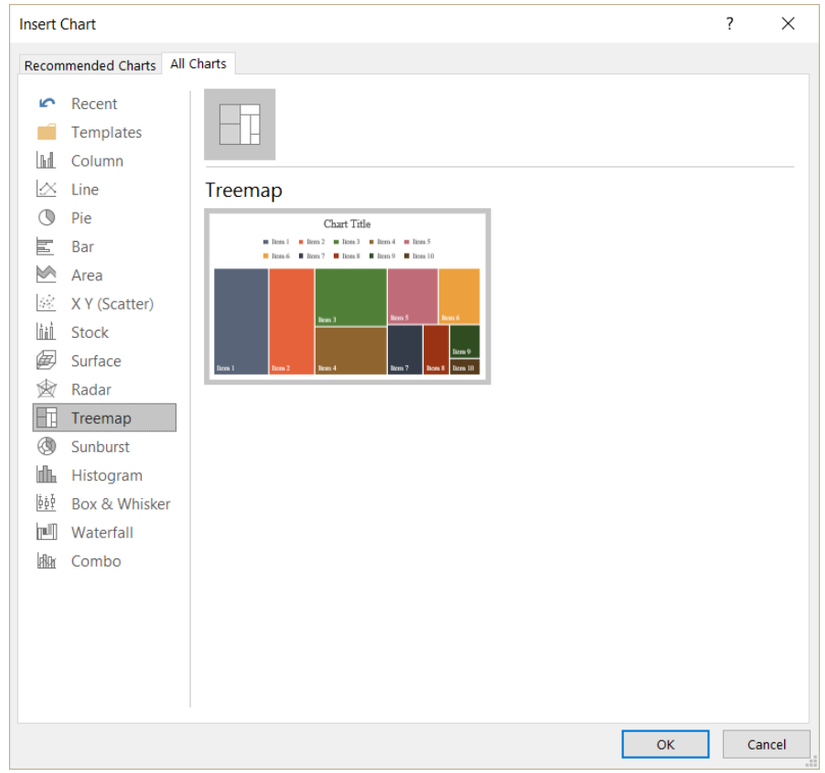
Selecting the options will bring up a menu that will appear in a vertical banner along the right-edge of the window. From here, you can modify the appearance of different chart elements.



A couple of new features in Excel 2016 are worth mentioning. First, you can now select a specific data range to use as labels in your chart. This comes in quite handy when, for example, you want to add custom labels to a scatterplot. Instead of having to do the labeling manually, you can select the data labels series in the spreadsheet.

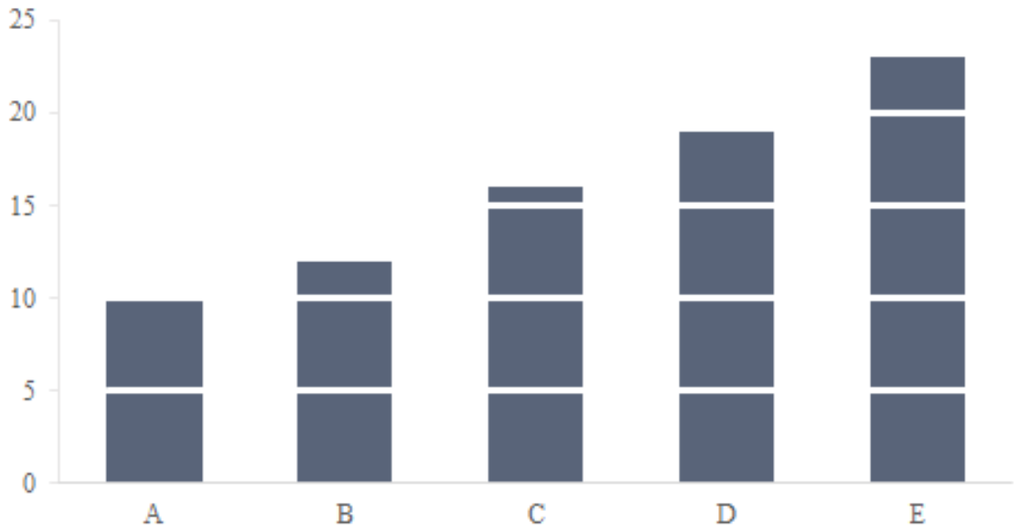



Second, Excel 2016 has a larger (and growing) charting library, accessed in the "Recommend Charts" area of the *Charts* tab. Among the new chart types is a Treemap, Histogram, Box & Whisker, and Waterfall chart. It should be noted, however, that not all of these chart types are available on the version of Excel 2016 available on the Mac.

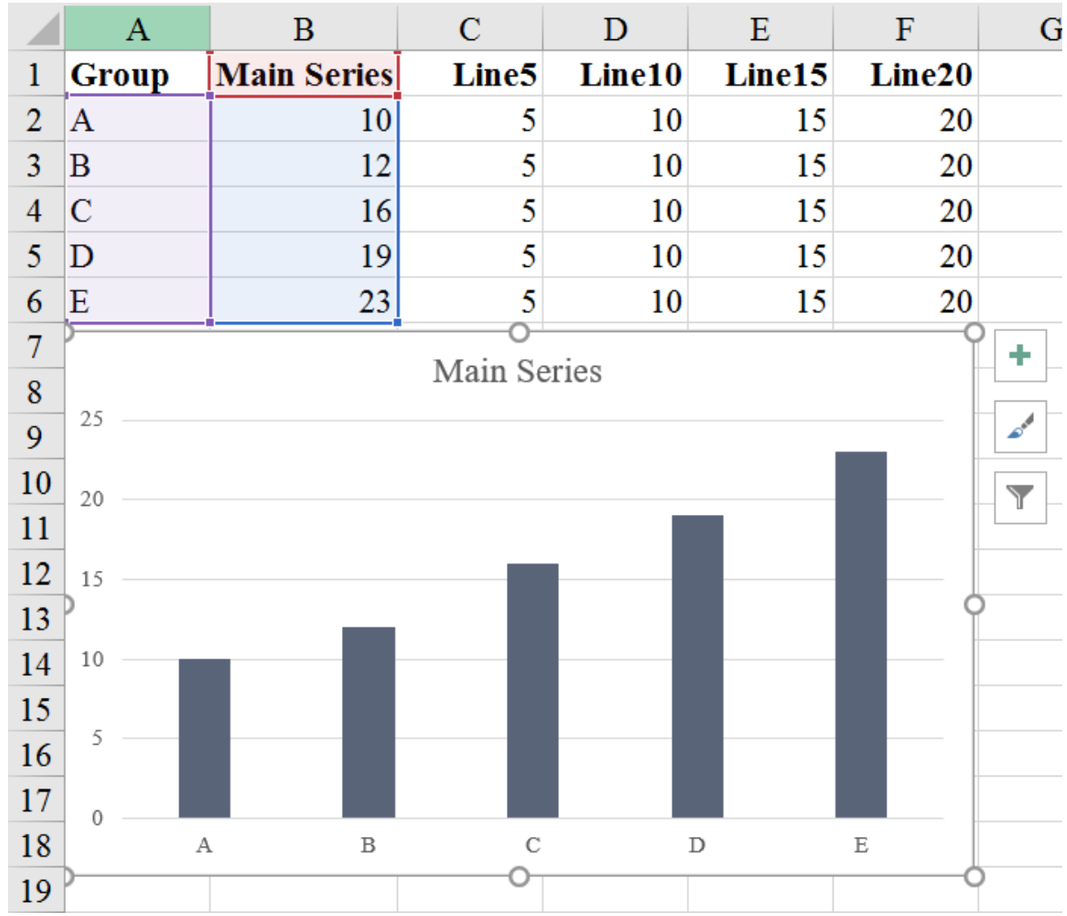


# Overlaid Gridlines

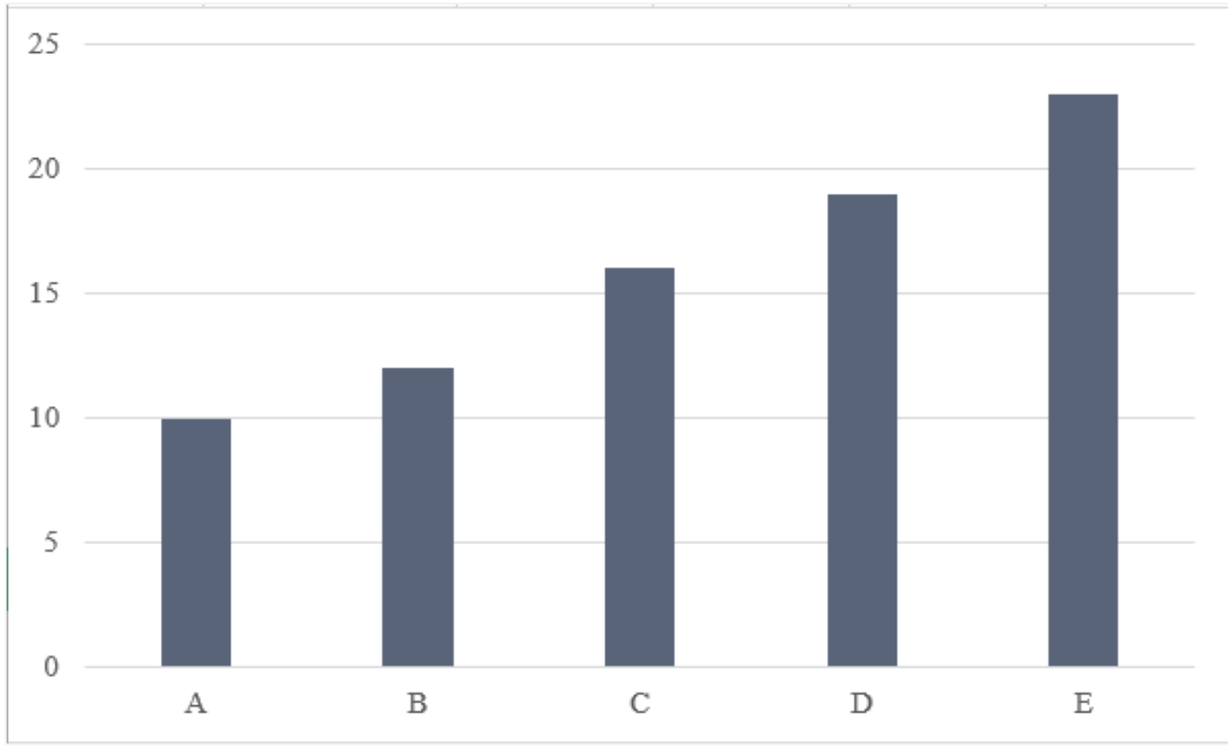
The Overlaid Gridline chart is a column chart with gridlines on top of the columns. This type of chart allows viewers to absorb the column data as segments rather than single columns. Use the *OverlaidGridline tab* in the *Advanced Data Visualizations with Excel 2016 Hands-On.xlsx spreadsheet* to create the chart.



1. Begin by creating a column chart from columns A (“Group”) and B (“Main Series”).

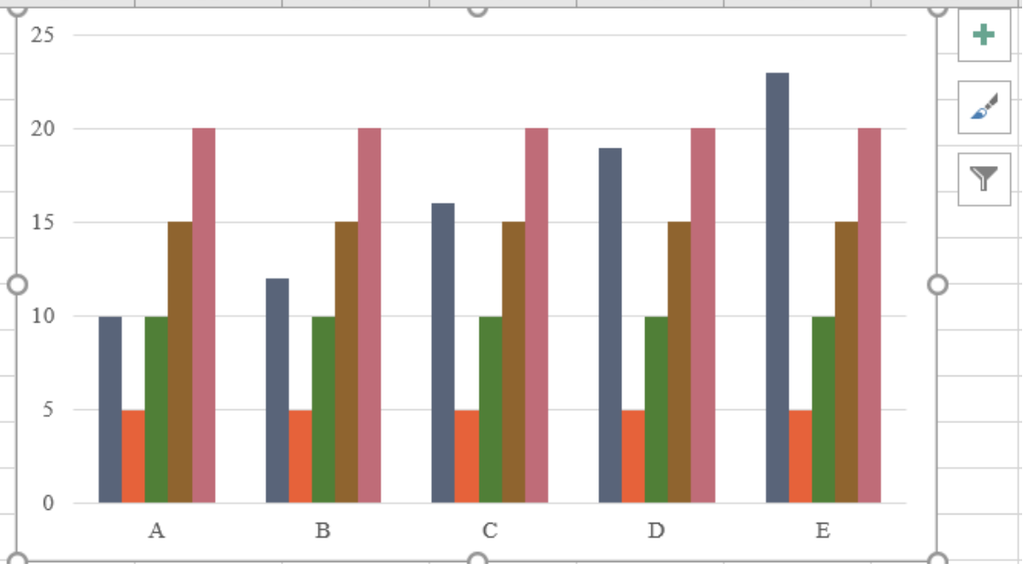


2. Remove the title.

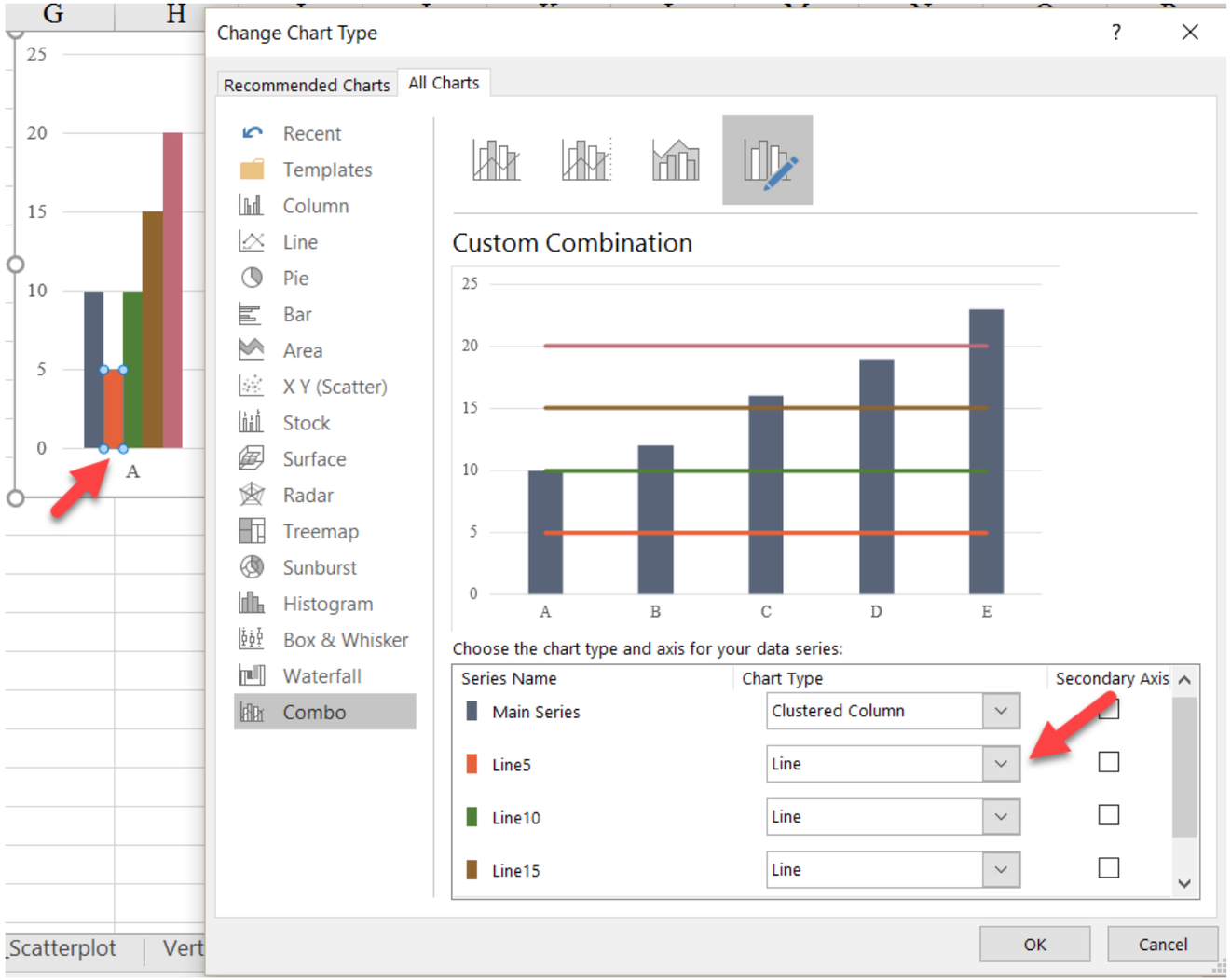


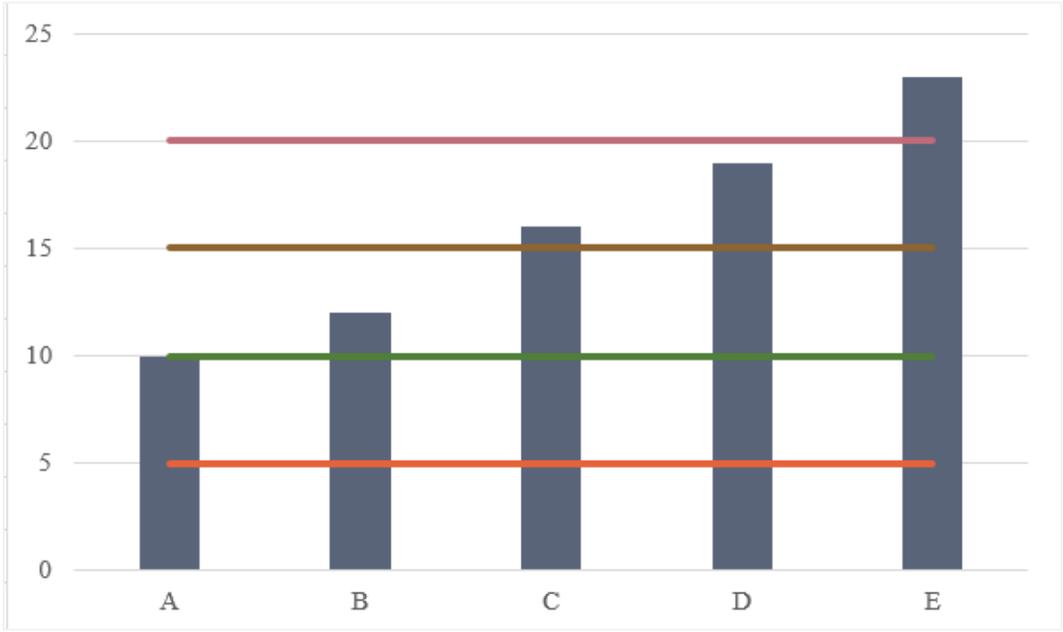
3. We're now going to add the four "Line" series to the chart. There are a few ways to do so. If you select the chart itself, you'll notice that the data are highlighted in the worksheet. You can simply select the little blue square at the bottom of the cells that are highlighted in blue and drag across. Alternatively, you can right-click on the chart and choose the "Select Data" option to add these series one at a time. We'll start by just adding the data in rows 2 through 6; the data in rows 7-11 will come later.

| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| 1 | **Group** | **Main Series** | **Line5** | **Line10** | **Line15** | **Line20** |
| 2 | A | 10 | 5 | 10 | 15 | 20 |
| 3 | B | 12 | 5 | 10 | 15 | 20 |
| 4 | C | 16 | 5 | 10 | 15 | 20 |
| 5 | D | 19 | 5 | 10 | 15 | 20 |
| 6 | E | 23 | 5 | 10 | 15 | 20 |
| 7 | | | 5 | 10 | 15 | 20 |
| 8 | | | 5 | 10 | 15 | 20 |
| 9 | | | 5 | 10 | 15 | 20 |
| 10 | | | 5 | 10 | 15 | 20 |
| 11 | | | 5 | 10 | 15 | 20 |
| 12 | | | | | | |



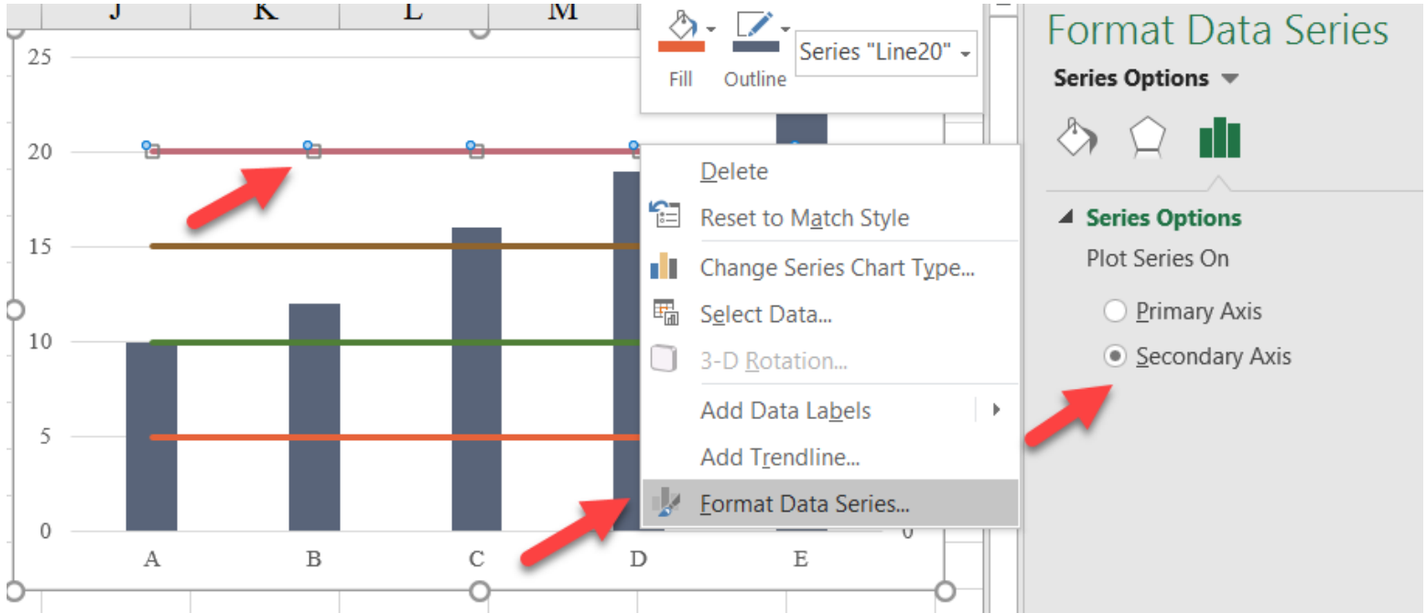
4. You will now have a clustered column chart, five series for each group. Select the **orange** series for “Line 5” on the graph. Under the “Design” tab under “Type” in the ribbon, select “Change Chart Type” (the third menu from the right). You can now use the dropdown menus to change the graph type for each series. Change the Chart Type for each “Line” series to “Line” and press “OK.”



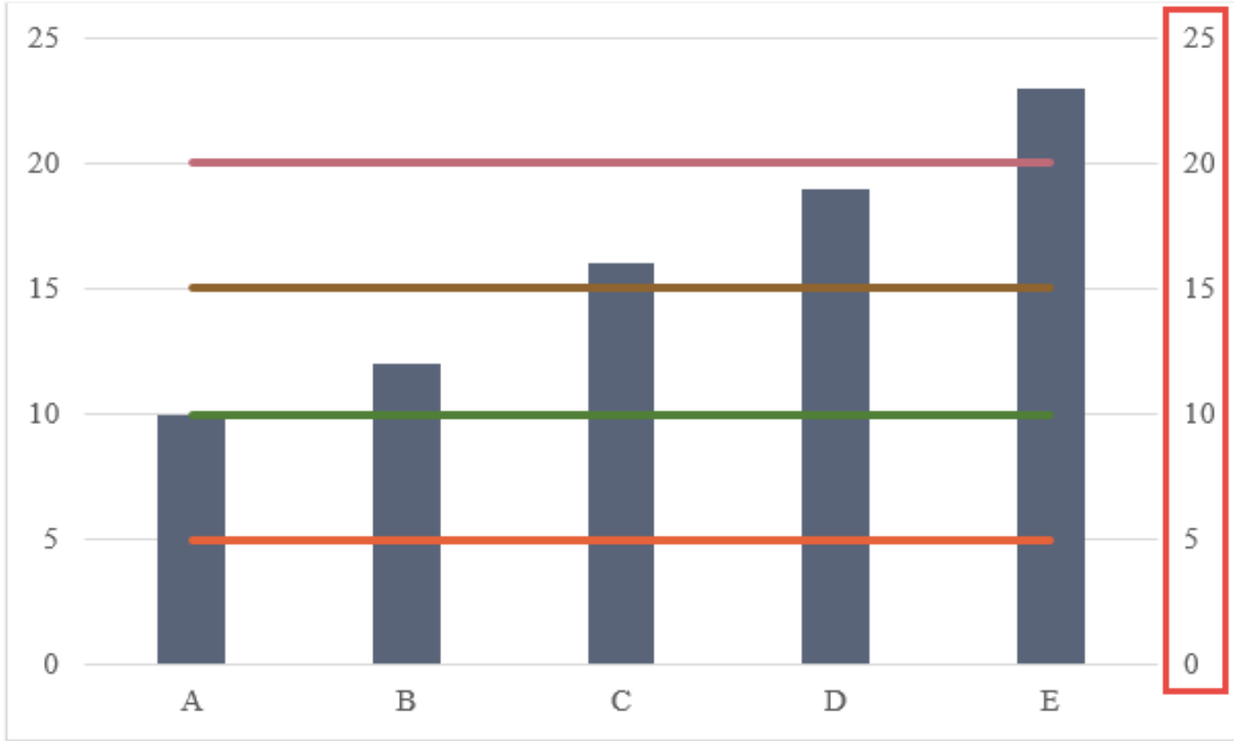



Each series except the “Main Series” now become lines.

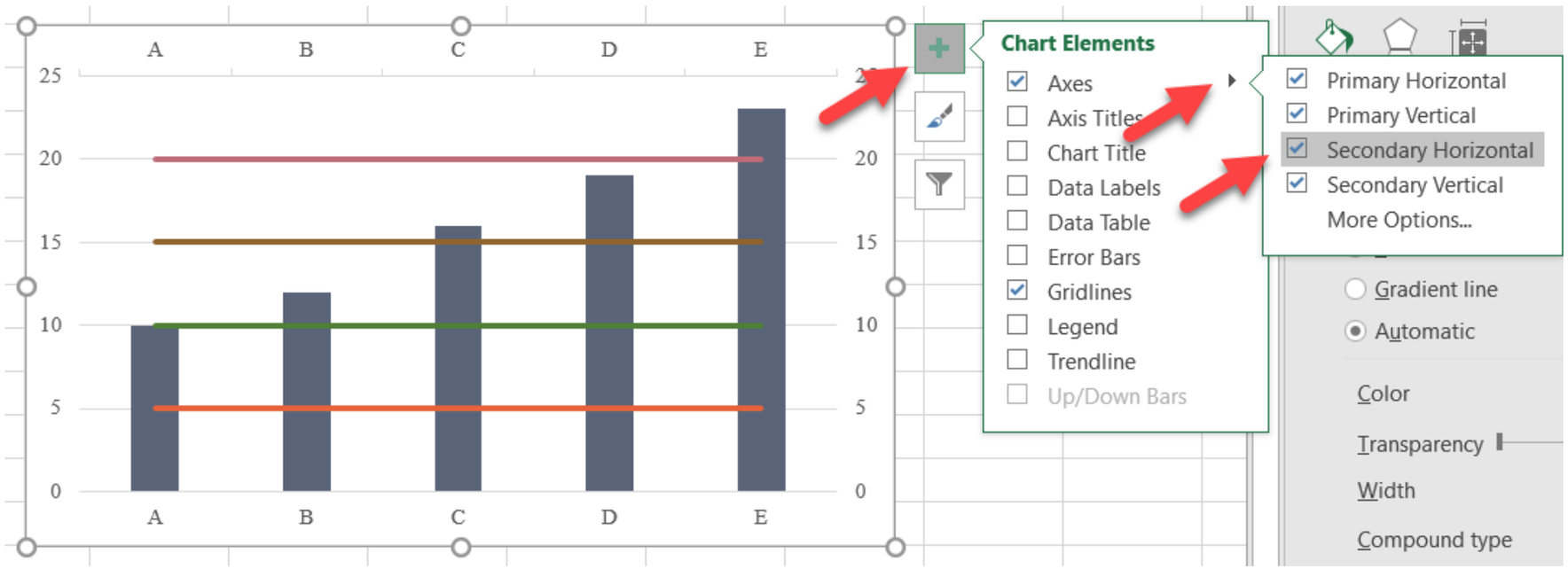
5. If we were to simply change the lines to white, they would end in the middle of the bars of the A and E groups. We now move each of those four lines to the "secondary axis" so we can get them to stretch through the bars. To do so, first select a line, right-click, and select "Format Data Series" (alternatively, use the CTRL-1 keyboard shortcut). Go to the "Series Options" tab and select the "Secondary Axis" option.



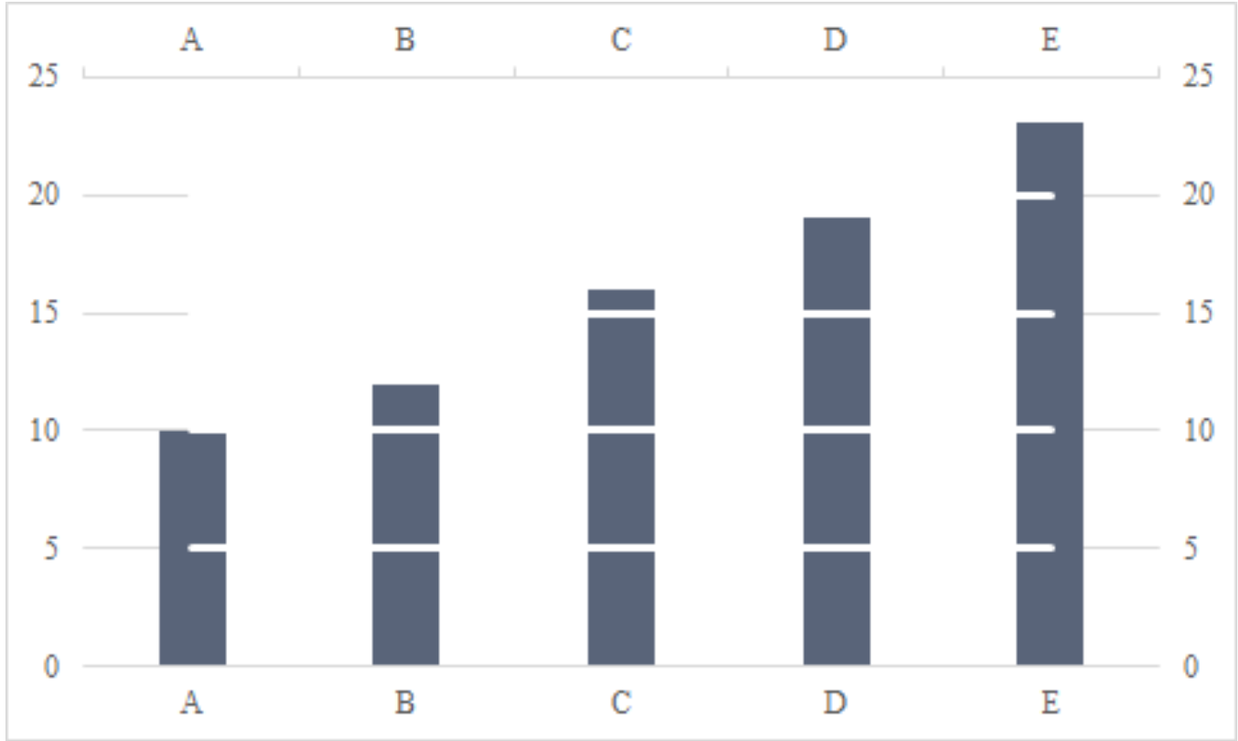
6. You'll notice that a new y-axis has appeared on the right side of the graph. When you're done moving all four series to the secondary axis, this new y-axis should go from 0 to 25 (if not, adjust the y-axes to be the same by selecting the axis and right-clicking or using the CTRL-1 keyboard shortcut).



7. There is also now a secondary x-axis, but we need to turn it on. To do so, select the "Axes" option in the "Chart Elements" menu by pressing the "plus" button that will appear when you select the chart. By hovering over the "Axes" menu, three of the boxes will have checkmarks next to them ("Primary Horizontal", "Primary Vertical", and "Secondary Vertical"). Turn on the "Secondary Horizontal" axis by selecting the checkbox.

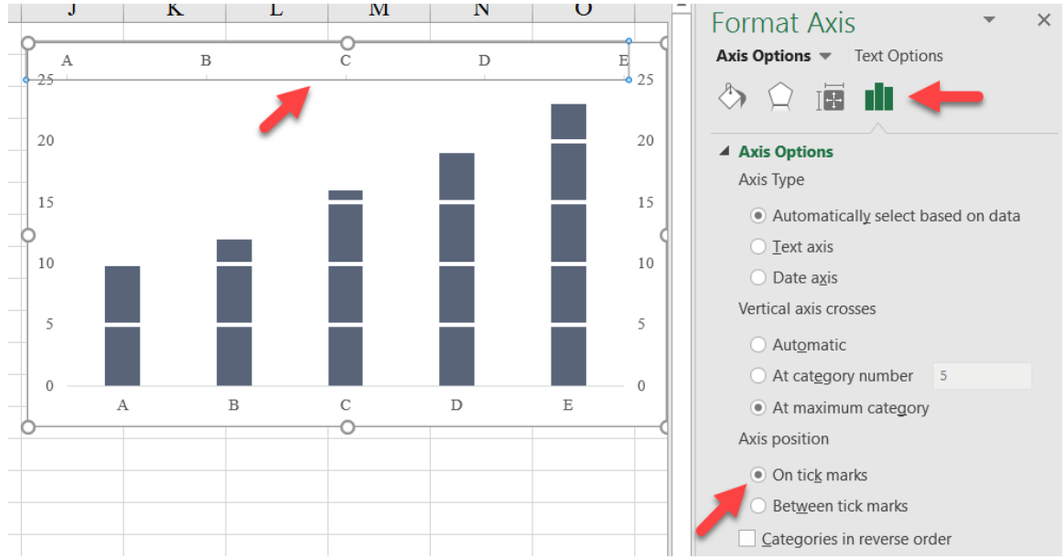


8. Change the colors of the lines to white using the “Format” tab option. And notice that the lines still end in the middle of the bars for the A and E groups.

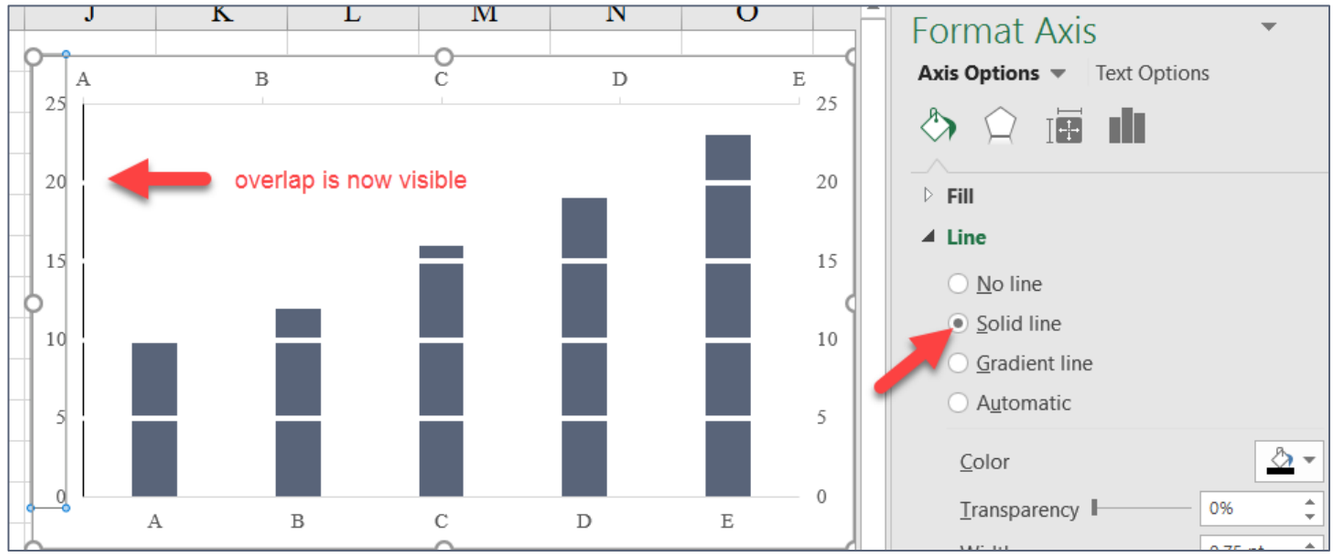


9. We fix that by changing how the data points line up with the tick marks. In a default line graph in Excel, the data markers line up *between* the tick marks; notice how the line begins in the middle of the A bar, between the y-axis and the tick mark between the A and B groups. By placing the data markers *on* the tick marks, we can extend the lines through the bars.

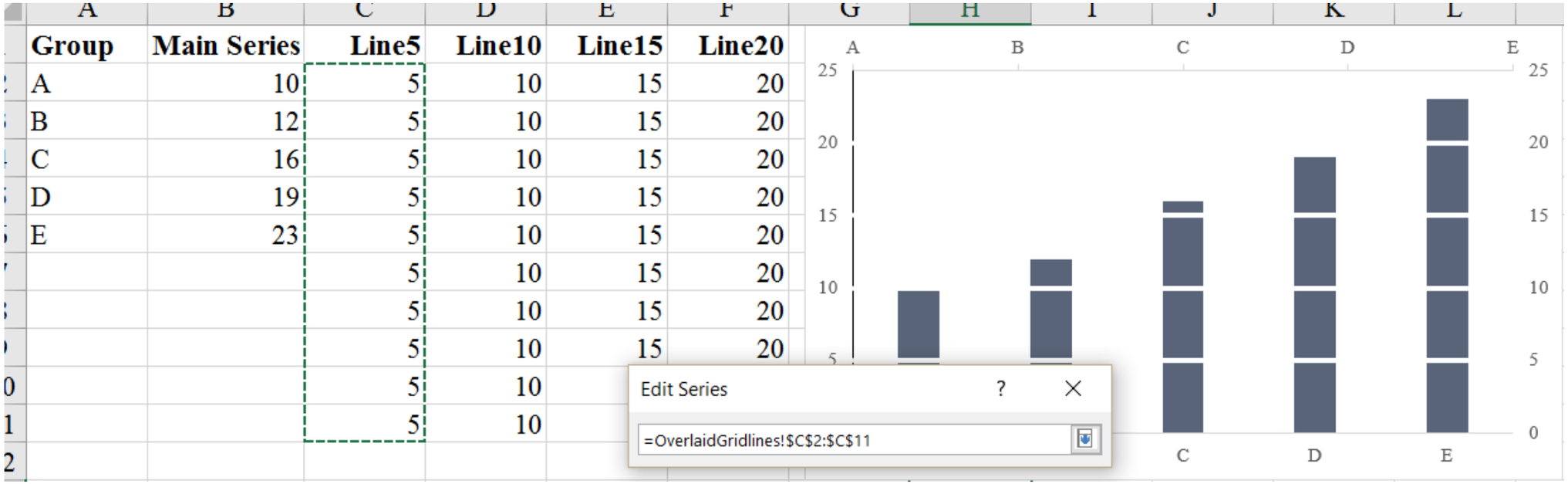
   To do so, we'll format the ***secondary x-axis*** (by right-clicking and navigating to the "Axis position" options under "Axis Options" in the "Format axis" menu (using the CTRL-1 shortcut or using the menu from the ribbon). Here, change the "Position Axis" marker from "Between tick marks" to "On tick marks". Notice how the lines now shift out slightly.



10. Add your vertical primary axis line (Excel 2016 leaves it off as default), select the axis and add the line under the “Format Axis” menu. Doing so, will show some overlap between the “gridlines” and the axis line. We can do a couple more things to line this up just the way we want it.



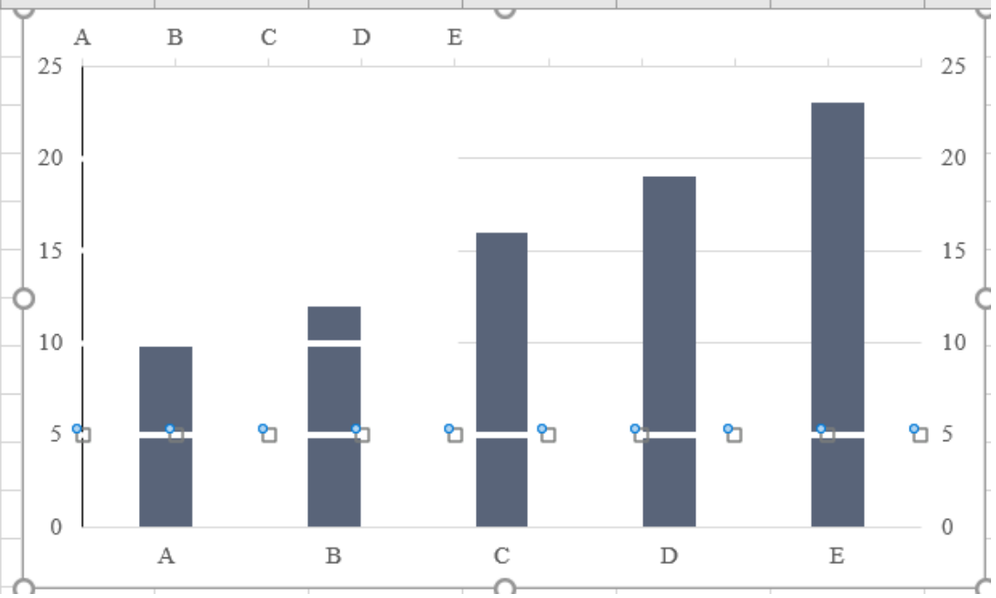
11. We want to extend the data series for each “Line” series through row 11. One way to do this is to right-click on the graph, select the “Select Data” option, and edit each of the 4 “Line” series to extend the data series.



Alternatively, you can select the line on the chart and you'll notice that your data are selected in the spreadsheet.

You can then drag the selection box to extend the data series.

| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| 1 | **Group** | **Main Series** | **Line5** | **Line10** | **Line15** | **Line20** |
| 2 | A | 10 | 5 | 10 | 15 | 20 |
| 3 | B | 12 | 5 | 10 | 15 | 20 |
| 4 | C | 16 | 5 | 10 | 15 | 20 |
| 5 | D | 19 | 5 | 10 | 15 | 20 |
| 6 | E | 23 | 5 | 10 | 15 | 20 |
| 7 | | | 5 | 10 | 15 | 20 |
| 8 | | | 5 | 10 | 15 | 20 |
| 9 | | | 5 | 10 | 15 | 20 |
| 10 | | | 5 | 10 | 15 | 20 |
| 11 | | | 5 | 10 | 15 | 20 |
| 12 | | | | | | |




This won't fix the overlap issue, but you'll notice that the group labels are shifted over to the left. This is because we now have ten values tagged to this secondary horizontal axis.

12. We need to now change where the data markers line up with the tick marks. Once again, format the secondary x-axis and change the “Position Axis” back to “Between tick marks”. You’ll notice how the lines shift in slightly so that they don’t overlap the vertical axes.

| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| 1 | **Group** | **Main Series** | **Line5** | **Line10** | **Line15** | **Line20** |
| 2 | A | 10 | 5 | 10 | 15 | 20 |
| 3 | B | 12 | 5 | 10 | 15 | 20 |
| 4 | C | 16 | 5 | 10 | 15 | 20 |
| 5 | D | 19 | 5 | 10 | 15 | 20 |
| 6 | E | 23 | 5 | 10 | 15 | 20 |
| 7 | | | 5 | 10 | 15 | 20 |
| 8 | | | 5 | 10 | 15 | 20 |
| 9 | | | 5 | 10 | 15 | 20 |
| 10 | | | 5 | 10 | 15 | 20 |
| 11 | | | 5 | 10 | 15 | 20 |
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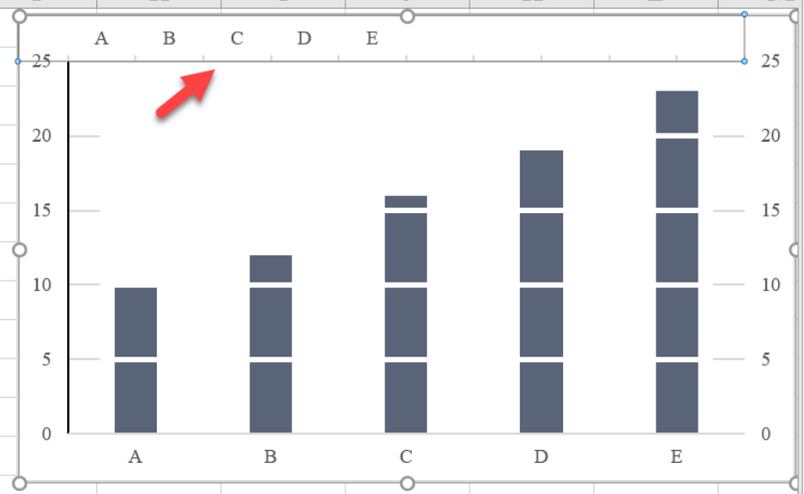
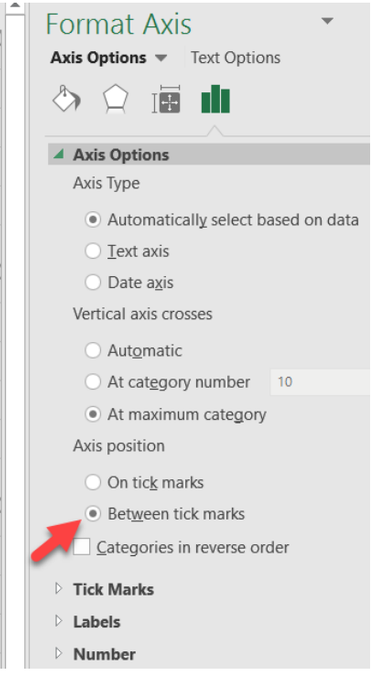
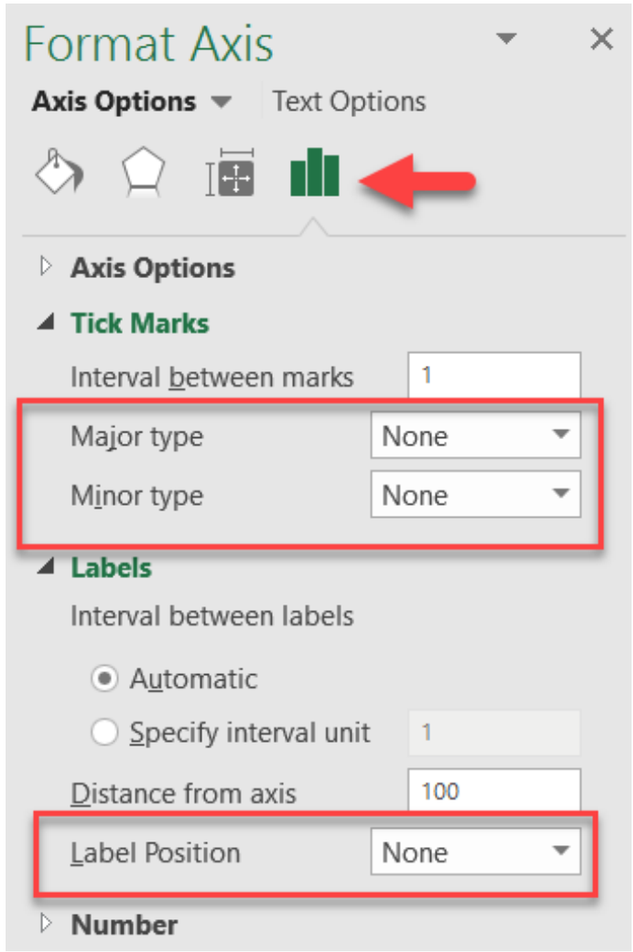
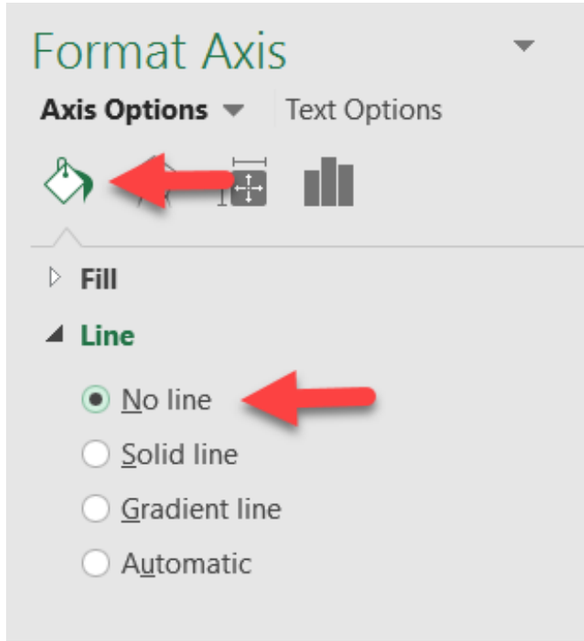
| 14 | | | | | | |
| 15 | | | | | | |
| 16 | | | | | | |



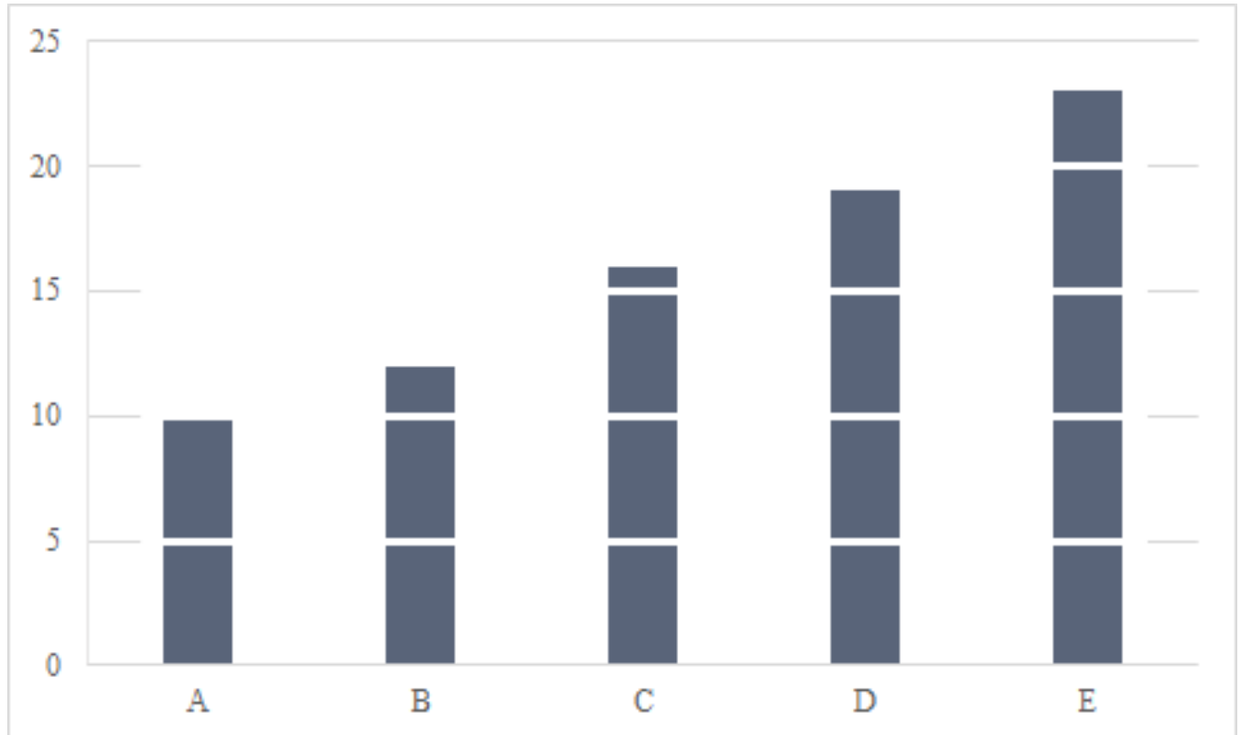



13. We also want to turn off the secondary horizontal axis. But don't delete it! You need to turn off the tick marks and labels (accomplished in the middle of this same menu) and set the "Line Color" to "No line".

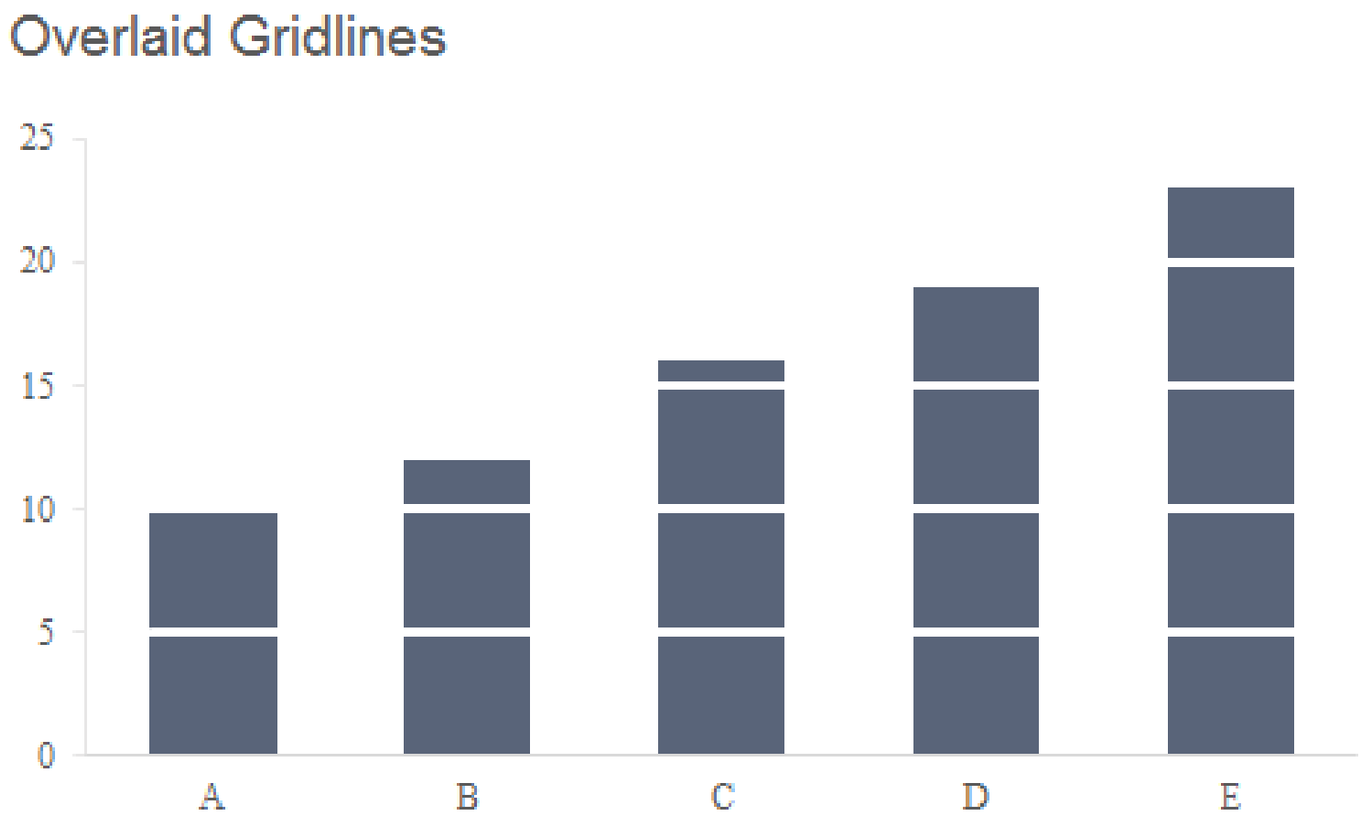


14. Repeat the process in Step 13 for the secondary vertical axis, remove the gridlines and style the rest as you see fit.

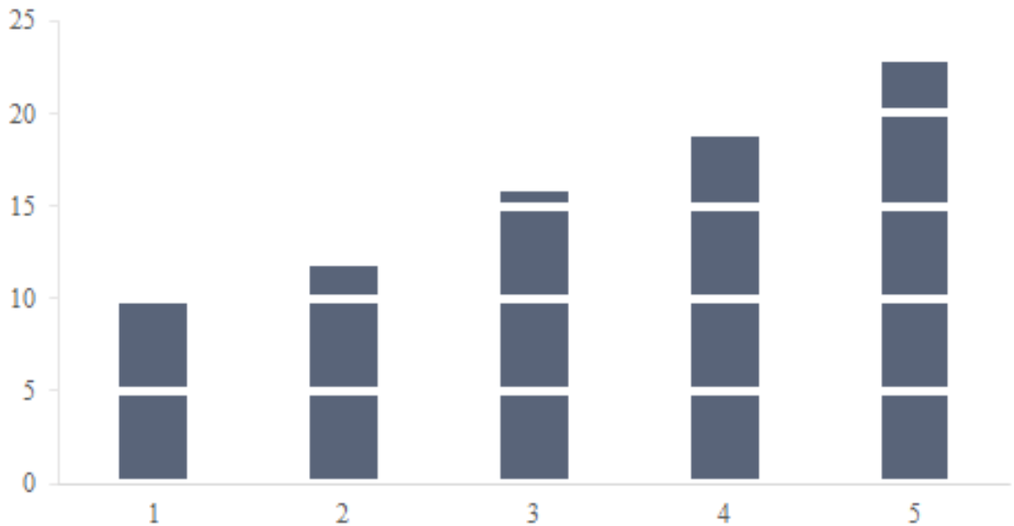


# Final Version with Styling



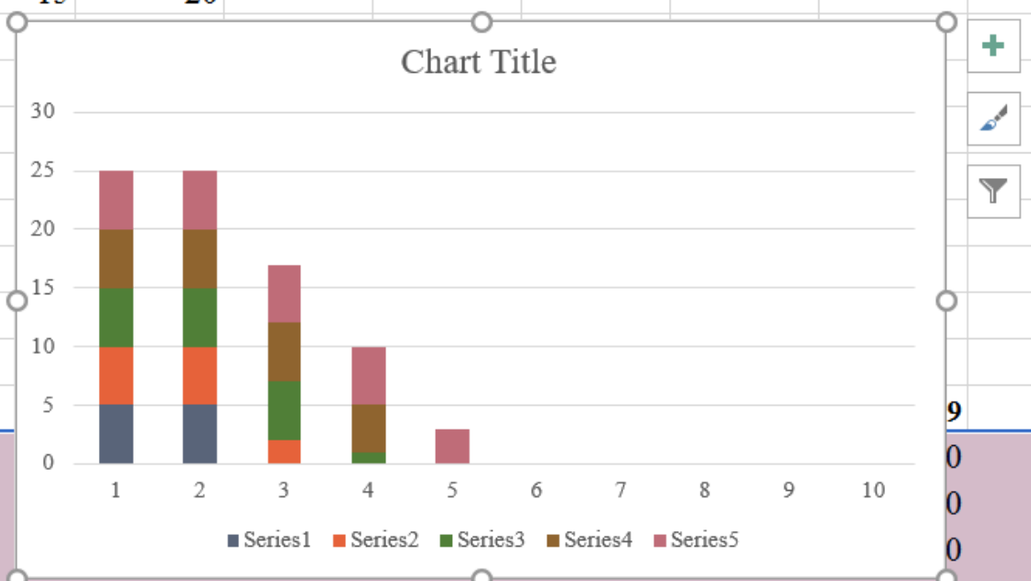
# Overlaid Gridlines with a Formula

In this version of the Overlaid Gridlines chart, I create a stacked column chart. Each section of the chart is given a white outline so that it *appears* like there are gridlines. There are fewer steps in this approach, but it's a bit more difficult to get the data set-up. The worksheet contains a rather complicated formula that makes this approach a bit more flexible: the "Breaker" cell allows you to modify where the "gridlines" appear. Use the *OverlaidGridlines_Formula tab* in the *Advanced Data Visualizations with Excel 2016 Hands-On.xlsx spreadsheet* to create the chart.

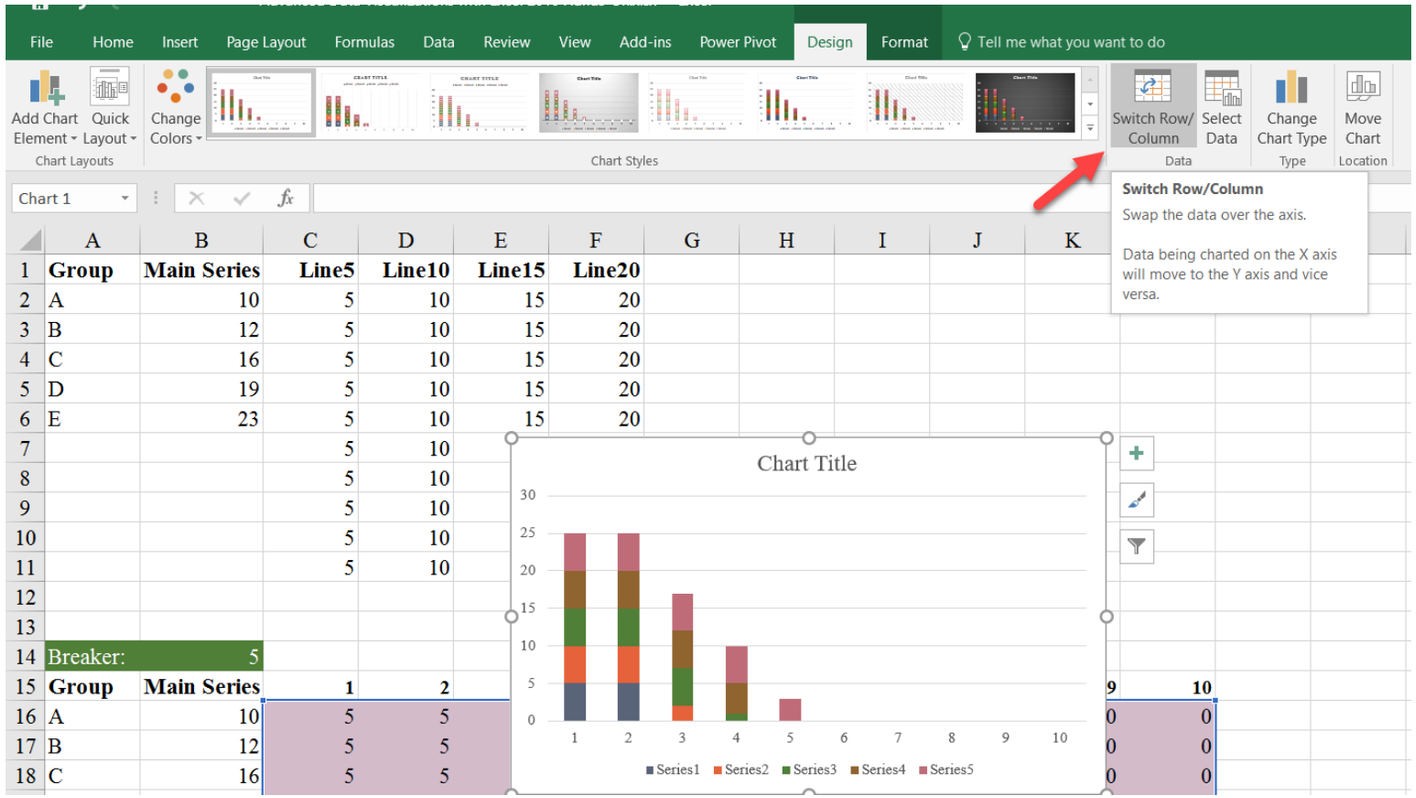


1. Create a stacked column chart from cells C16:M20. These are the cells that contain the formula.

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **Group** | **Main Series** | **Line5** | **Line10** | **Line15** | **Line20** | | | | | | |
| 2 | A | 10 | 5 | 10 | 15 | 20 | | | | | | |
| 3 | B | 12 | 5 | 10 | 15 | 20 | | | | | | |
| 4 | C | 16 | 5 | 10 | 15 | 20 | | | | | | |
| 5 | D | 19 | 5 | 10 | 15 | 20 | | | | | | |
| 6 | E | 23 | 5 | 10 | 15 | 20 | | | | | | |
| 7 | | | 5 | 10 | | | | | | | | |
| 8 | | | 5 | 10 | | | | | | | | |
| 9 | | | 5 | 10 | | | | | | | | |
| 10 | | | 5 | 10 | | | | | | | | |
| 11 | | | 5 | 10 | | | | | | | | |
| 12 | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | |
| 14 | Breaker: | 5 | | | | | | | | | | |
| 15 | **Group** | **Main Series** | **1** | **2** | | | | | | | **9** | **10** |
| 16 | A | 10 | 5 | 5 | | | | | | | 0 | 0 |
| 17 | B | 12 | 5 | 5 | | | | | | | 0 | 0 |
| 18 | C | 16 | 5 | 5 | | | | | | | 0 | 0 |
| 19 | D | 19 | 5 | 5 | 5 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | E | 23 | 5 | 5 | 5 | 5 | 3 | 0 | 0 | 0 | 0 | 0 |



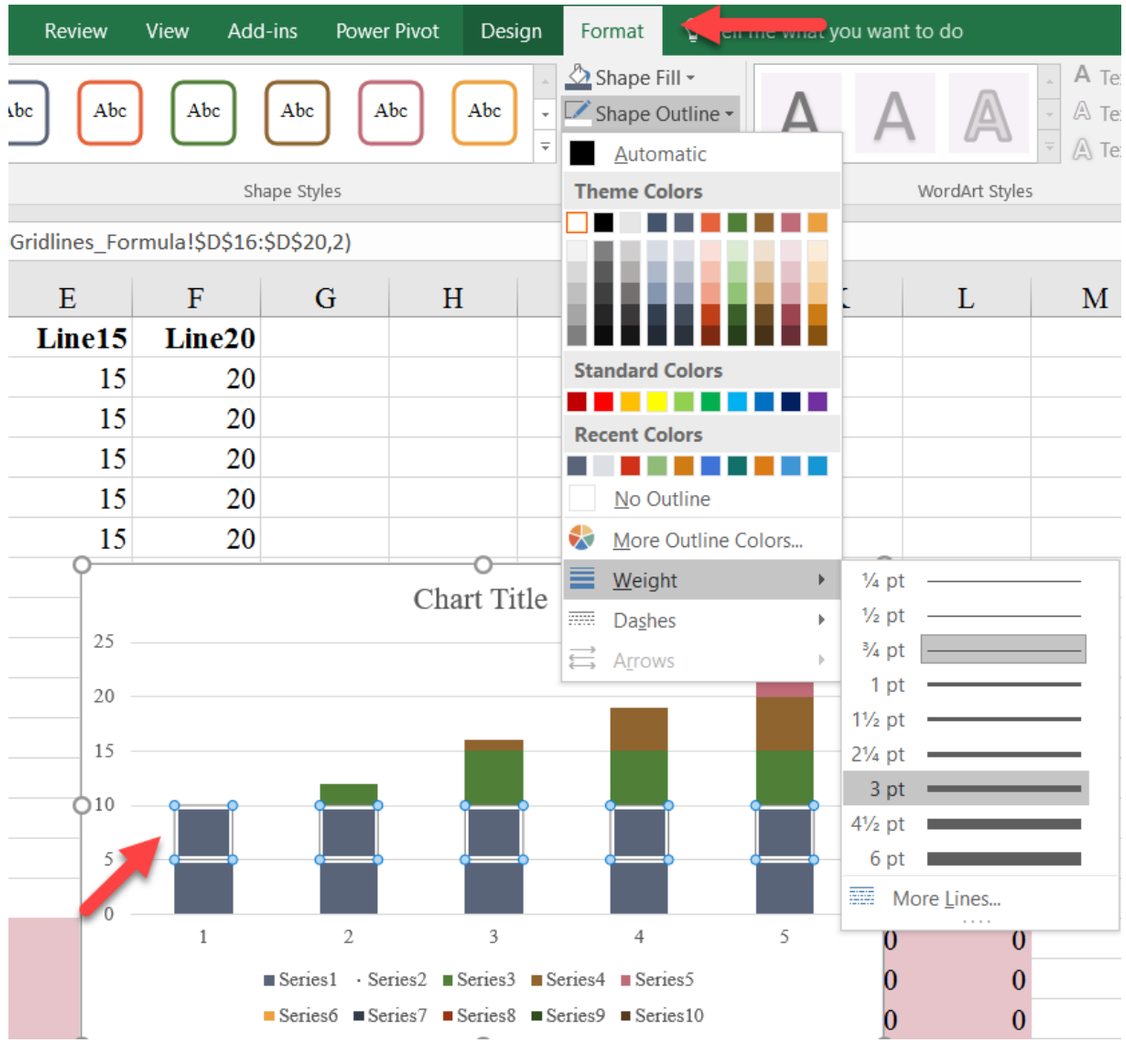
2. Notice how the default version of the chart plots the columns; we want to plot the rows. To do so, select the chart and the “Switch Row/Column” button in the “Design” tab of the ribbon.



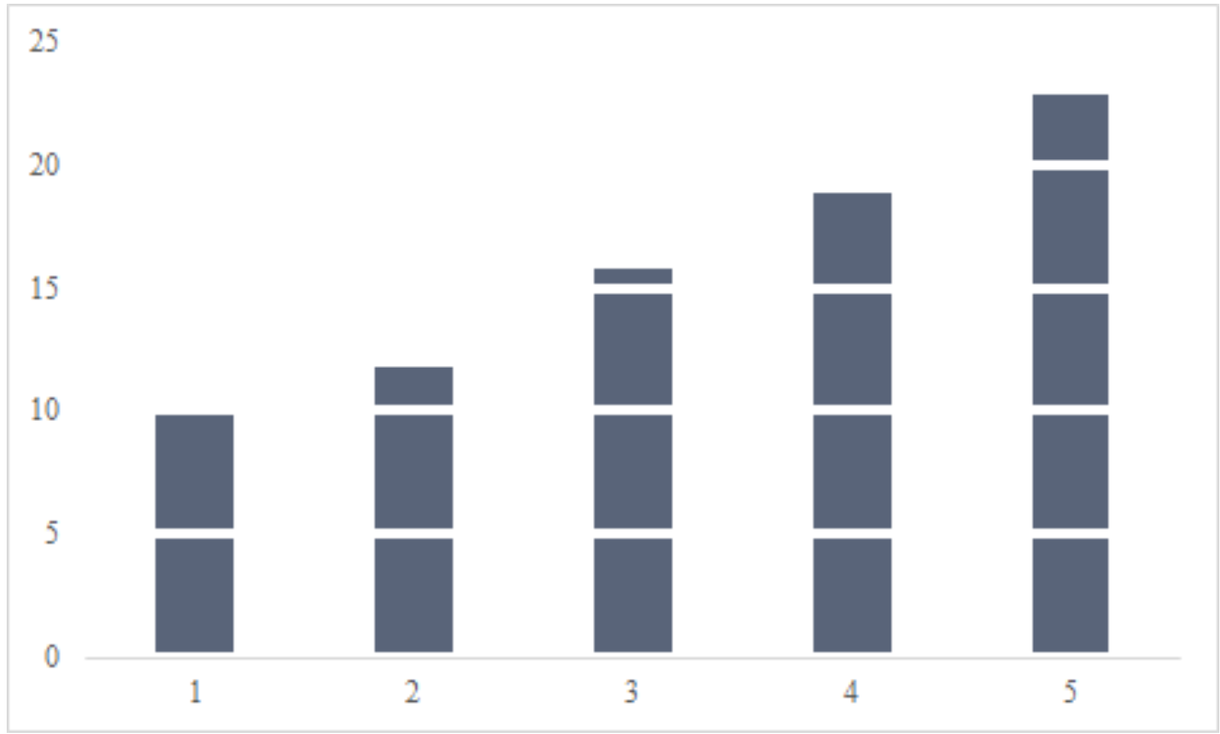

| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| 1 | **Group** | **Main Series** | **Line5** | **Line10** | **Line15** | **Line20** |
| 2 | A | 10 | 5 | 10 | 15 | 20 |
| 3 | B | 12 | 5 | 10 | 15 | 20 |
| 4 | C | 16 | 5 | 10 | 15 | 20 |
| 5 | D | 19 | 5 | 10 | 15 | 20 |
| 6 | E | 23 | 5 | 10 | 15 | 20 |
| 7 | | | 5 | 10 | | |
| 8 | | | 5 | 10 | | |
| 9 | | | 5 | 10 | | |
| 10 | | | 5 | 10 | | |
| 11 | | | 5 | 10 | | |
| 12 | | | | | | |
| 13 | | | | | | |
| 14 | Breaker: | 5 | | | | |
| 15 | **Group** | **Main Series** | **1** | **2** | | |
| 16 | A | 10 | 5 | 5 | | |
| 17 | B | 12 | 5 | 5 | | |
| 18 | C | 16 | 5 | 5 | | |

| | J | K |
|---|---|---|
| 15 | **9** | **10** |
| 16 | 0 | 0 |
| 17 | 0 | 0 |
| 18 | 0 | 0 |

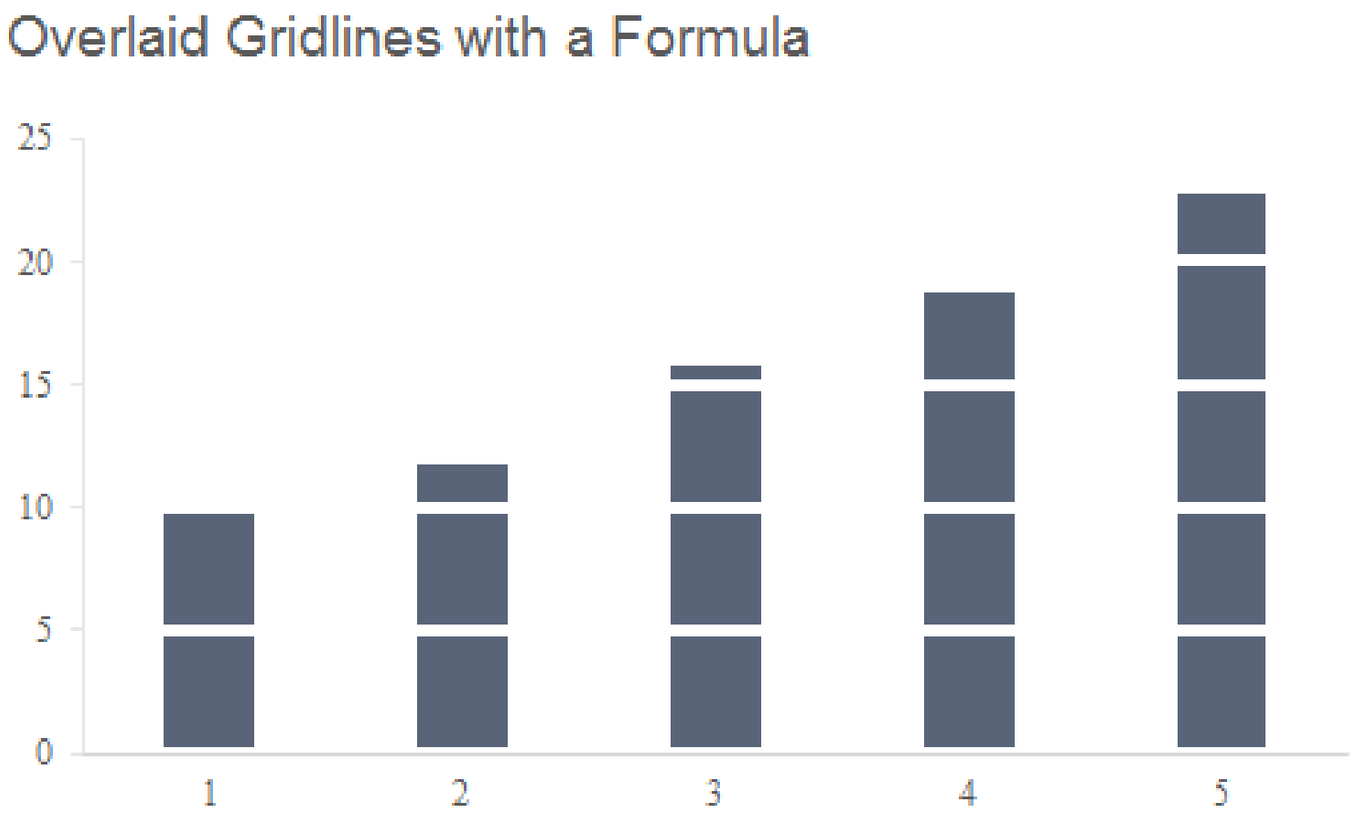
3. Now it's just a matter of styling. Change the fill of each shape under the "Shape Fill" dropdown in the "Format" menu to the same color. Similarly, change the color of the "Shape Outline" to white and increase the thickness to your desired weight. Of course, delete the existing (default) gridlines, legend, etc.



4. Repeat for all 5 series.

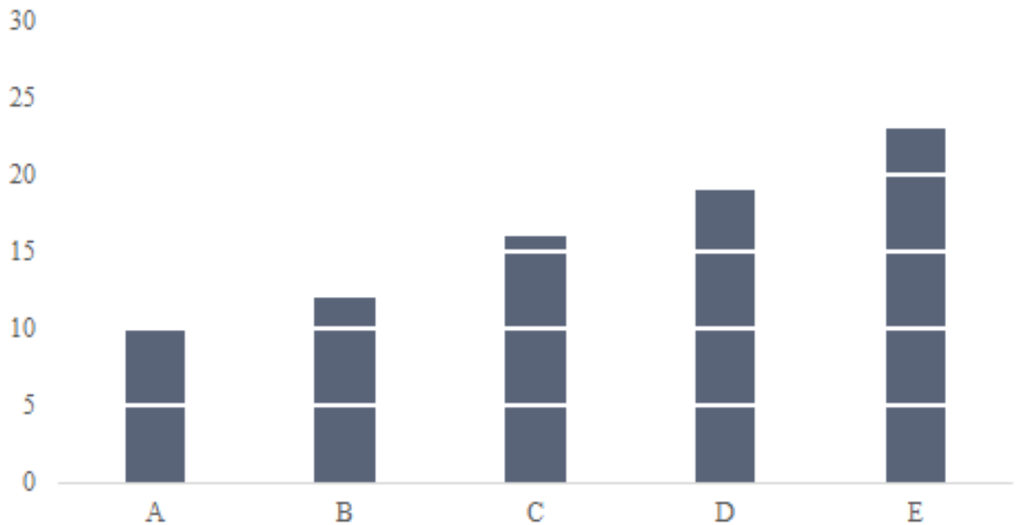


## Final Version with Styling

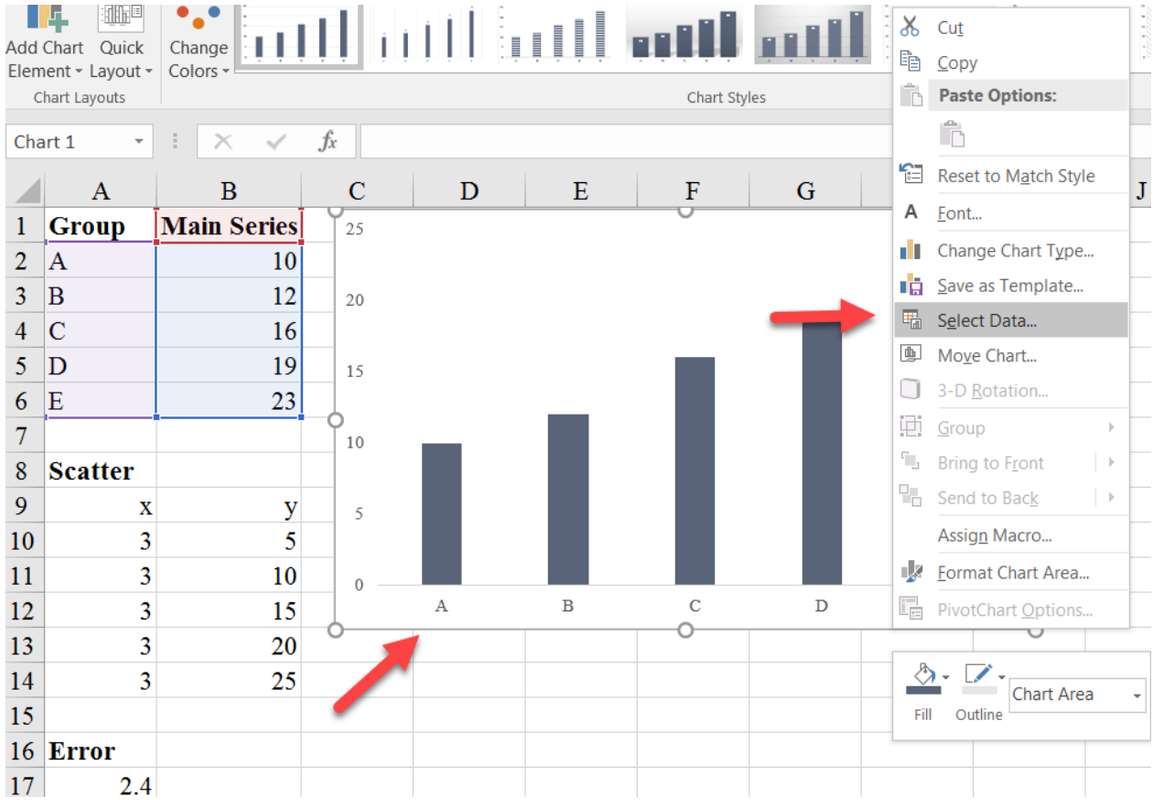


# Overlaid Gridlines with a Scatterplot

In this version of the Overlaid Gridlines graph, we'll combine a column chart and a scatterplot. We'll then add horizontal error bars to the scatterplot points to mimic the gridlines. Use the *OverlaidGridlines_Scatterplot tab* in the *Advanced Data Visualizations with Excel 2016 Hands-On.xlsx spreadsheet* to create the chart.

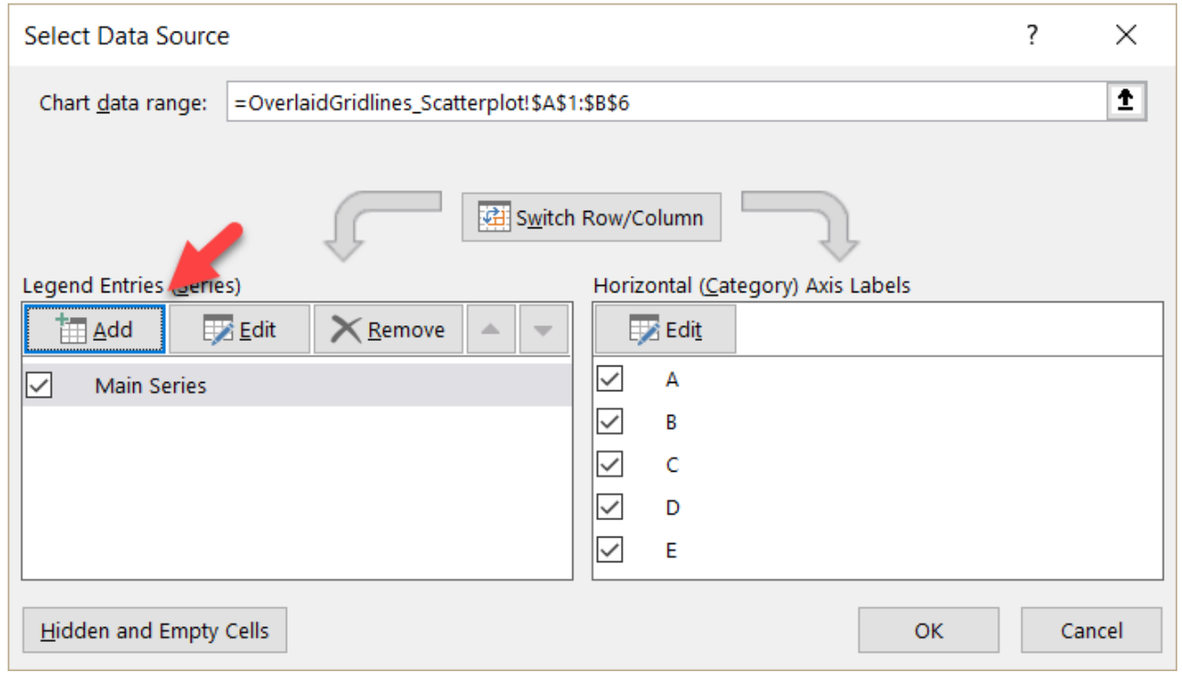


1. Create a column chart with the “Main Series” data. Delete the existing gridlines and chart title. Then, right-click on the chart and choose “Select Data” in the menu.

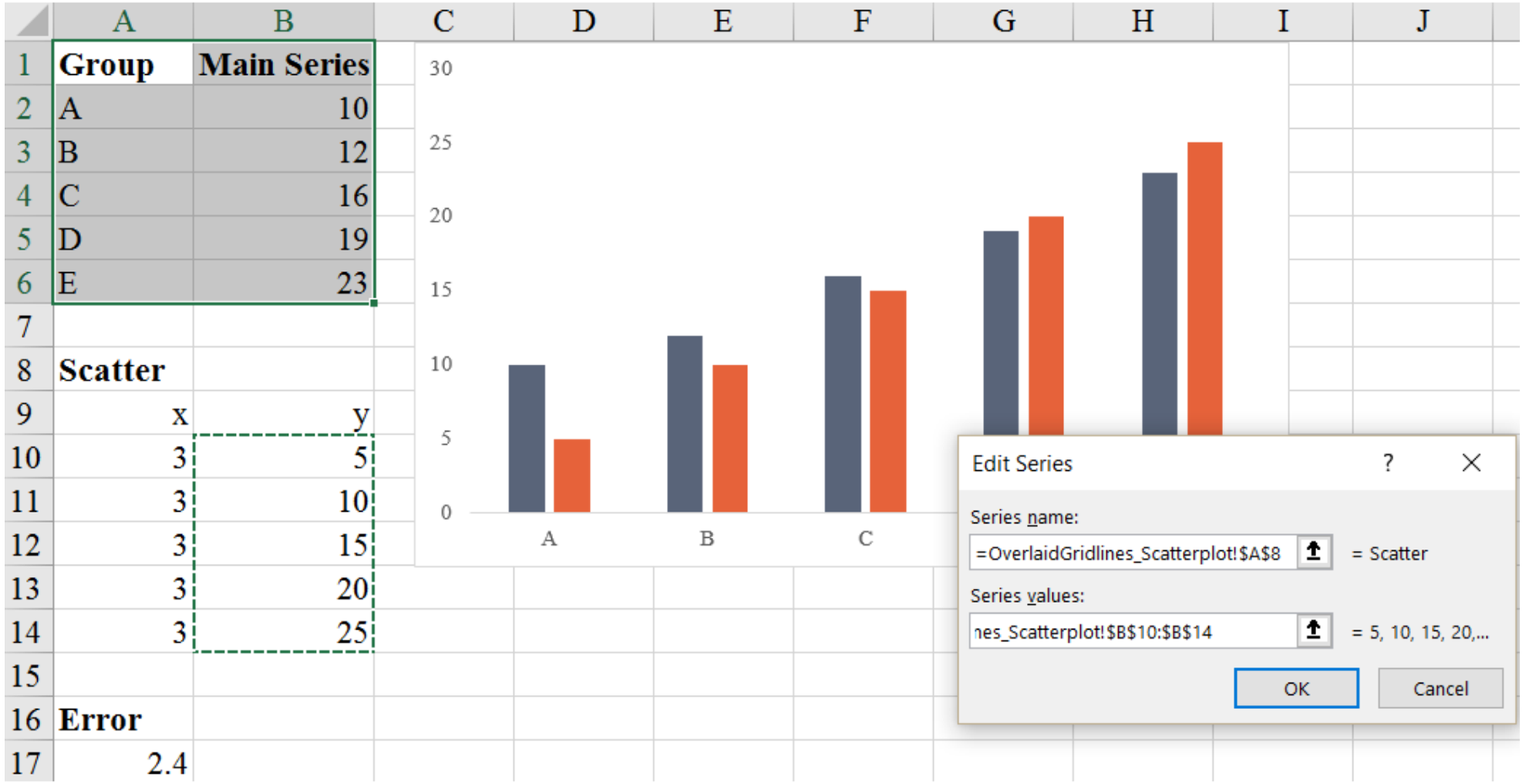



| | A | B |
|---|---|---|
| 1 | **Group** | **Main Series** |
| 2 | A | 10 |
| 3 | B | 12 |
| 4 | C | 16 |
| 5 | D | 19 |
| 6 | E | 23 |
| 7 | | |
| 8 | **Scatter** | |
| 9 | x | y |
| 10 | 3 | 5 |
| 11 | 3 | 10 |
| 12 | 3 | 15 |
| 13 | 3 | 20 |
| 14 | 3 | 25 |
| 15 | | |
| 16 | **Error** | |
| 17 | 2.4 | |

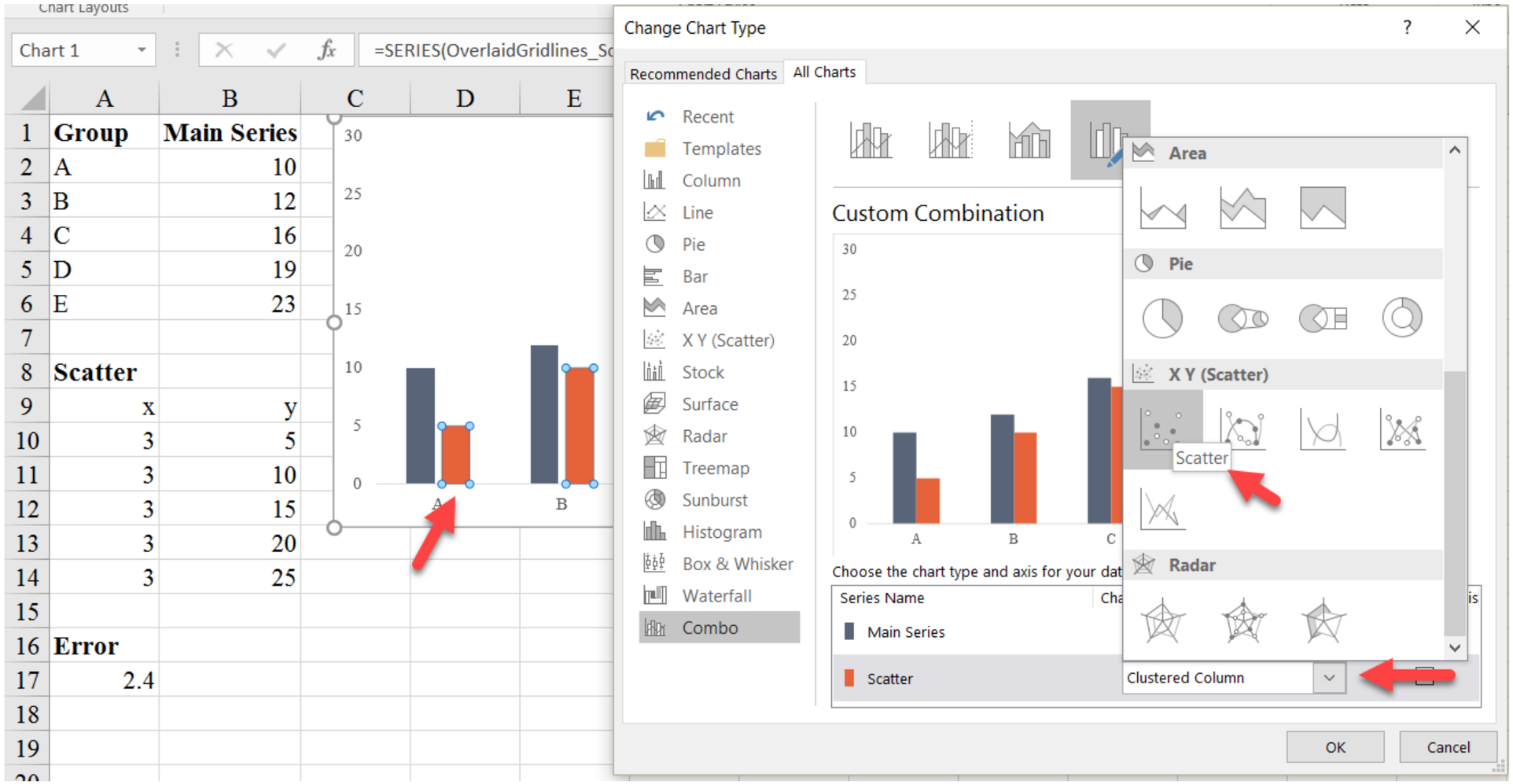
2. In the next menu, under “Legend Entries (Series)” select “Add”.



3. We are going to add the scatterplot series, so after choosing "Add", insert the reference to the "Scatter" name in the "Series name:" box (cell A8) and (what will become) the y-series (B10:B14) in the "Series values:" box. You'll end up with a paired column chart.

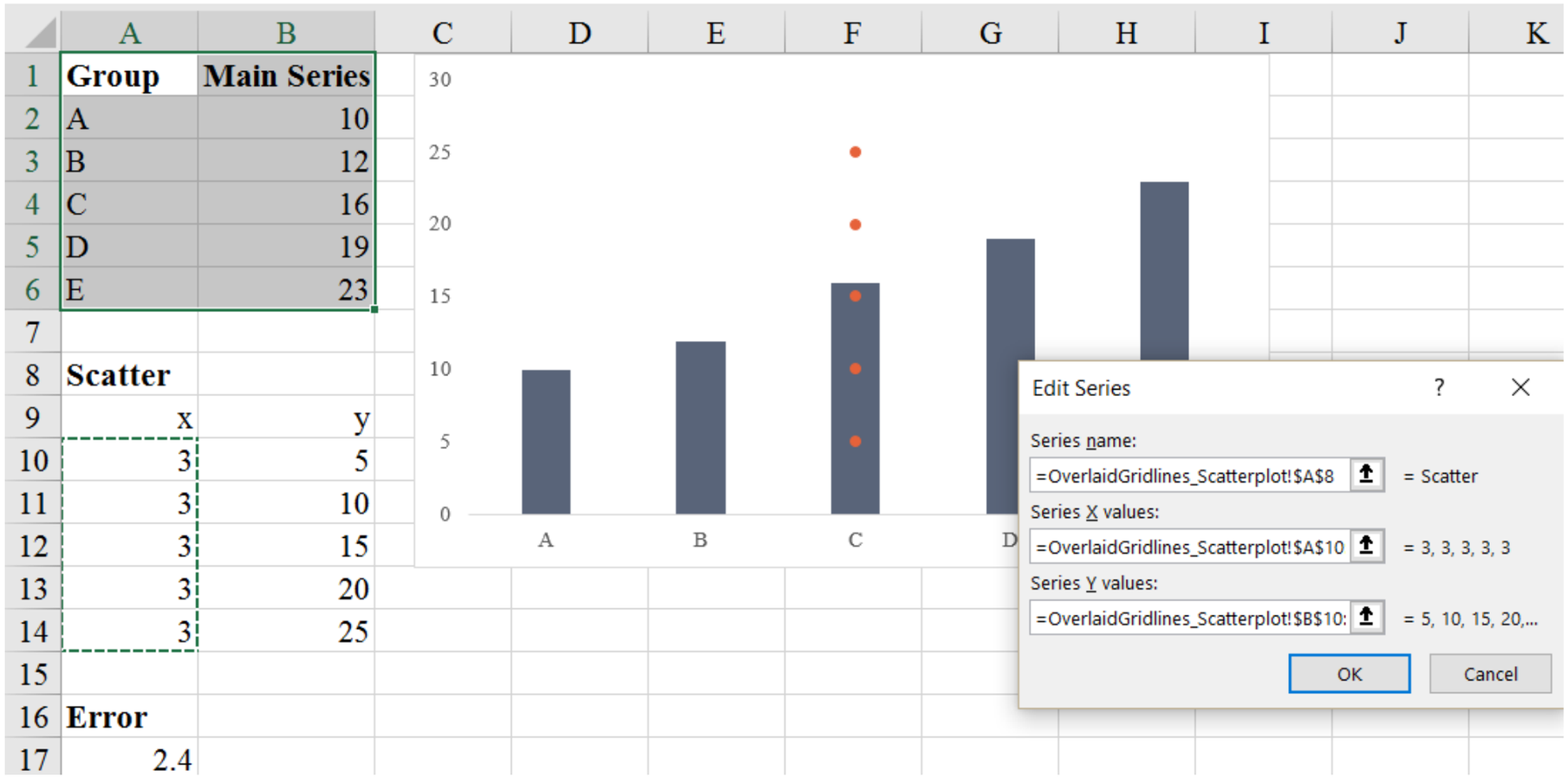


4. Select the **orange** (“Scatter”) series and under the “Design” tab in the ribbon, select “Change Chart Type”. In the resulting menu, change the chart type for the “Scatter” series to a scatterplot chart type.

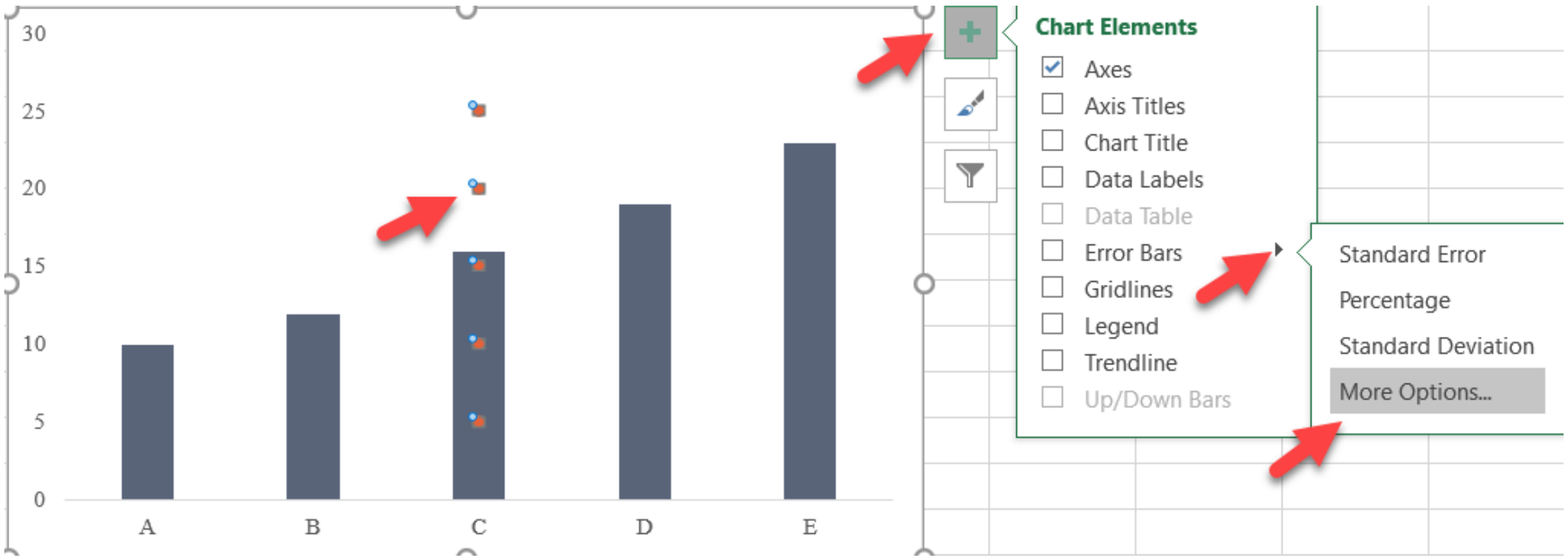



| | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | **Group** | **Main Series** | | | |
| 2 | A | 10 | | | |
| 3 | B | 12 | | | |
| 4 | C | 16 | | | |
| 5 | D | 19 | | | |
| 6 | E | 23 | | | |
| 7 | | | | | |
| 8 | **Scatter** | | | | |
| 9 | x | y | | | |
| 10 | 3 | 5 | | | |
| 11 | 3 | 10 | | | |
| 12 | 3 | 15 | | | |
| 13 | 3 | 20 | | | |
| 14 | 3 | 25 | | | |
| 15 | | | | | |
| 16 | **Error** | | | | |
| 17 | 2.4 | | | | |
| 18 | | | | | |
| 19 | | | | | |

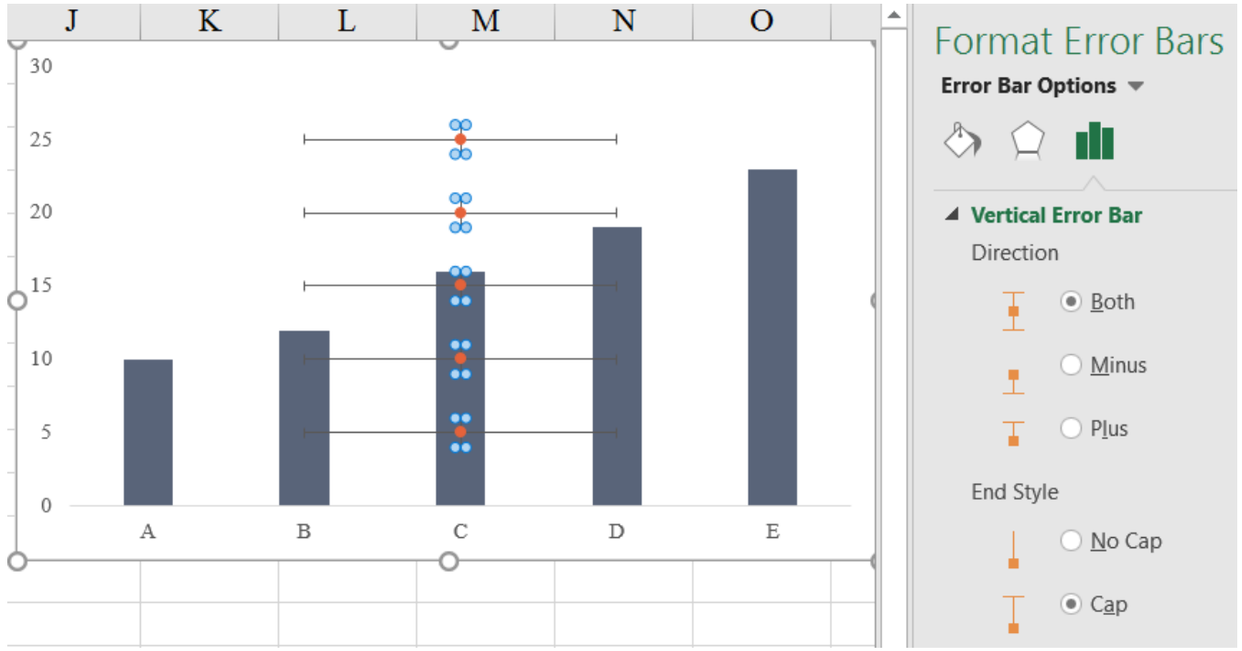
5. We have only assigned y-values to the scatterplot series, so we now need to give it the x-values. Right-click on the chart and choose “Select Data” again. Select “Edit” for the “Scatter” series and insert the cell reference for the x-values (A10:A14).



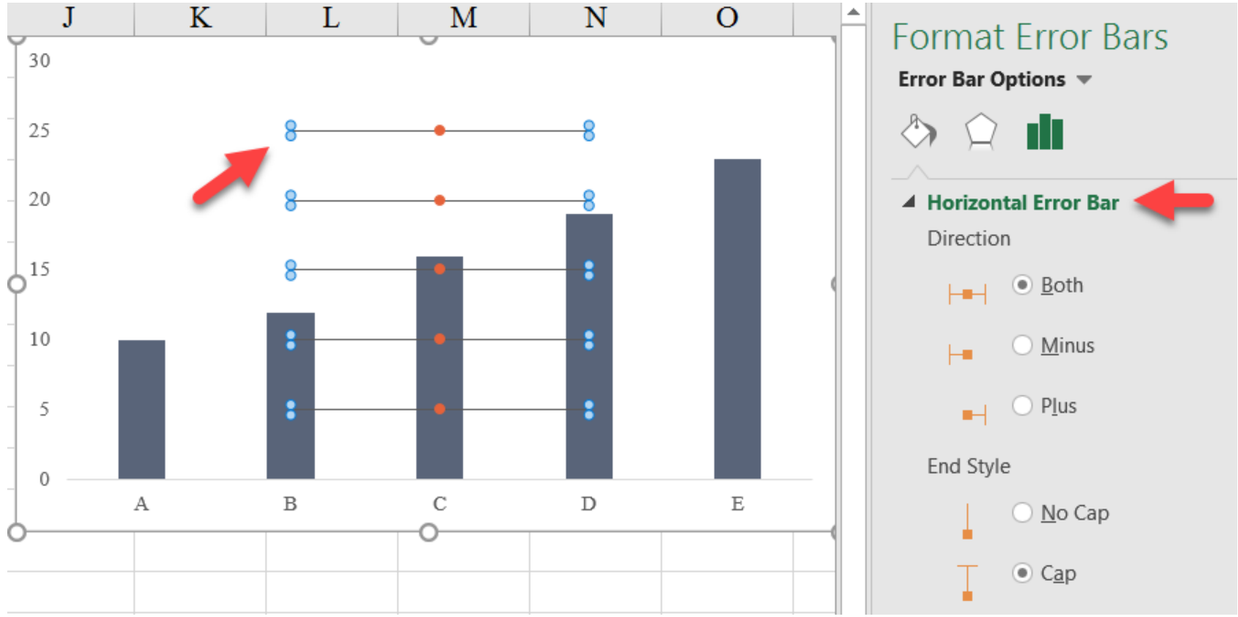
6. We now have the scatterplot overlaid with the column chart. We now need to add the horizontal error bars. To do so, select the “Error Bars” option that appears in the “Chart Elements” menu that appears when you select the chart. Now, select the “More Options” and menu item and in the resulting “Add Error Bars” menu that appears, select the “Scatter” series and select “OK”.



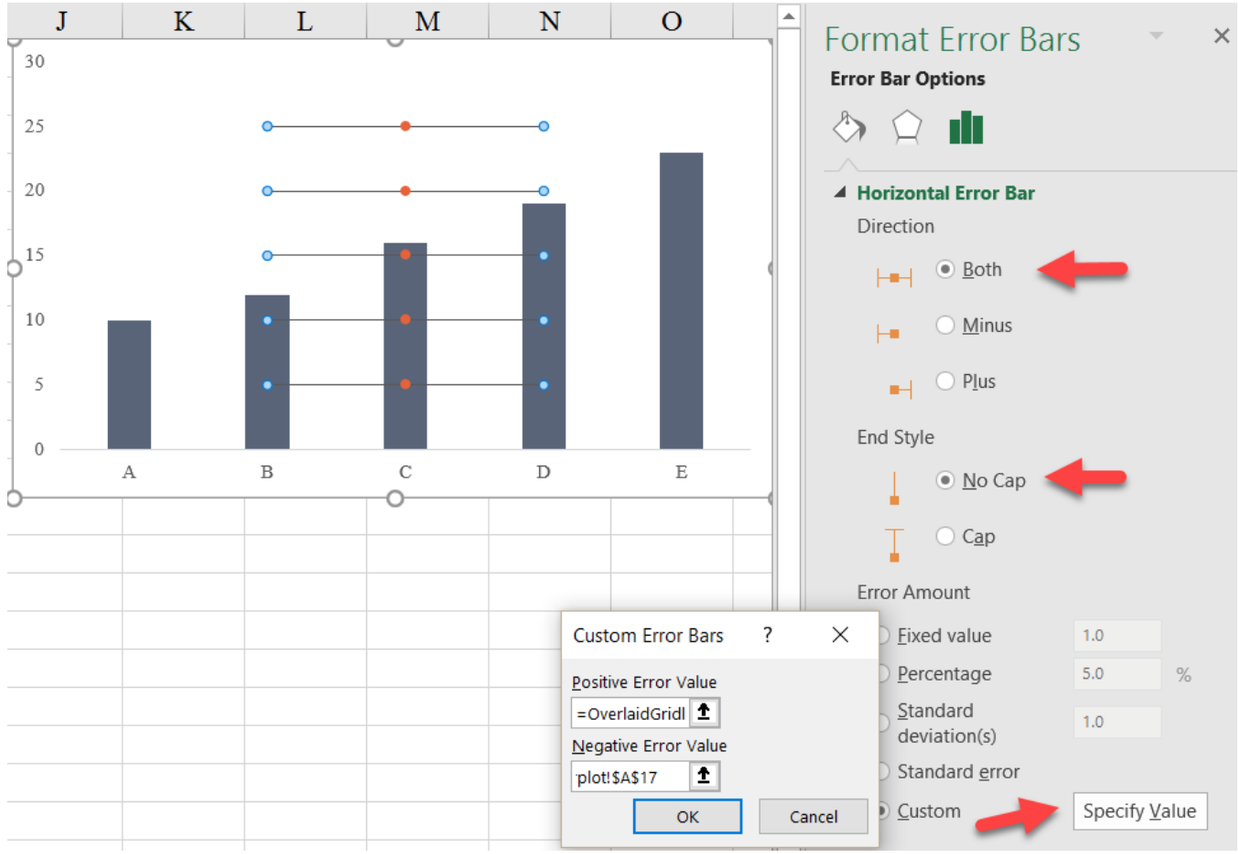
7. You may notice that Excel will, by default, add both vertical and horizontal error bars. The default pane is for styling the Vertical Error Bars. We don't need these, so you can press delete.



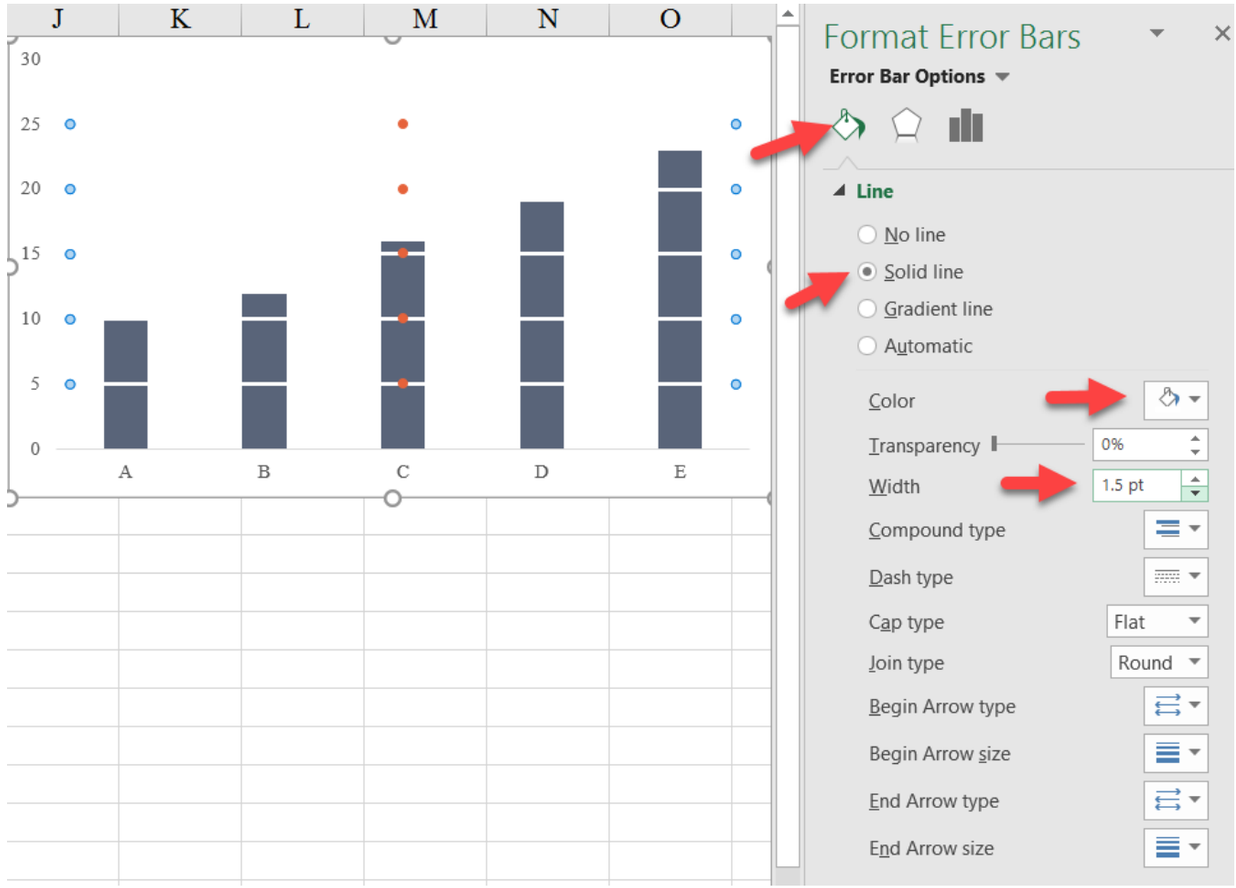
8. What we want to do is to style the horizontal error bars. Select those error bars (again, by right-clicking or using CTRL-1) and you'll be brought to the Horizontal Error Bars formatting pane.



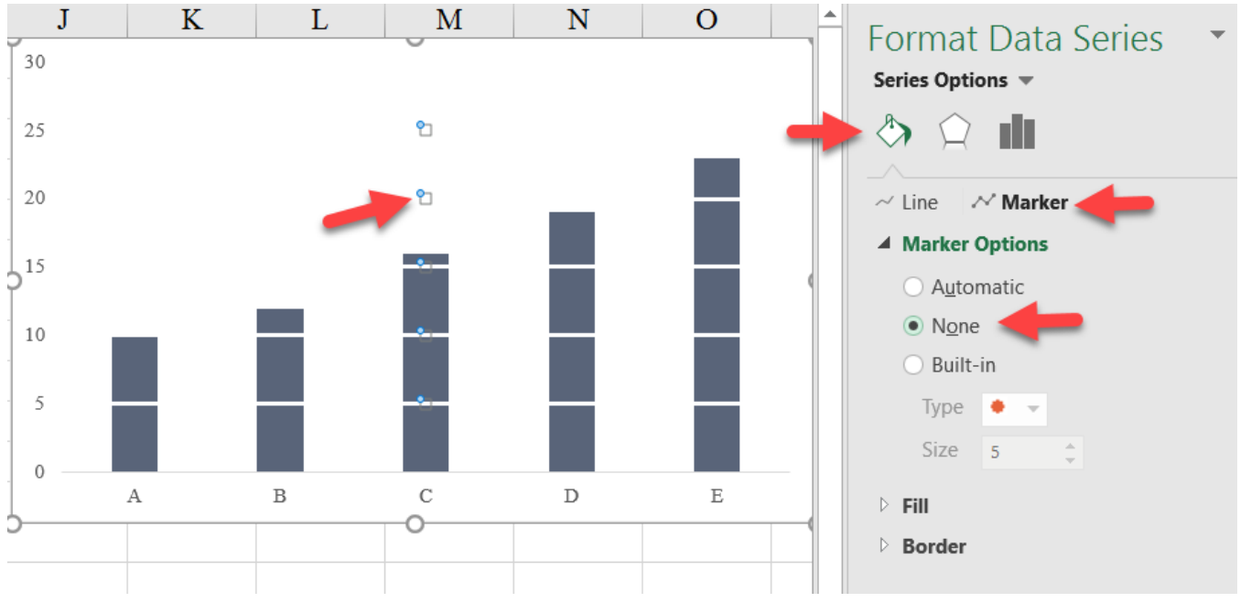
9. Some changes to make here: Under “Direction” select “Both” and under “End Style” select “No Cap”. At the bottom, under “Error Amount”, select the “Custom” menu and hit the “Specify value” button. Here, you’ll be prompted for a Positive and Negative Error Value. We’ll insert a reference to cell A17 for both values here. Why 2.4 for the error bar value? The error bars refer to the *position* along the x-axis. We want the lines to extend from the scatterplot point just beyond the A bar, so that results in two “positions” plus a bit more.



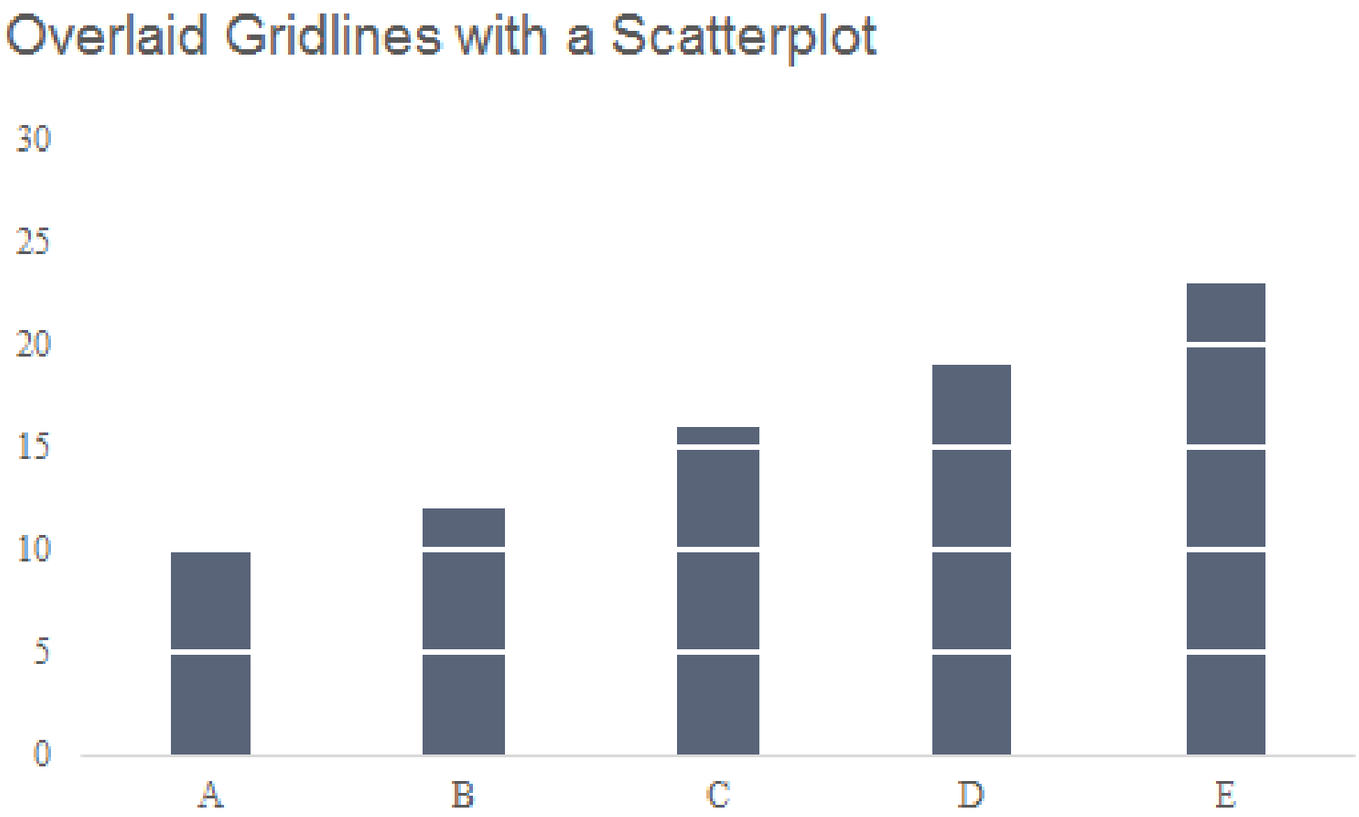
10. In the “Line Color” tab, you can change the line color to a white solid line and in the “Line Style” tab, change the line width to 1.5 pt.



11. Right-click (or CTRL-1) to format the scatterplot points and under “Format Data Series”, select the “Marker” Options” tab and then select “None” for “Marker Type”. This will hide the marker, and all you are left with is the column chart with overlaid gridlines.

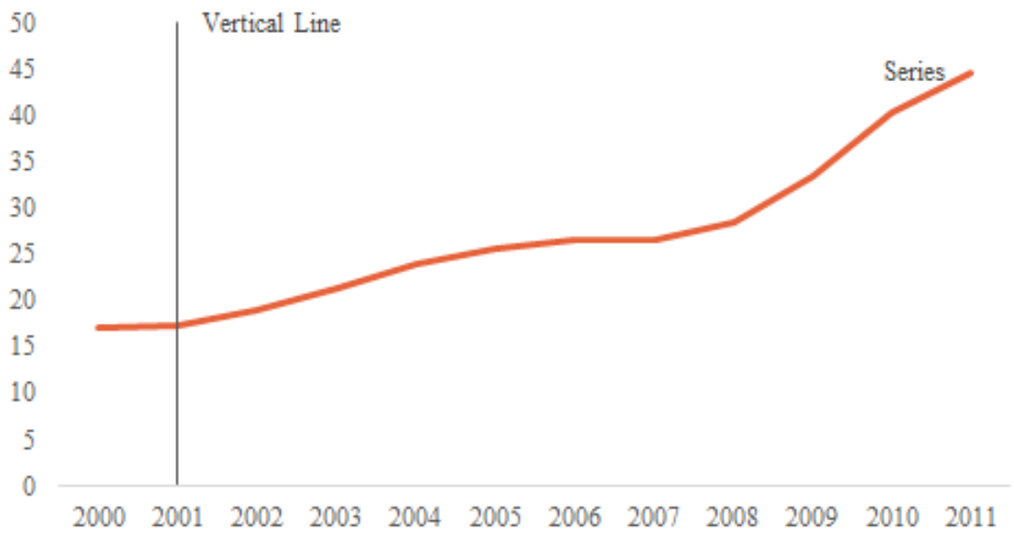


## Final Version with Styling

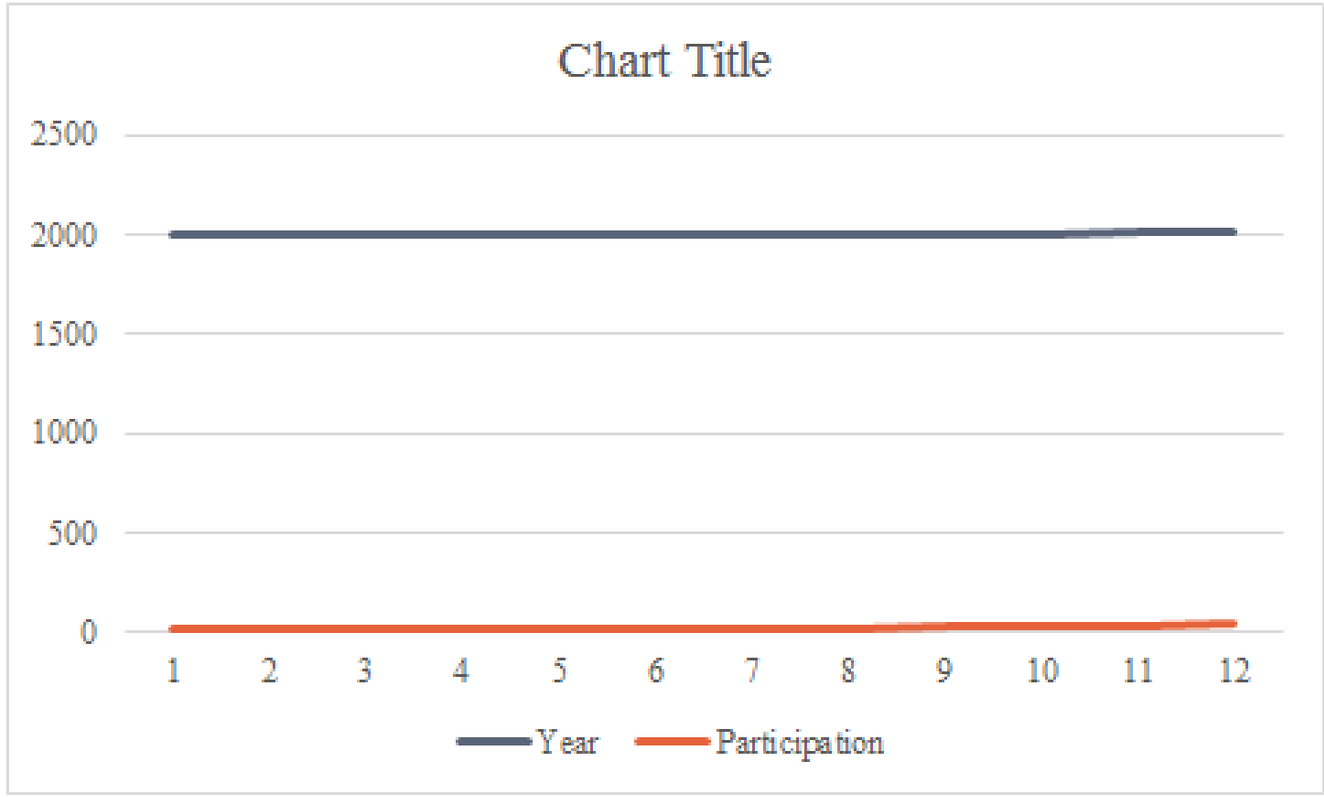


# Vertical Line

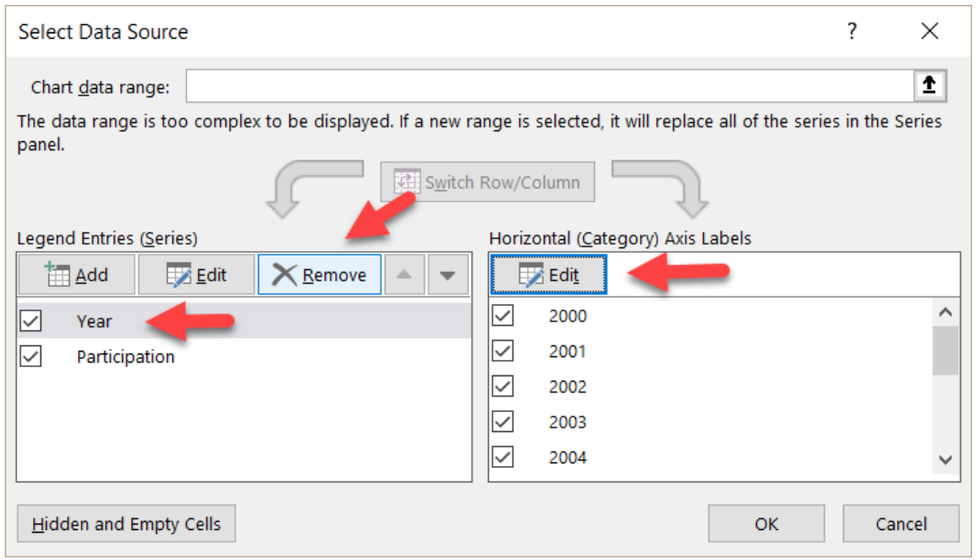
This tutorial shows you how to add a vertical line to a line chart. This could be used to mark an event, a policy change, or some other annotation. This approach is superior to drawing a line or shape on the graph because it is a part of the graph and can be moved to other programs (e.g. PowerPoint) and is linked to data for easier updating and replication. Use the *VerticalLine tab* in the *Advanced Data Visualizations with Excel 2016 Hands-On.xlsx spreadsheet* to create the chart.

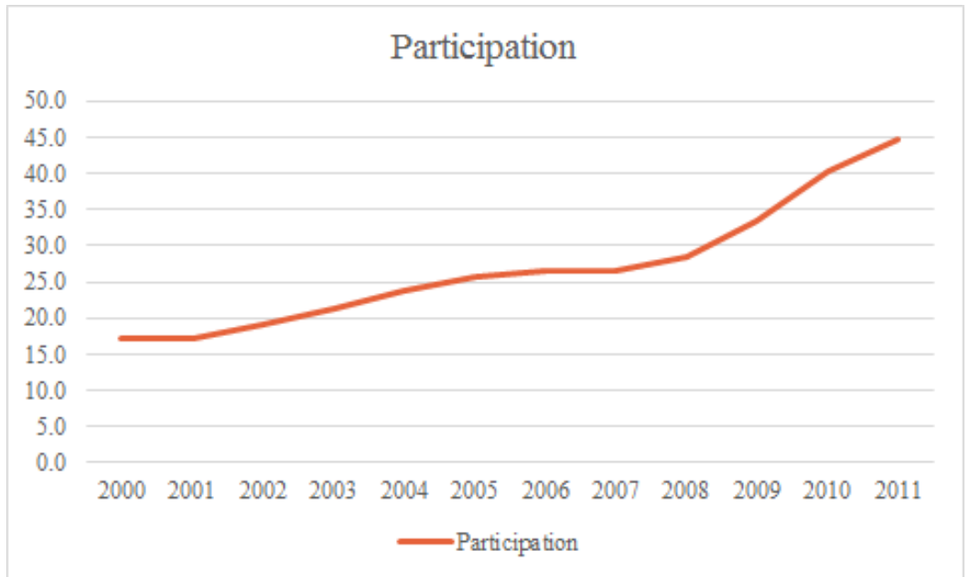


1. Start by making the line graph using cells A1:B13. You'll notice you get two lines. Excel assumes that you want to plot the values in column A and not use them as x-axis labels.

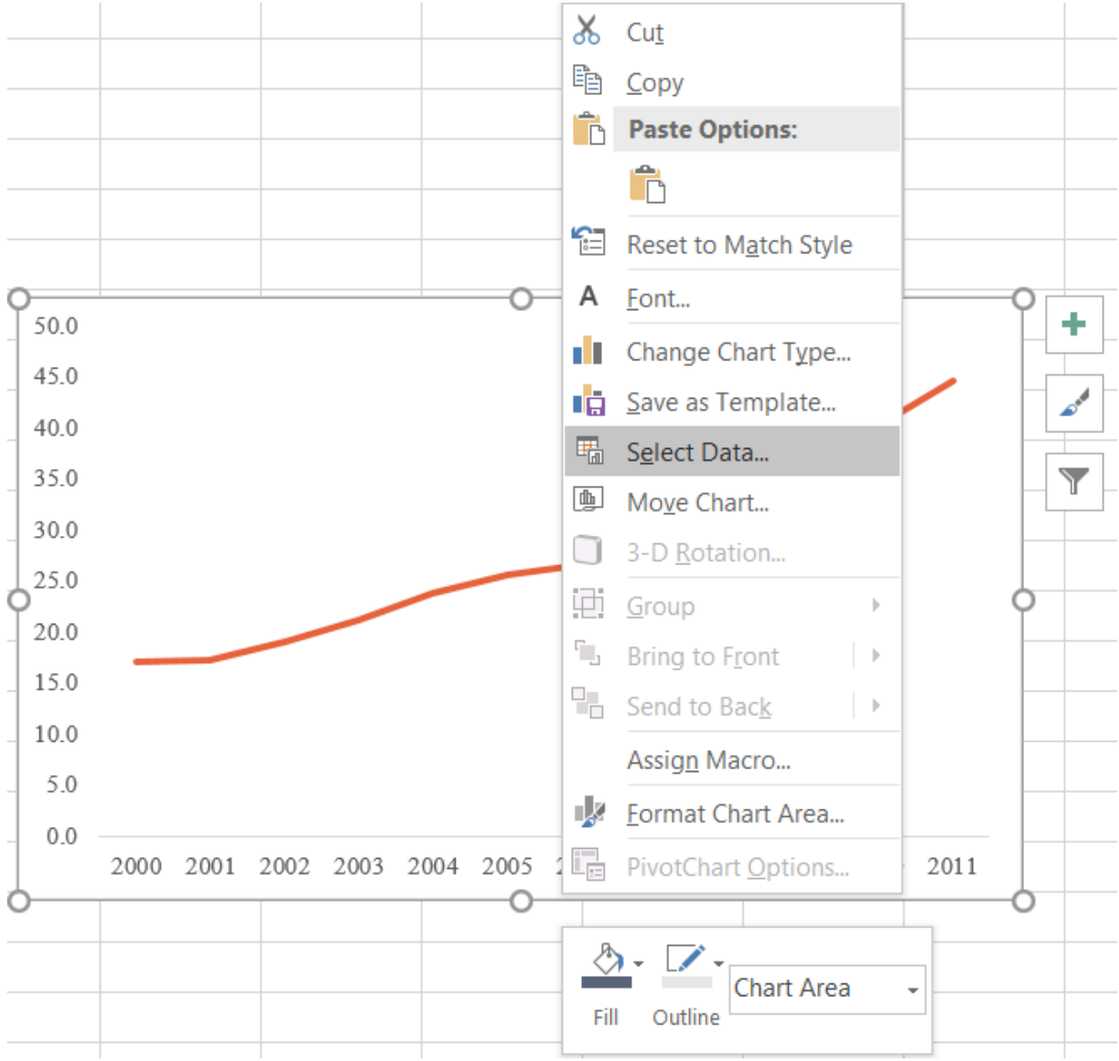


2. If you select data and remove the “Year” series and remake the chart to use A2:A13 as Horizontal Axis labels, you’ll get a graph of the Participation series with the Year labeled along the axis.

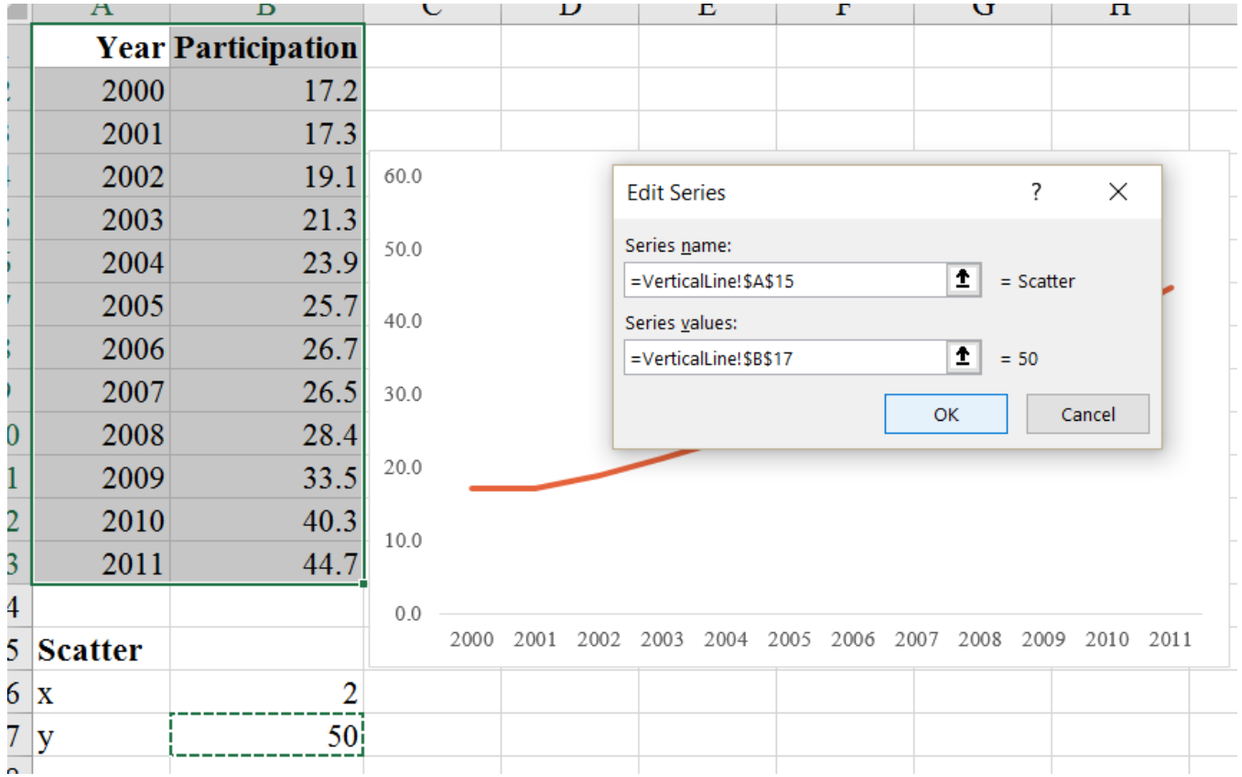


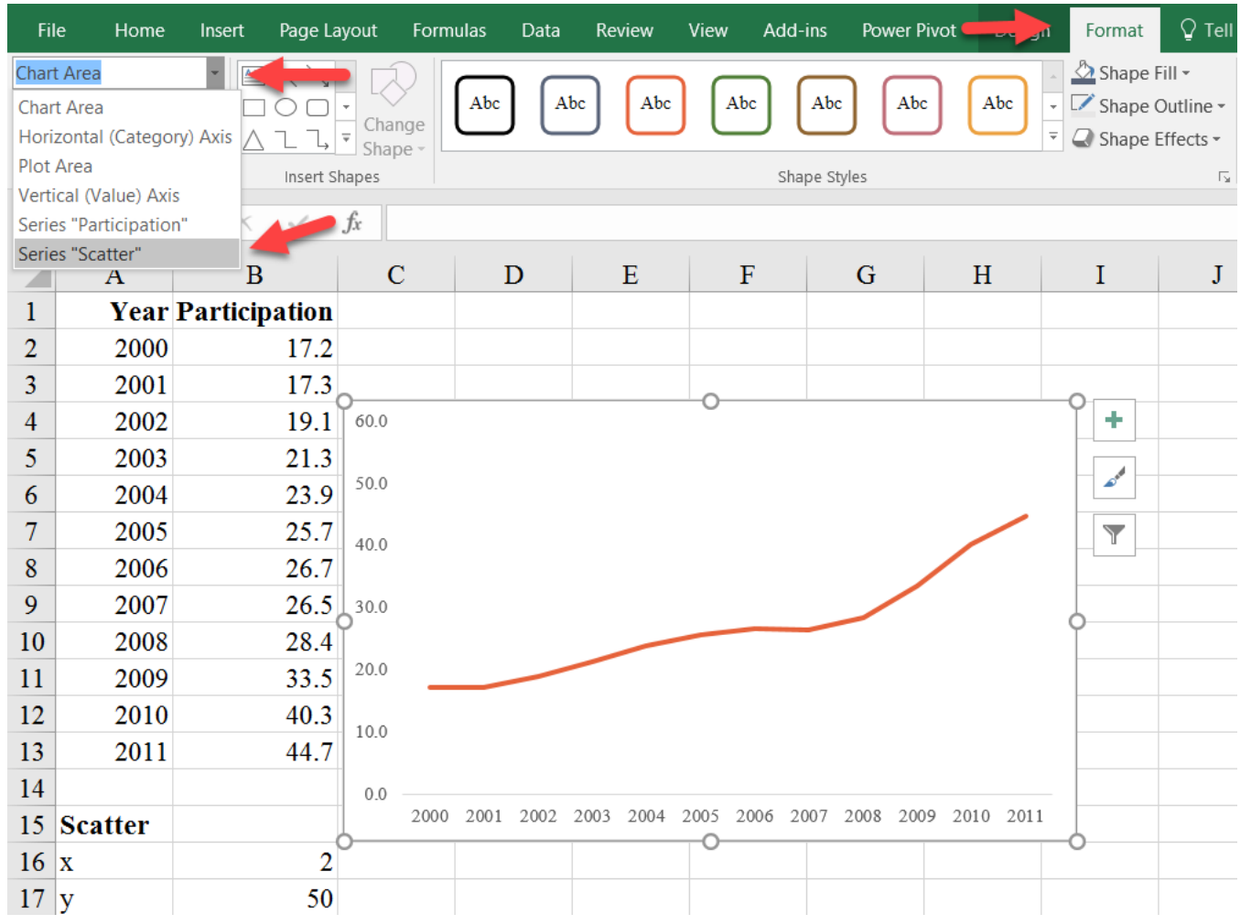
3. We'll add the vertical line by adding a scatterplot chart to the line chart and then dropping a vertical error bar from that point. We start by adding the scatterplot point. Right-click on the chart and choose the "Select Data" option. (You'll notice I've deleted the title, legend, and gridlines here.)



4. From there, select “Add” and input the “Series name” (cell A15) and the y value of 50 into the “Series values” (cell B17) into the box.

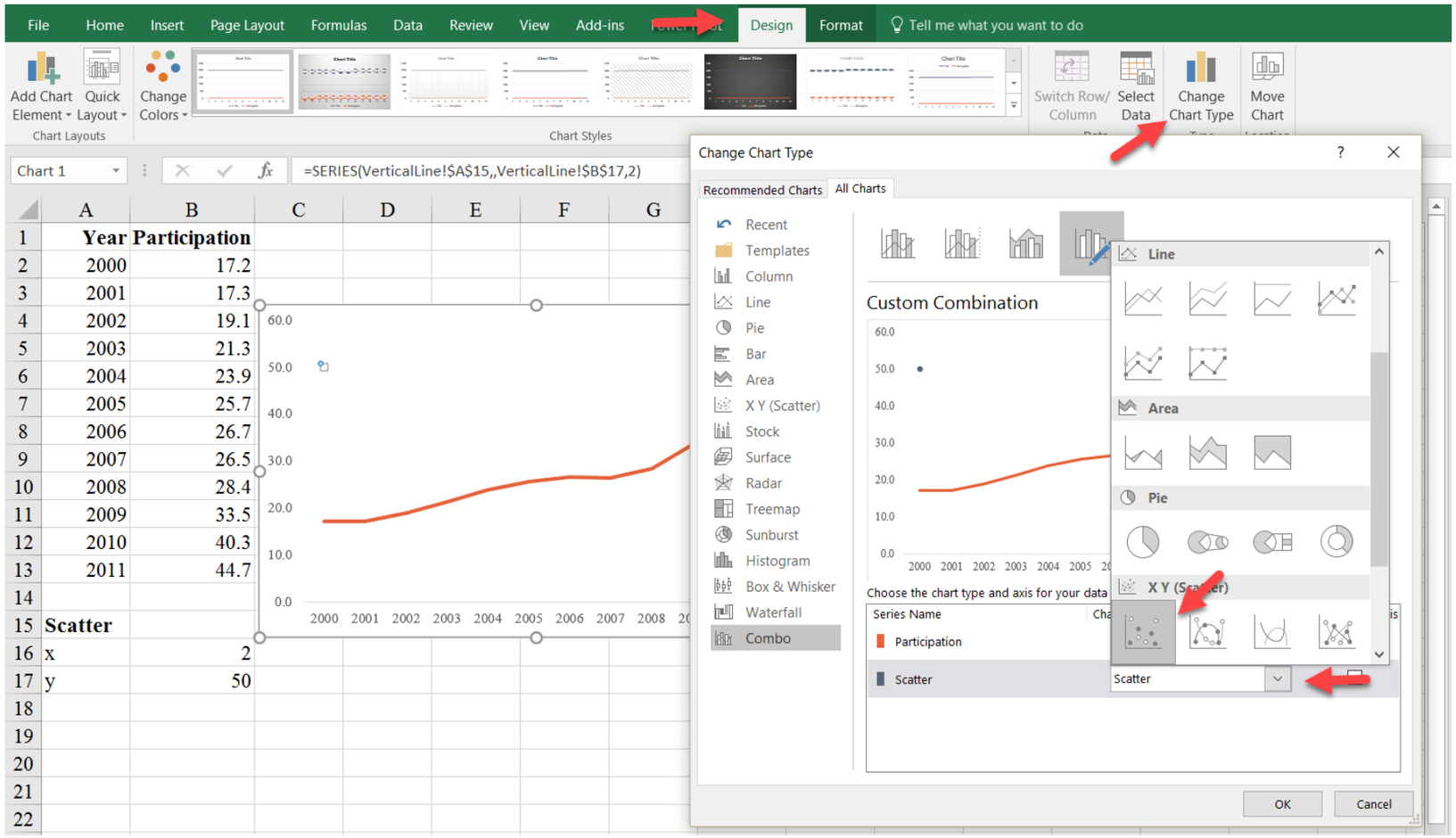


5. You'll notice that two things occurred. First, the y-axis moved from a maximum of 50 to a maximum of 60. Excel will not allow you to put a data series at the maximum of the chart, and we just added a y-value of 50 to the chart. Second, a data marker didn't appear. This is because we have just added a line to the chart, but a line needs two points, so nothing appears on the chart. To select our newly-added point to the chart and convert it to the scatterplot, use the dropdown menu in the "Format" tab. The "Scatter" series will appear in that dropdown.

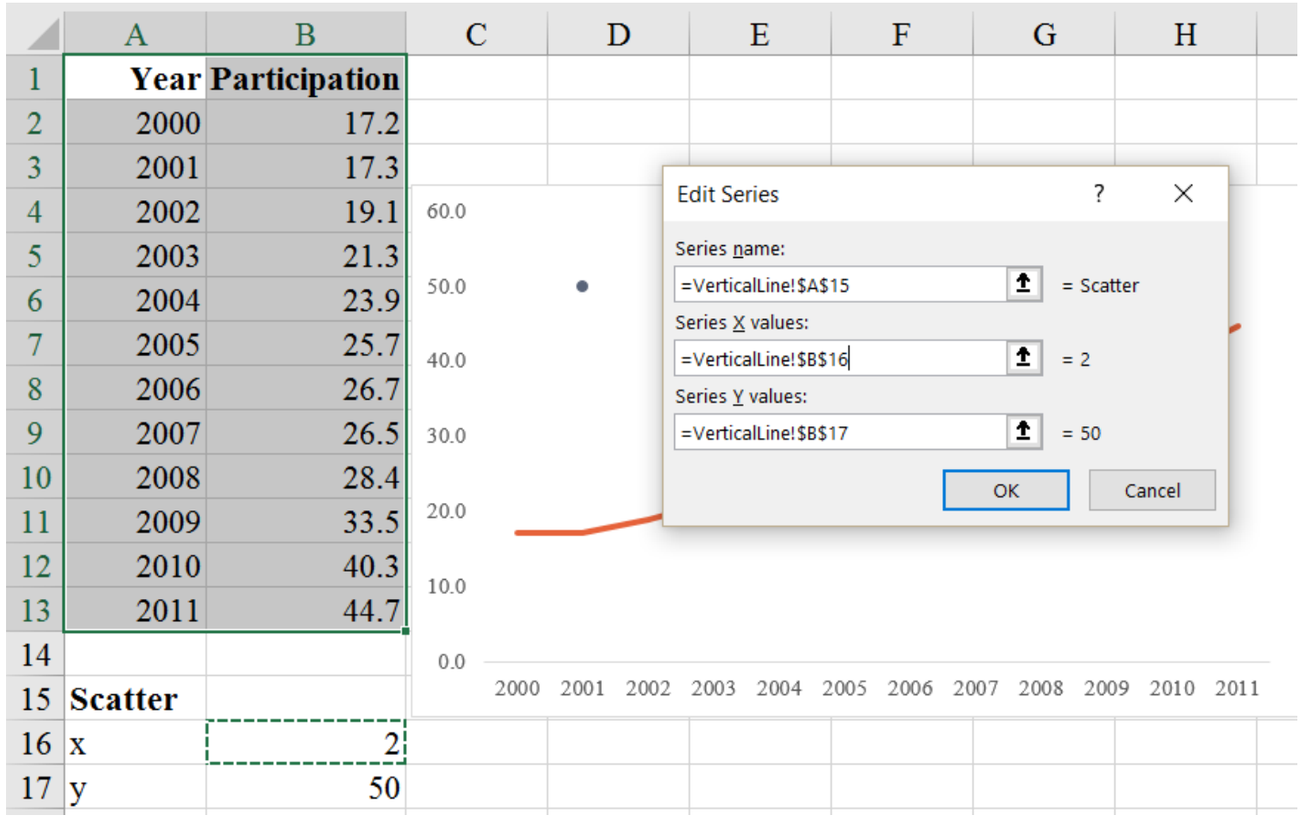


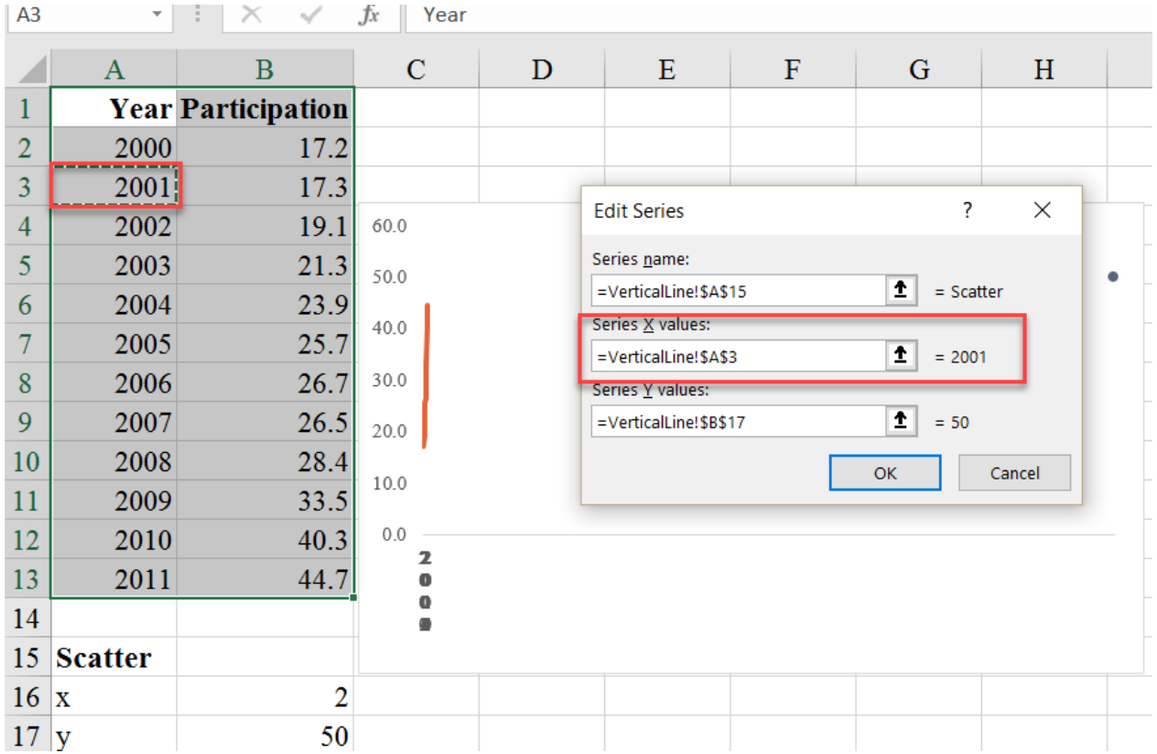

| | A | B |
|---|---|---|
| 1 | **Year** | **Participation** |
| 2 | 2000 | 17.2 |
| 3 | 2001 | 17.3 |
| 4 | 2002 | 19.1 |
| 5 | 2003 | 21.3 |
| 6 | 2004 | 23.9 |
| 7 | 2005 | 25.7 |
| 8 | 2006 | 26.7 |
| 9 | 2007 | 26.5 |
| 10 | 2008 | 28.4 |
| 11 | 2009 | 33.5 |
| 12 | 2010 | 40.3 |
| 13 | 2011 | 44.7 |
| 14 | | |
| 15 | **Scatter** | |
| 16 | x | 2 |
| 17 | y | 50 |

6. The “Scatter” series is now selected, so while it is selected, we will change it to a scatterplot by choosing the “Change Chart Type” button in the “Design” tab on the ribbon. In that menu, select the “Scatter” option in the dropdown menu next to the “Scatter” series and press “OK”.



7. We've now changed the point to a scatterplot, but need to feed it an x-value. To do so, right-click on the chart and choose "Select Data." Select the "Scatter" series, click "Edit", and input the x-value (cell B16) into the "Series X Values" box.

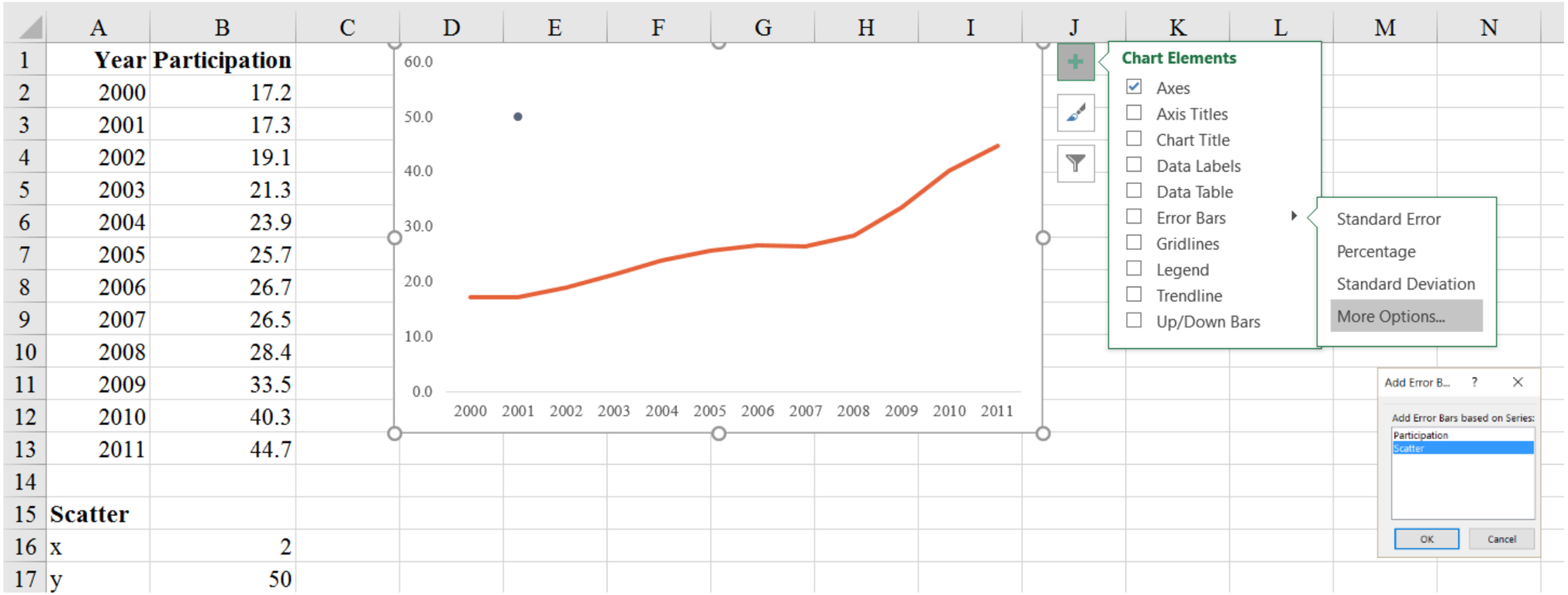




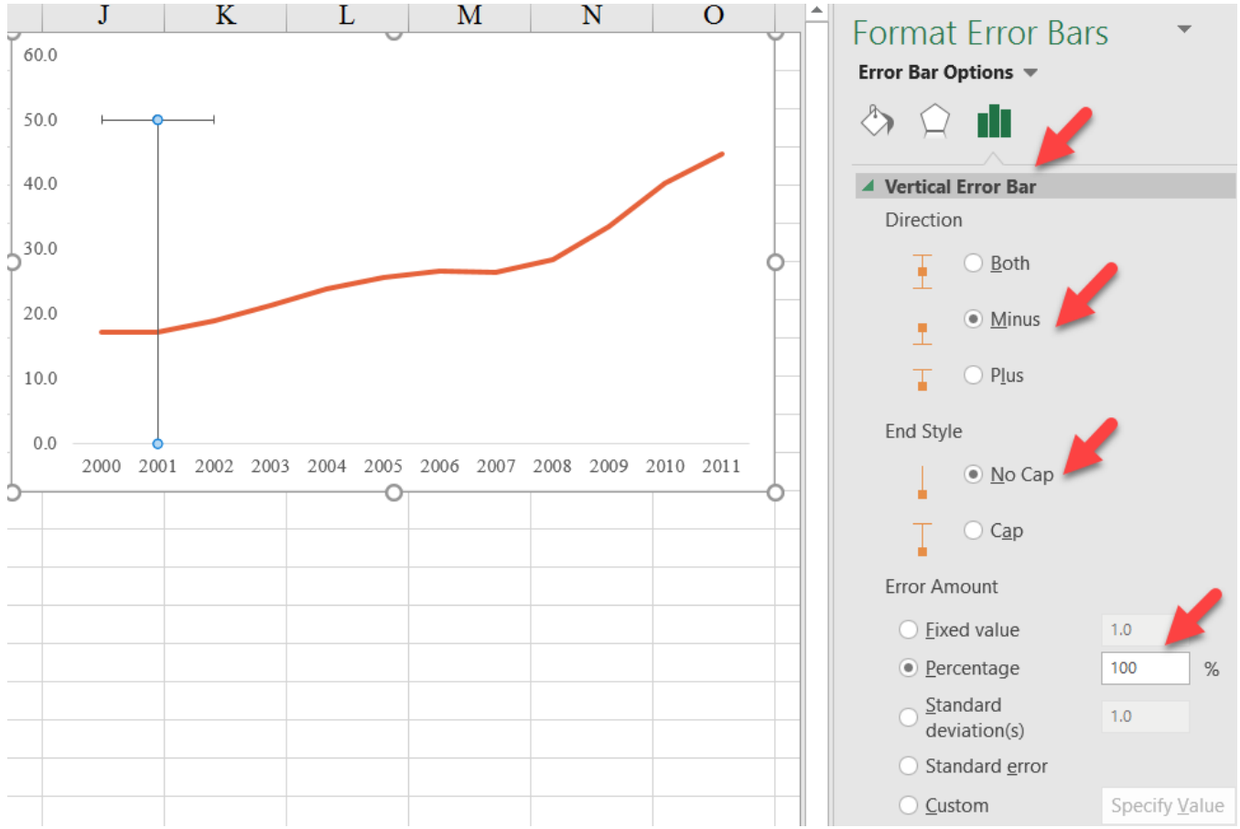

| | A | B |
|---|---|---|
| 1 | **Year** | **Participation** |
| 2 | 2000 | 17.2 |
| 3 | 2001 | 17.3 |
| 4 | 2002 | 19.1 |
| 5 | 2003 | 21.3 |
| 6 | 2004 | 23.9 |
| 7 | 2005 | 25.7 |
| 8 | 2006 | 26.7 |
| 9 | 2007 | 26.5 |
| 10 | 2008 | 28.4 |
| 11 | 2009 | 33.5 |
| 12 | 2010 | 40.3 |
| 13 | 2011 | 44.7 |
| 14 | | |
| 15 | **Scatter** | |
| 16 | x | 2 |
| 17 | y | 50 |

The scatterplot now appears on the chart at the y-value of 50 and an x-value of 2—note that this is the 2nd position, not the year 2001. If, instead of 50, cell B16 was set to 2001, Excel would interpret this as the 2,001st position on the horizontal axis as illustrated here. Leave the x value at cell B16 on your chart.

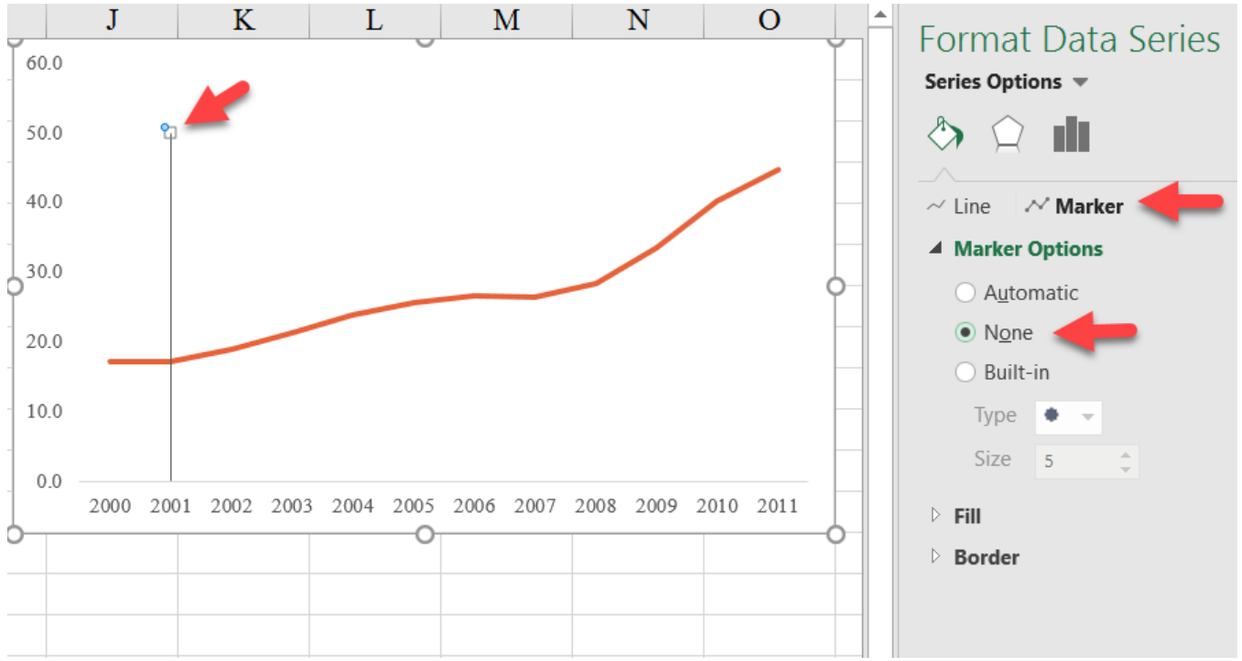
8. Time to add the vertical error bar. Select the “Error Bars” menu option in the “Chart Elements” menu that appears when you select the chart. In the “Add Error Bars” menu, select the “Scatter” series and press “OK”. (You can skip this additional menu if you select the “Scatter” series first and then select the “Error Bars” option in the “Chart Elements” menu.) In either case, select the “More Error Bars Options” in the “Error Bars” menu.



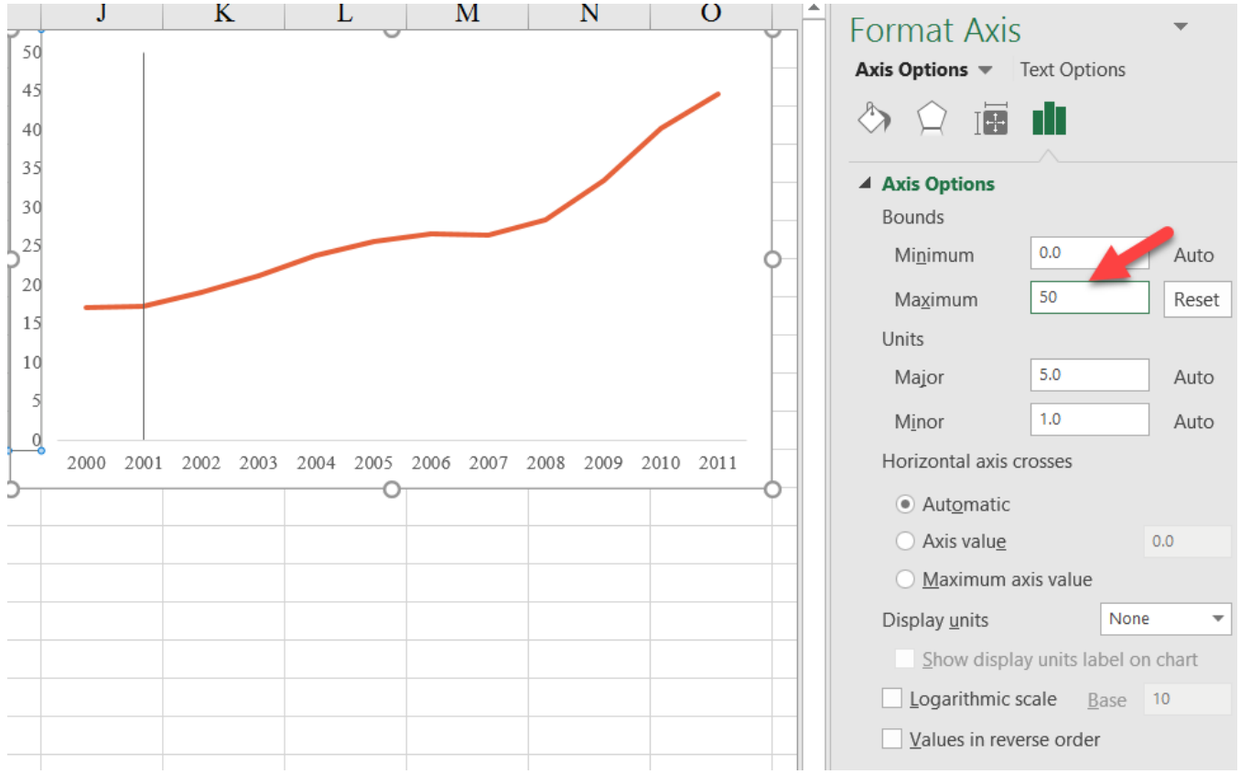
9. Excel will add both horizontal and vertical error bars. Notice that you'll first be brought to the Vertical Error Bars formatting menu. From here, make a few changes: Change the "Direction" to "Minus", the "End Style" to "No Cap", and select the "Percentage" option in the "Error Amount" menu and type 100 into the box. Notice the vertical error bar will drop to the x-axis.



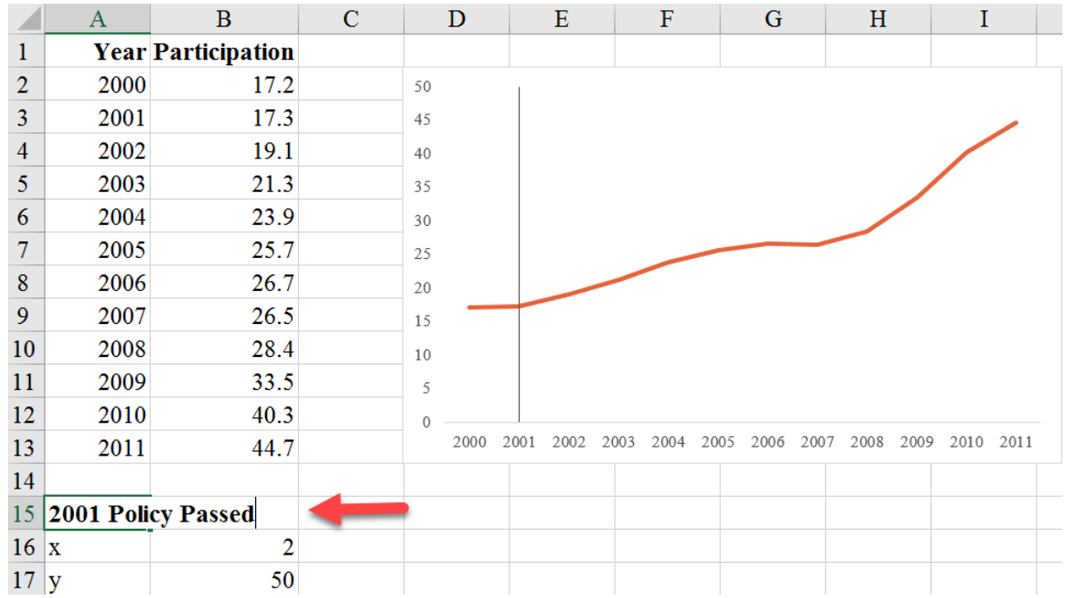
10. Notice that you're also left with a horizontal error bar, which we don't need, so select it and delete. To hide the scatterplot marker, select it and select format (right-click or CTRL-1). In the "Marker Options" tab, select the option for "None".



11. Finally, adjust the maximum of the y-axis to 50 by formatting the y-axis (again, right-click or CTRL-1) and changing the “Maximum” value to 50.

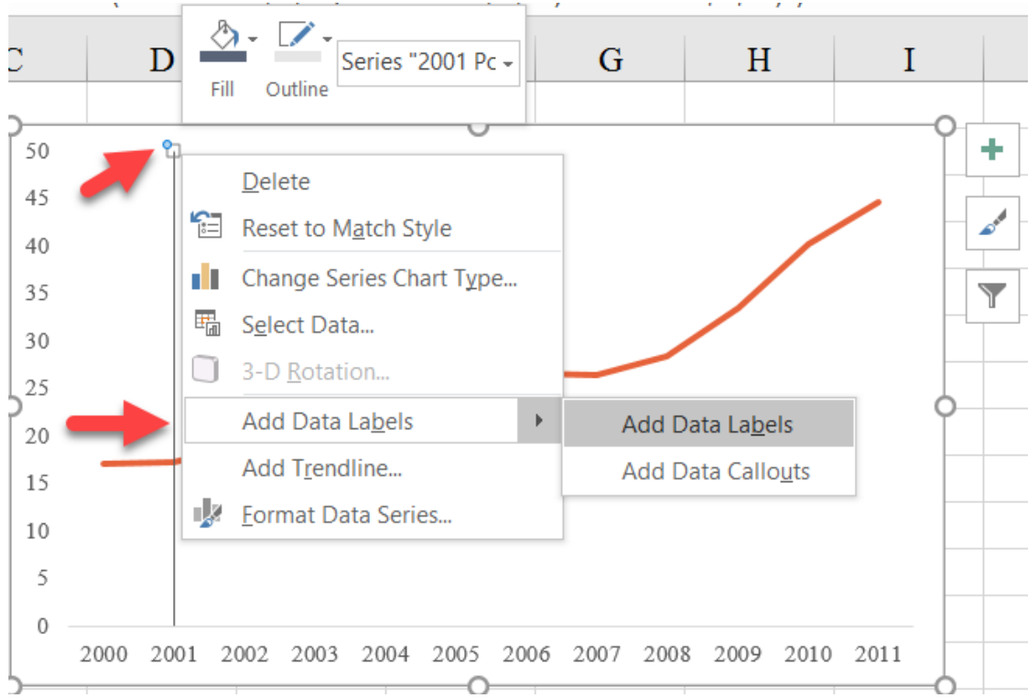


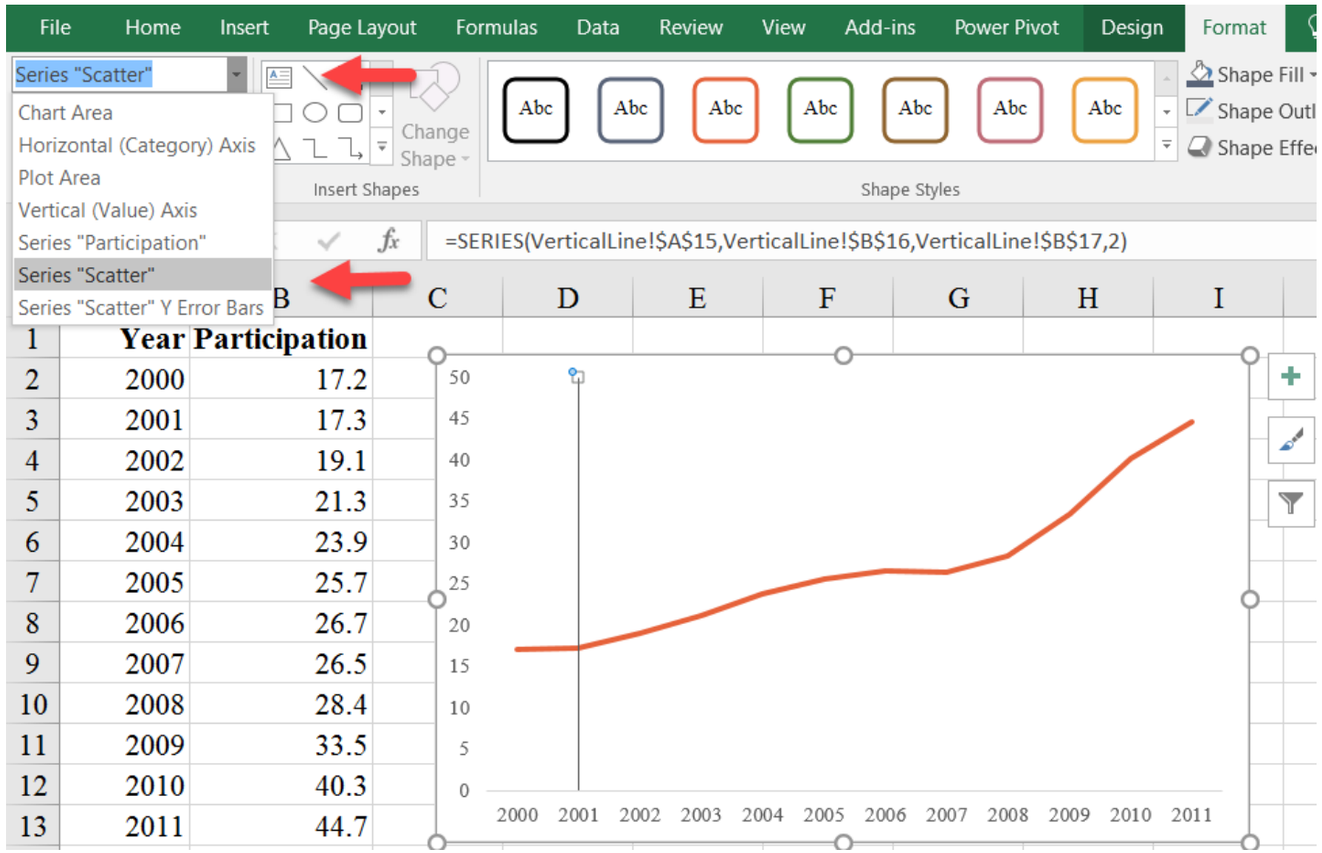
12. As an aside, you can easily add annotation to this line by taking the following steps.
    a. First, instead of naming the series “Scatter”, give it the name of the annotation you want; for example, “2001 Policy Passed”.



| | A | B | C |
|---|---|---|---|
| 1 | **Year** | **Participation** | |
| 2 | 2000 | 17.2 | |
| 3 | 2001 | 17.3 | |
| 4 | 2002 | 19.1 | |
| 5 | 2003 | 21.3 | |
| 6 | 2004 | 23.9 | |
| 7 | 2005 | 25.7 | |
| 8 | 2006 | 26.7 | |
| 9 | 2007 | 26.5 | |
| 10 | 2008 | 28.4 | |
| 11 | 2009 | 33.5 | |
| 12 | 2010 | 40.3 | |
| 13 | 2011 | 44.7 | |
| 14 | | | |
| 15 | **2001 Policy Passed** | | |
| 16 | x | 2 | |
| 17 | y | 50 | |

b. Second, select the marker for that series and right-click to add data labels.

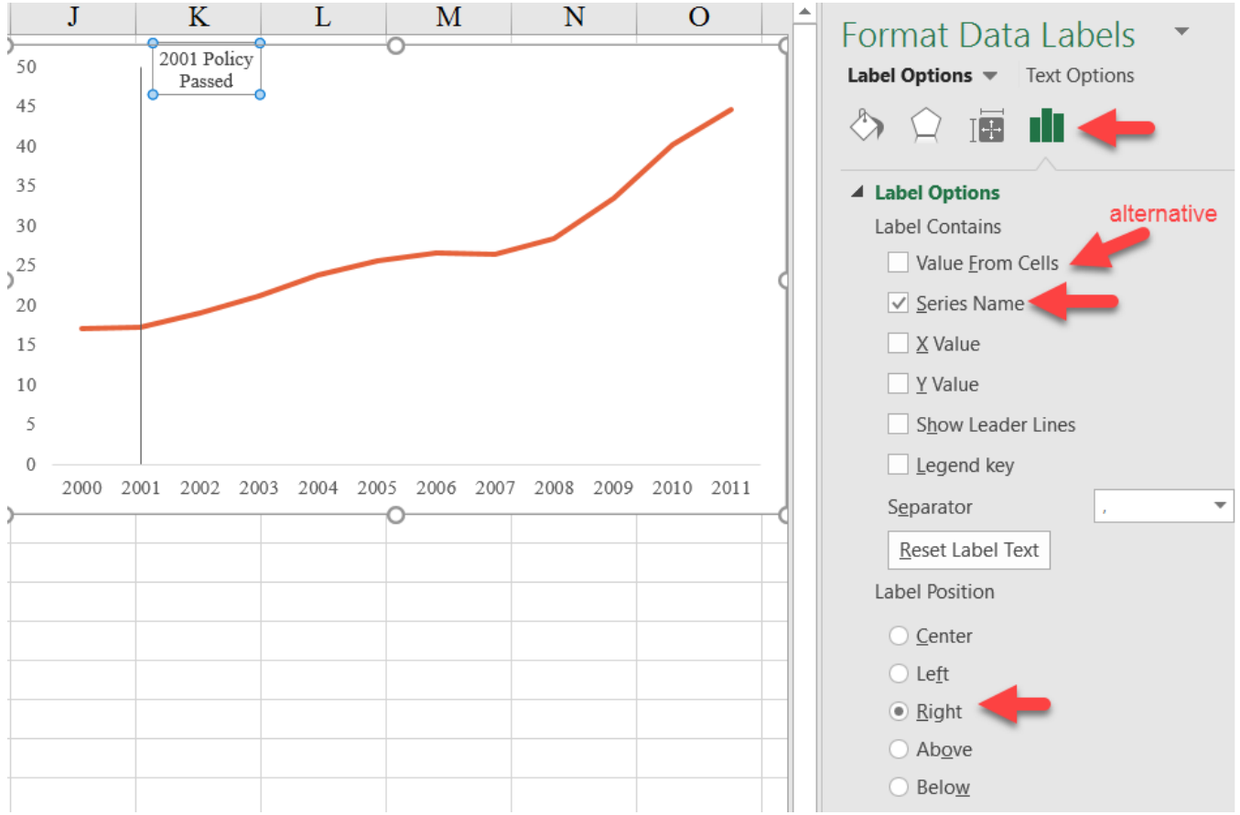




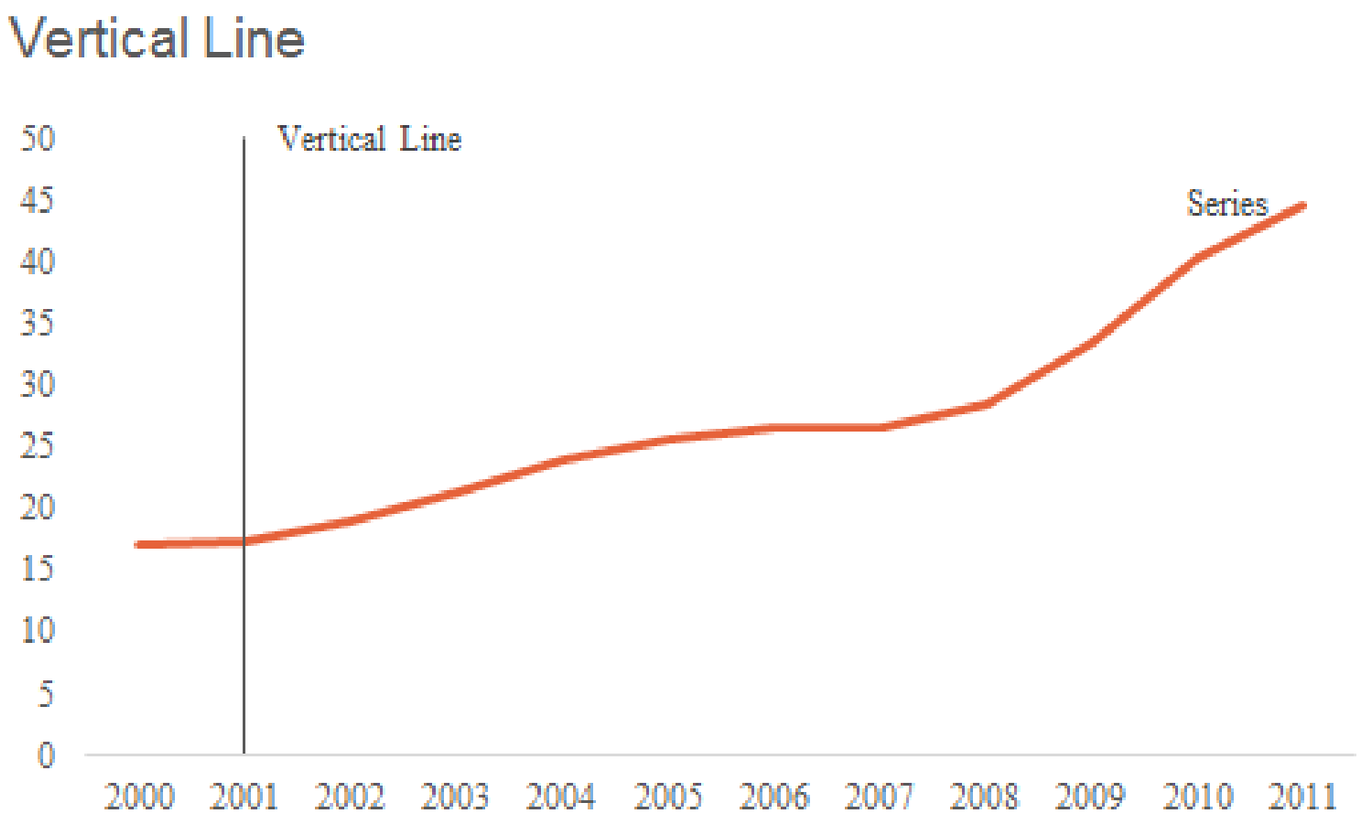

Alternatively, you can use the drop-down menu in the top-left of the *Format* tab to directly select the data marker.

c. Third, select the data label and right-click to format. In the menu, check the box for "Series Name" and uncheck the box for "Y value". Format the label as you see fit.

d. You can also accomplish the same goal by adding a Data Label to the point. In the Data Label formatting menu (which you can get to by selecting the Data Label and using the CTRL+1 keyboard shortcut), selecting the "Value from Cells" option. The new menu will allow you to select a cell for the label. (Note: this custom Data Labels option is not available in the Mac OS.)

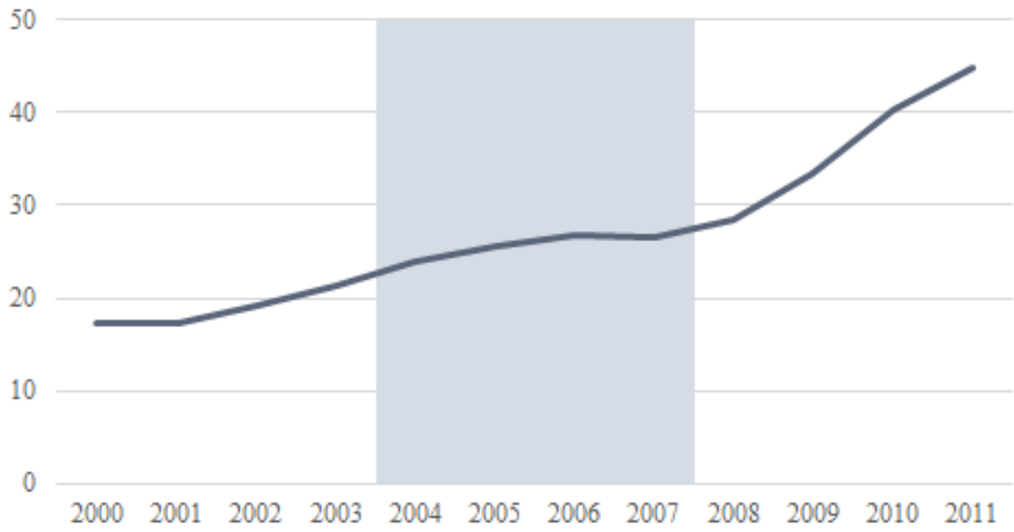


## Final Version with Styling.

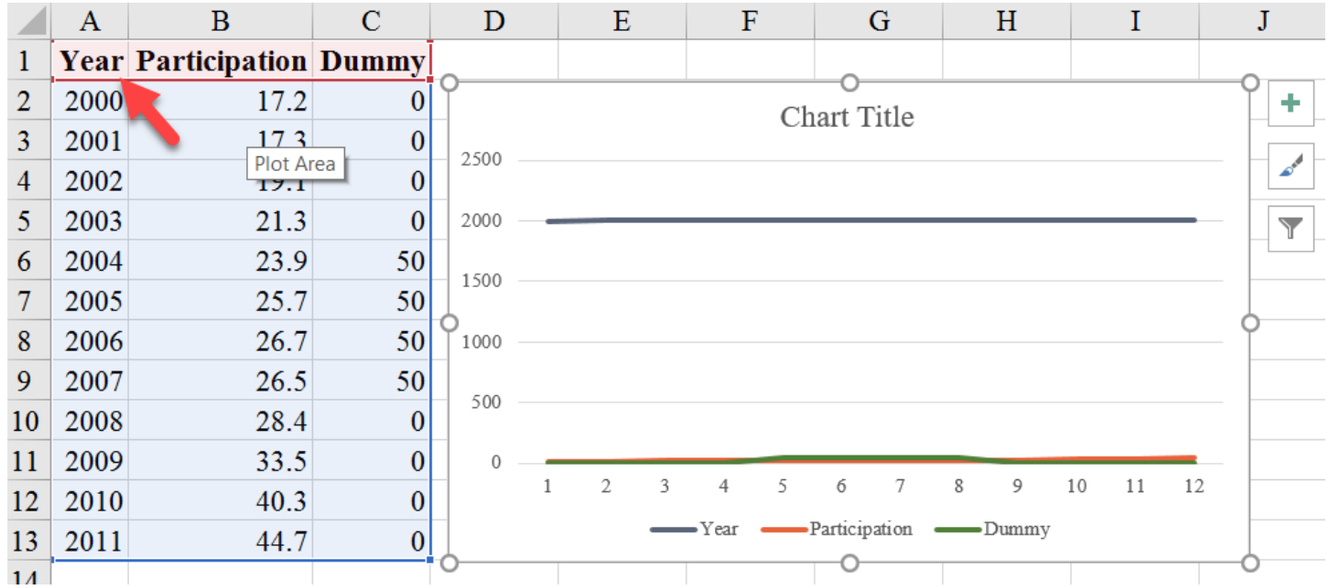


# Block Shading (annual-annual)

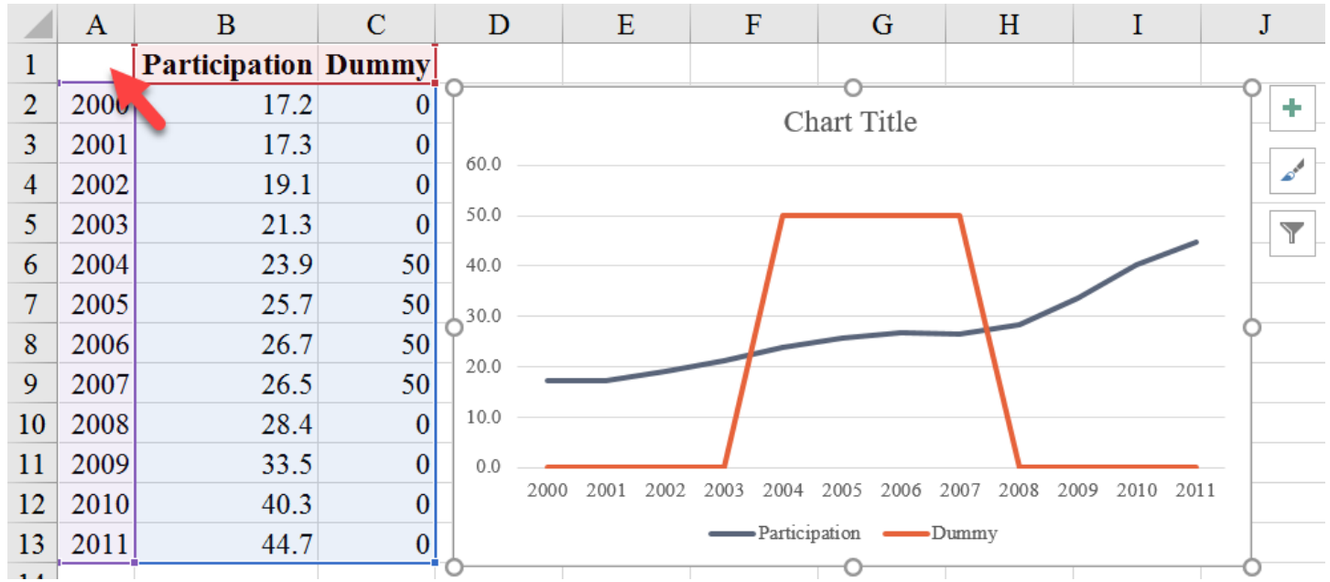
This chart type is typically used to mark some period of time behind a line or column chart, for example, a forecast period or to mark recessions. When the frequencies of the data match up—in this case *annual* and *annual*—the chart is made quickly and easily. Use the *BlockShading_Annual tab* in the *Advanced Data Visualizations with Excel 2016 Hands-On.xlsx spreadsheet* to create the chart.



1. First, notice that if you leave the “Year” label in cell A1 and insert a line chart with cells A1:C13, Excel will plot the “Year” series.

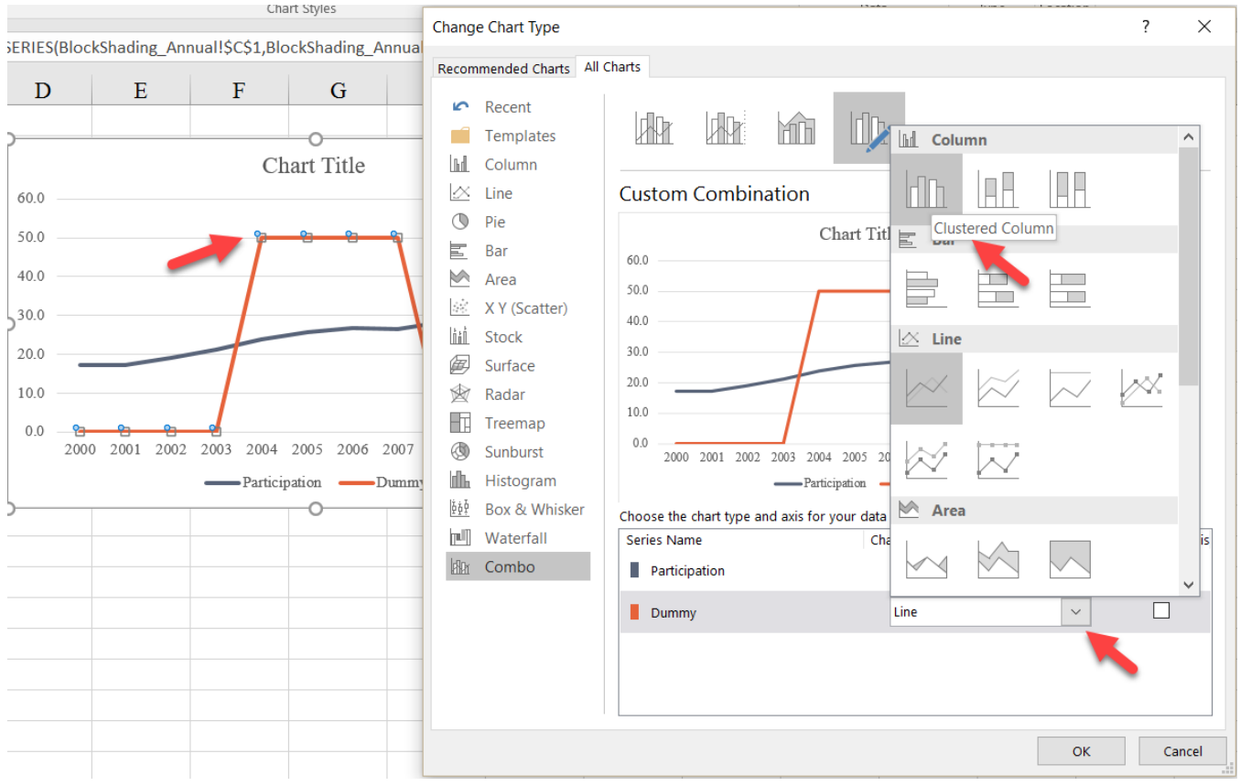


2. Deleting the “Year” in cell A1 and then inserting a line chart with cells A1:C13 generates the line chart we’ll start with.

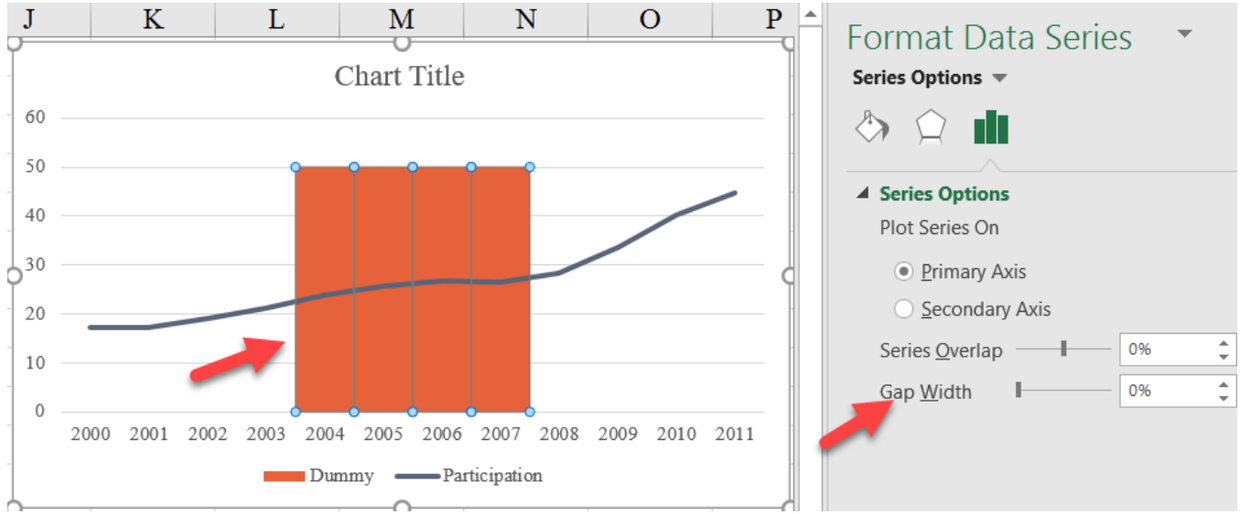



| | A | B | C |
|---|---|---|---|
| 1 | | Participation | Dummy |
| 2 | 2000 | 17.2 | 0 |
| 3 | 2001 | 17.3 | 0 |
| 4 | 2002 | 19.1 | 0 |
| 5 | 2003 | 21.3 | 0 |
| 6 | 2004 | 23.9 | 50 |
| 7 | 2005 | 25.7 | 50 |
| 8 | 2006 | 26.7 | 50 |
| 9 | 2007 | 26.5 | 50 |
| 10 | 2008 | 28.4 | 0 |
| 11 | 2009 | 33.5 | 0 |
| 12 | 2010 | 40.3 | 0 |
| 13 | 2011 | 44.7 | 0 |

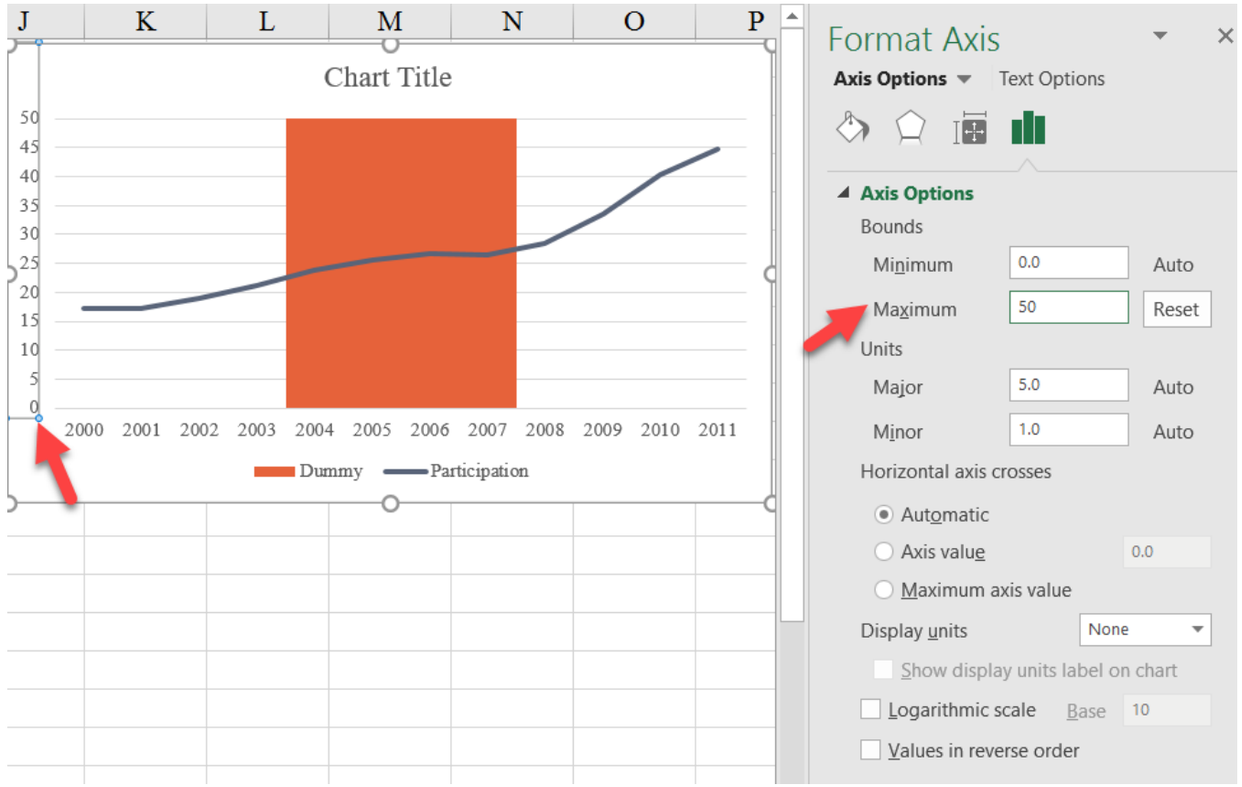
3. Select the “Dummy” (**orange** line) series, and under “Change Chart Type” in the “Design” tab on the ribbon, change the chart type for that series to a clustered column chart using the dropdown menu.



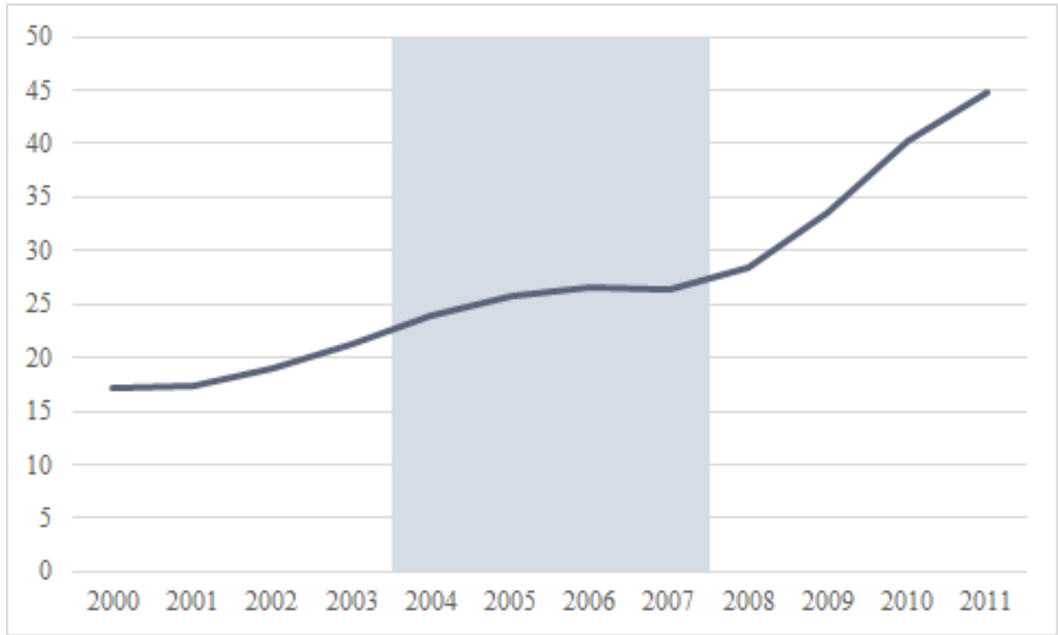
4. Select the “Dummy” (**orange** bars) series and right-click to format. In the “Series Options” tab, change the “Gap Width” to 0%.



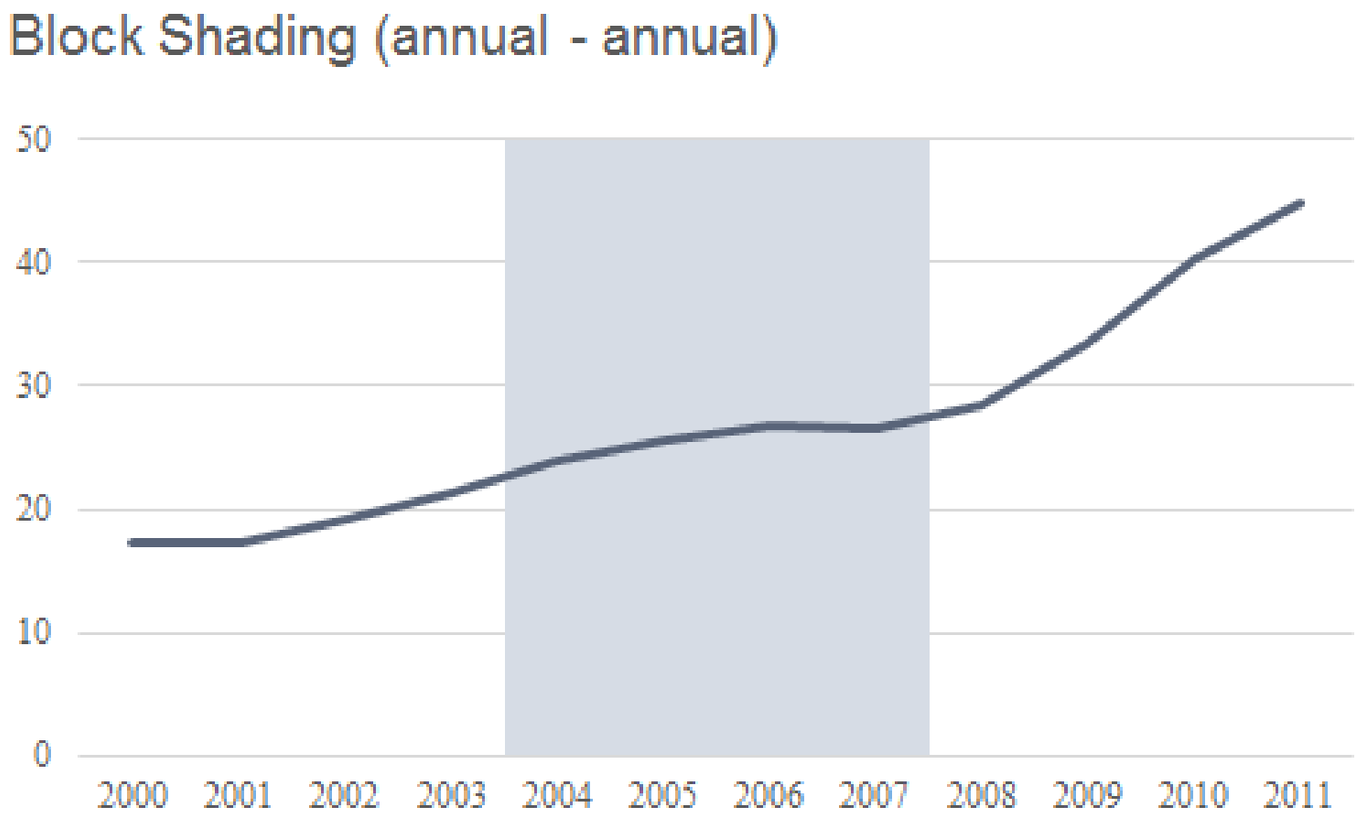
5. Format the y-axis (by right-clicking or CTRL-1) and change the maximum y-value to 50 (to match the "Dummy" series).



6. Style as you like by deleting the legend, changing the color of the bars, and the number and appearance of the gridlines.

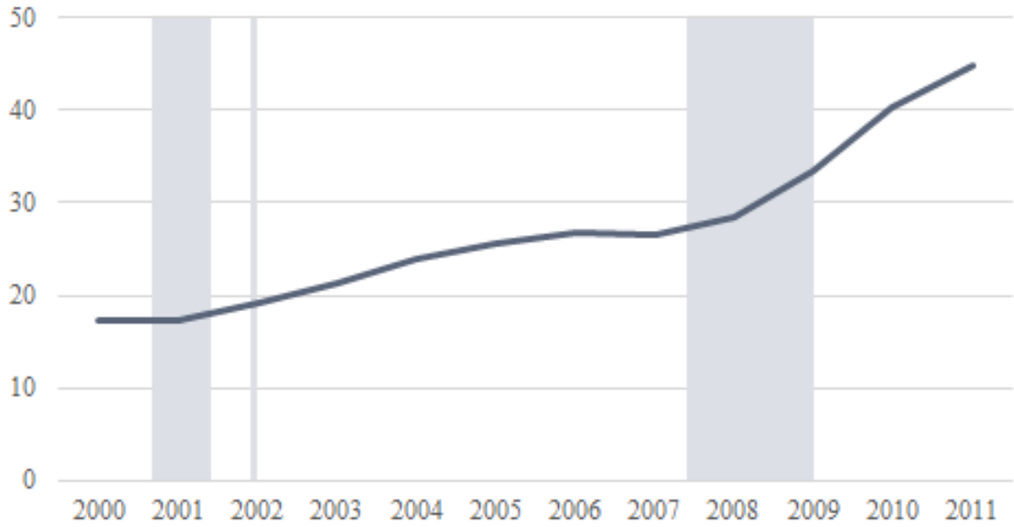


# Final Version with Styling



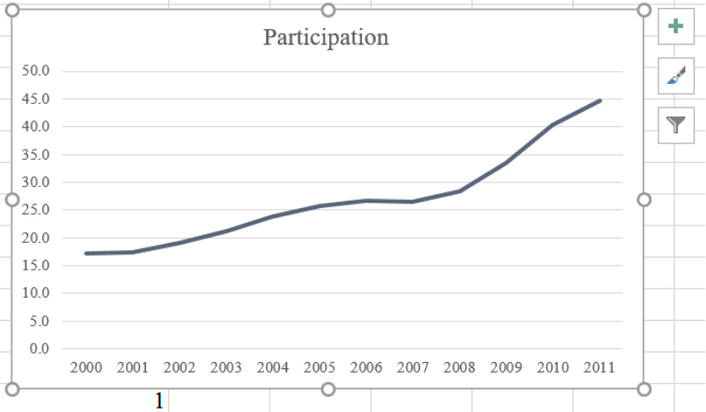
# Block Shading (monthly-annual)

This version of the block shading chart is more complicated than the one where the data frequencies line up. In this case—where the one series is annual and the shading is monthly (e.g., recessions)—building the chart requires using the secondary axes. Use the *BlockShading_Monthly tab* in the *Advanced Data Visualizations with Excel 2016 Hands-On.xlsx spreadsheet* to create the chart.

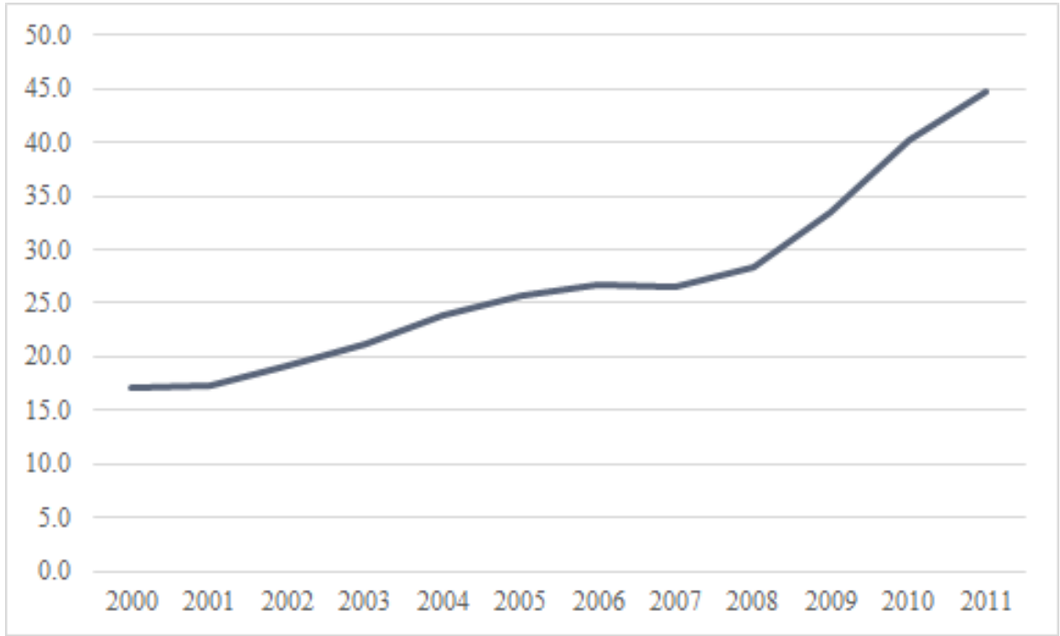


1. We start in the same way as the previous chart except with the “Year” label in cell A deleted. Create a line chart using the data in cells A1:B13.

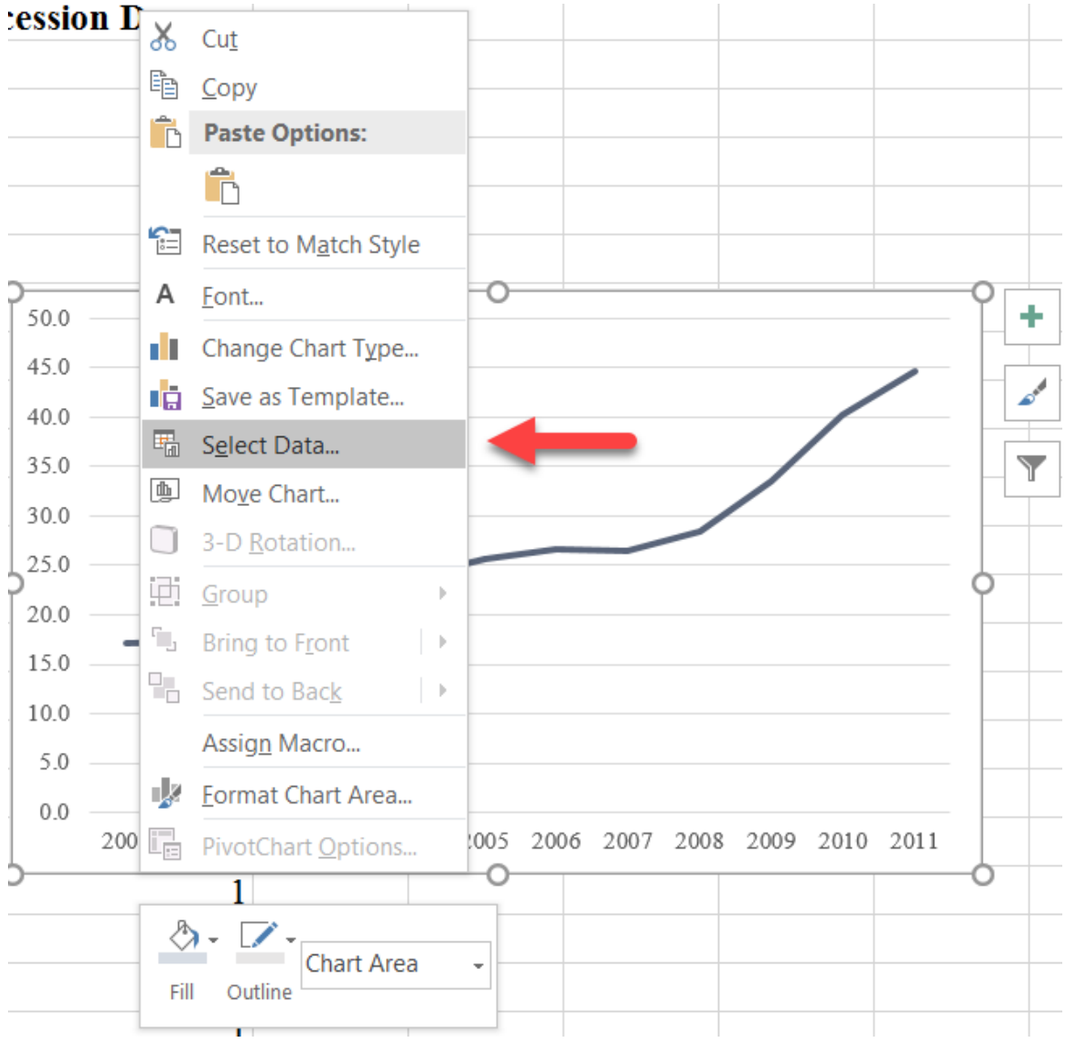
| | A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | **Participation** | | **Year** | **Month** | **Recession Dummy** | | | | | |
| 2 | 2000 | 17.2 | | 2000 | 1 | | | | | | |
| 3 | 2001 | 17.3 | | 2000 | 2 | | | | | | |
| 4 | 2002 | 19.1 | | 2000 | 3 | | | | | | |
| 5 | 2003 | 21.3 | | 2000 | 4 | | | | | | |
| 6 | 2004 | 23.9 | | 2000 | 5 | | | | | | |
| 7 | 2005 | 25.7 | | 2000 | 6 | | | | | | |
| 8 | 2006 | 26.7 | | 2000 | 7 | | | | | | |
| 9 | 2007 | 26.5 | | 2000 | 8 | | | | | | |
| 10 | 2008 | 28.4 | | 2000 | 9 | | | | | | |
| 11 | 2009 | 33.5 | | 2000 | 10 | | | | | | |
| 12 | 2010 | 40.3 | | 2000 | 11 | | | | | | |
| 13 | 2011 | 44.7 | | 2000 | 12 | | | | | | |
| 14 | | | | 2001 | 1 | | | | | | |
| 15 | | | | 2001 | 2 | | | | | | |
| 16 | | | | 2001 | 3 | | | | | | |
| 17 | | | | 2001 | 4 | | | | | | |
| 18 | | | | 2001 | 5 | | | | | | |
| 19 | | | | 2001 | 6 | 1 | | | | | |
| 20 | | | | 2001 | 7 | 1 | | | | | |
| 21 | | | | 2001 | 8 | 1 | | | | | |
| 22 | | | | 2001 | 9 | 1 | | | | | |
| 23 | | | | 2001 | 10 | 1 | | | | | |



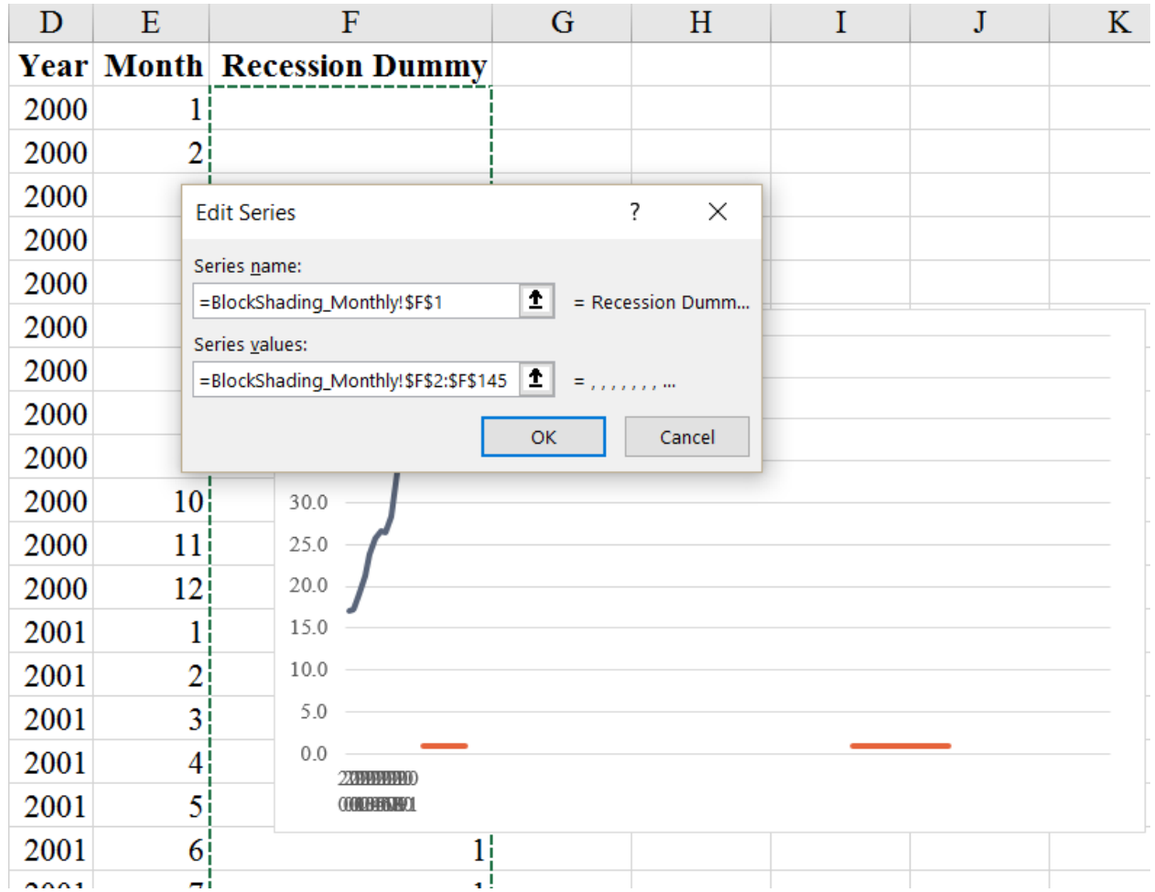
2. Then delete the title (and legend).



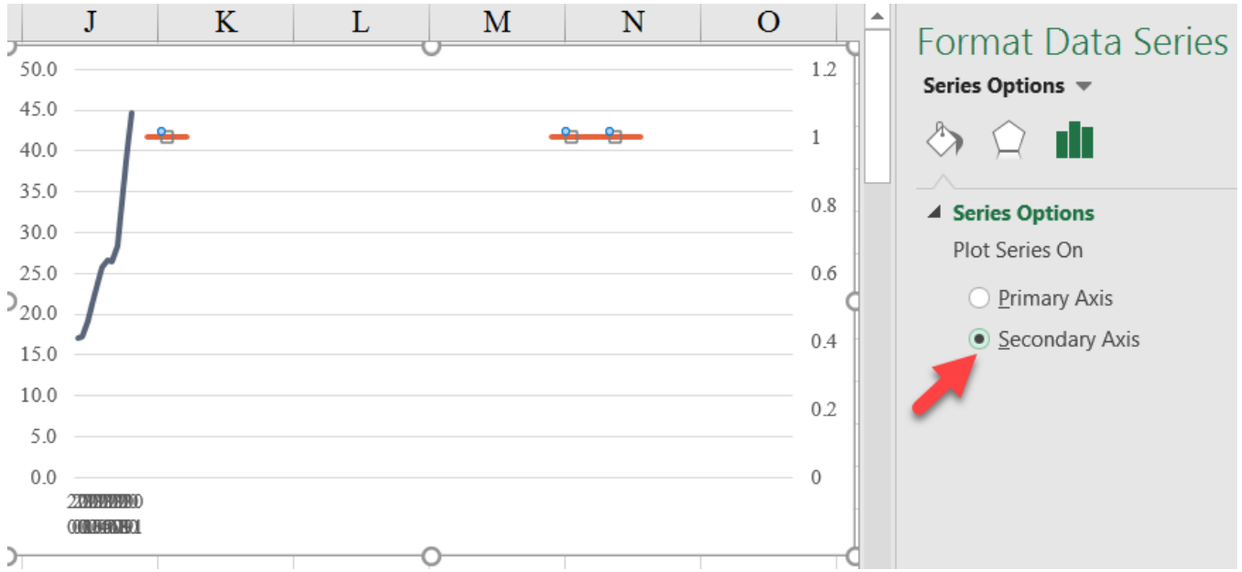
3. Right-click on the chart and choose “Select Data”.



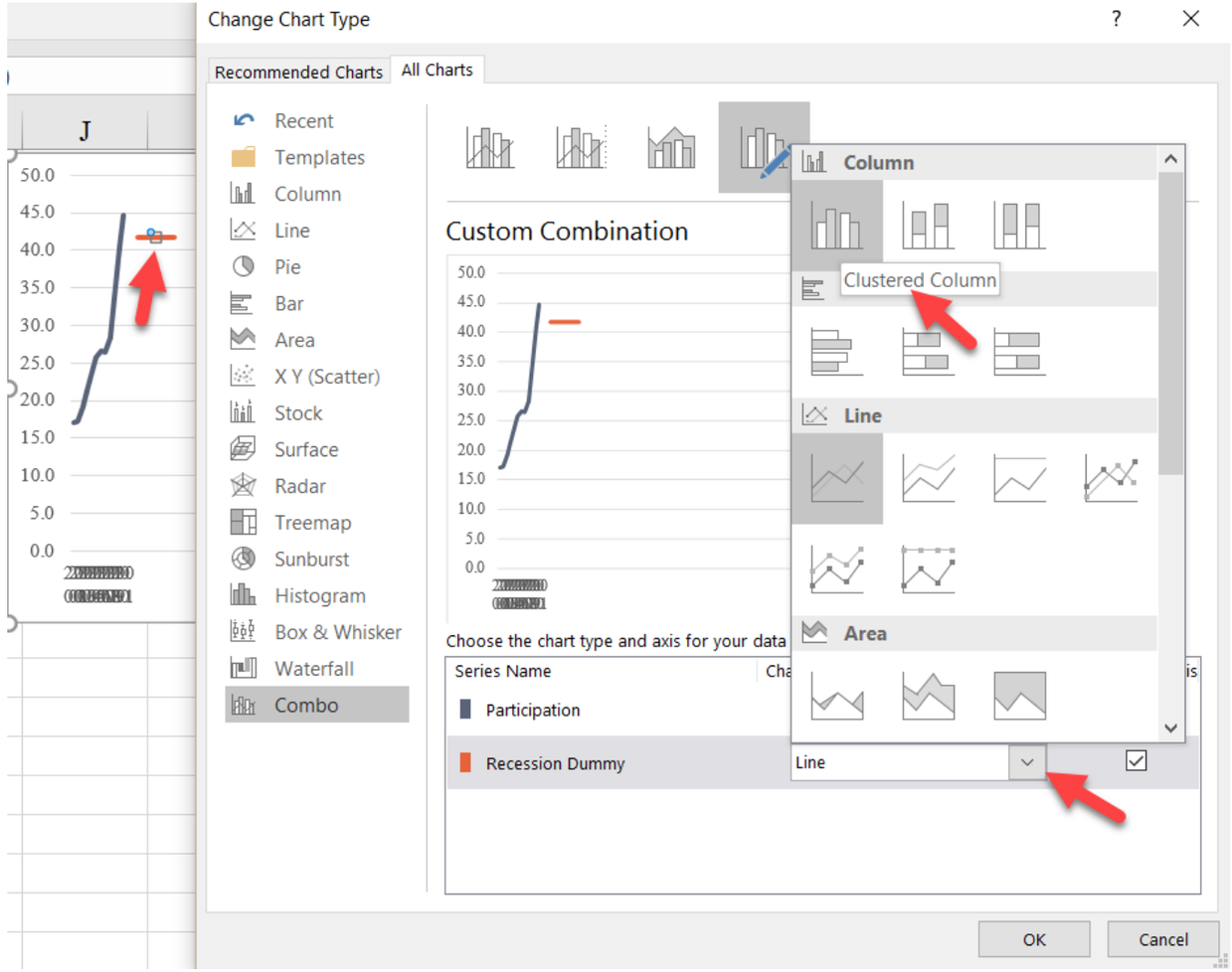
4. We will add the "Recession Dummy" series by selecting "Add" in the resulting menu. Then, reference cell F1 for the "Series Name" and that series (cells F2:F145) for the "Series values". This will slide the **blue** series far over to the left because Excel now views this as a line chart with 144 spaces (corresponding to the number of observations in the "Recession Dummy" series).



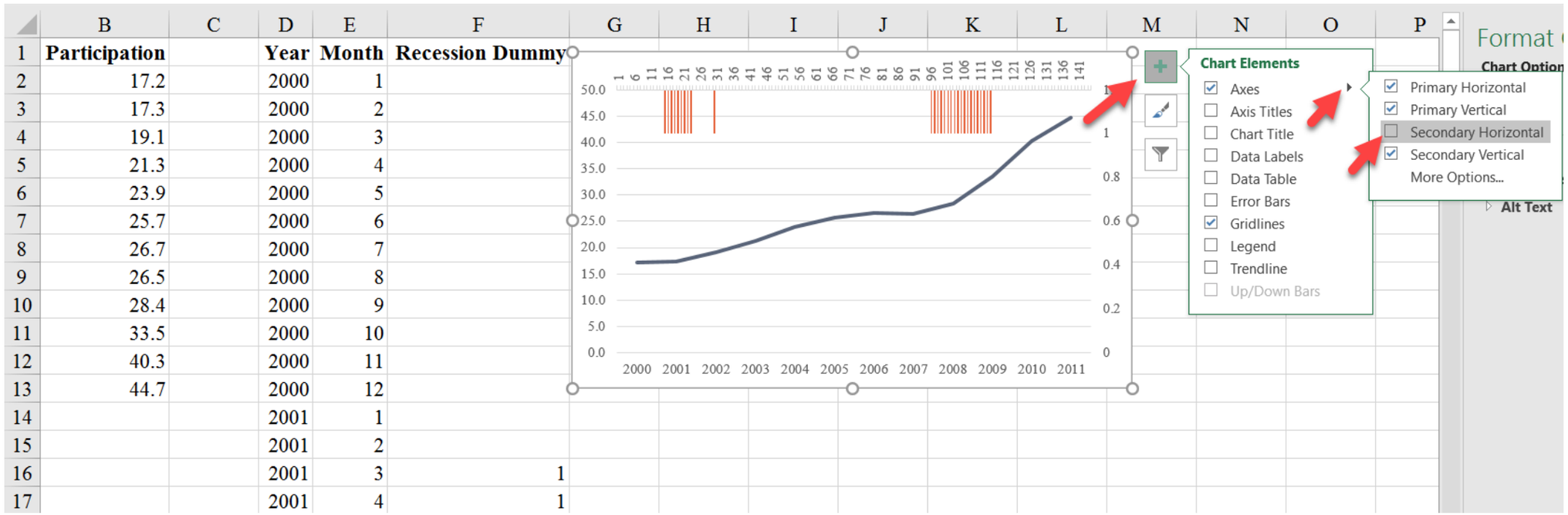
5. Select the **orange** ("Recession Dummy") series, right-click and move that series to the "Secondary Axis" by selecting the option in the "Series Options" tab.



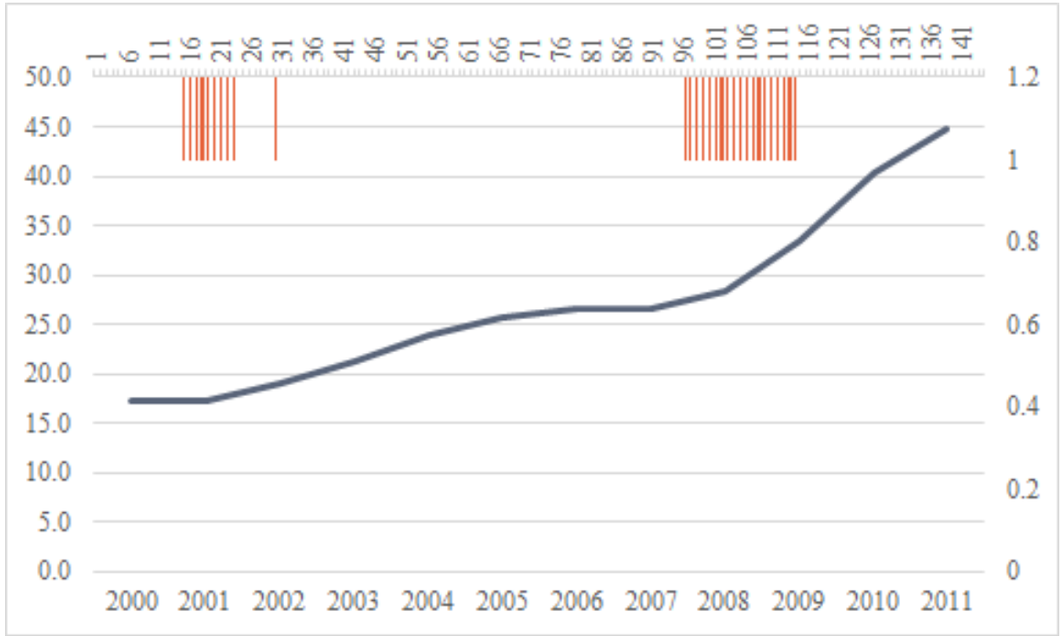
6. Again, select the **orange** ("Recession Dummy") series, and under "Change Chart Type" in the "Design" tab on the ribbon, change the chart type for that series to a clustered column chart.



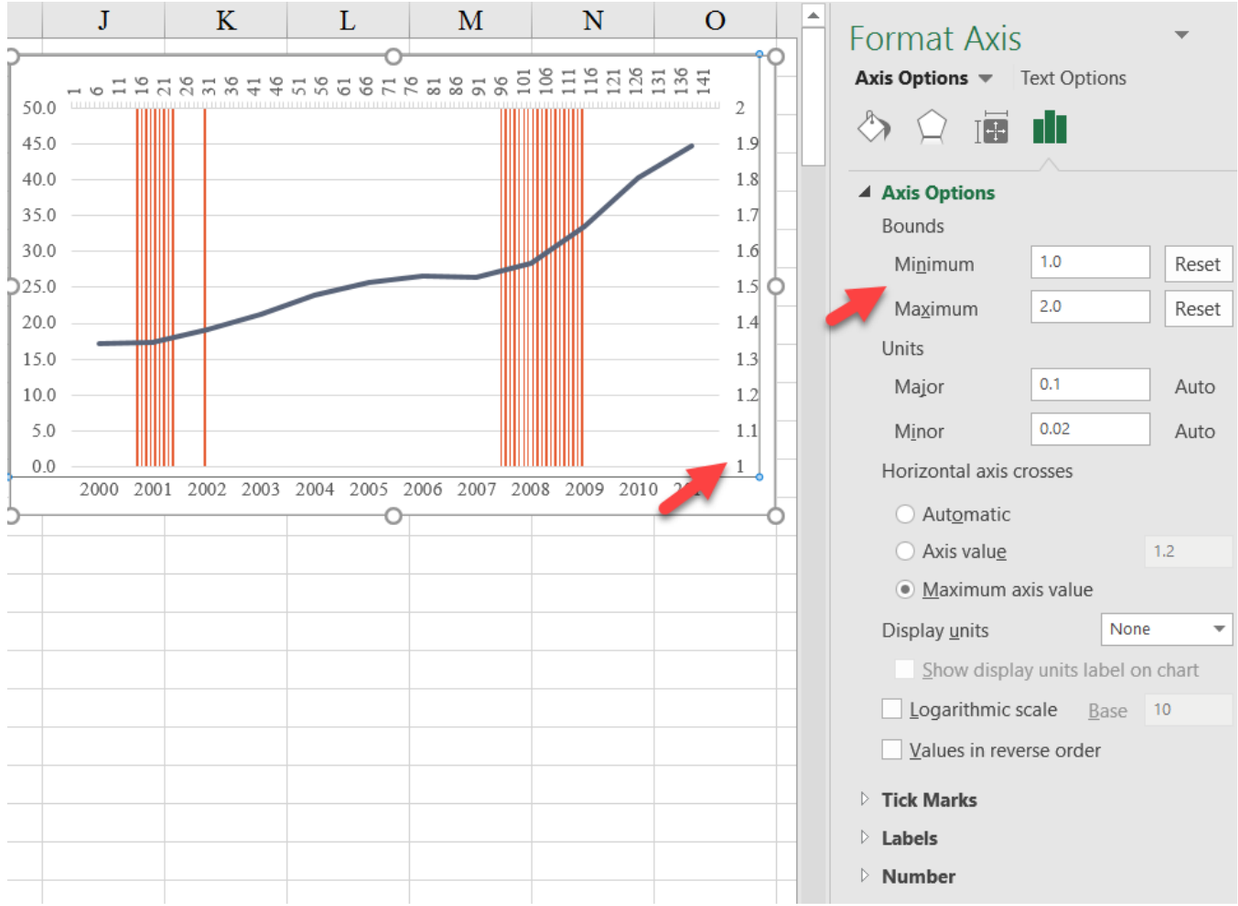
7. With a column chart now created—and tagged to the secondary axis—we need to "turn on" the secondary horizontal axis. To do so, select the chart, and under the "Axis" dropdown menu in the "Chart Elements" menu, select the checkbox next to "Secondary Horizontal."



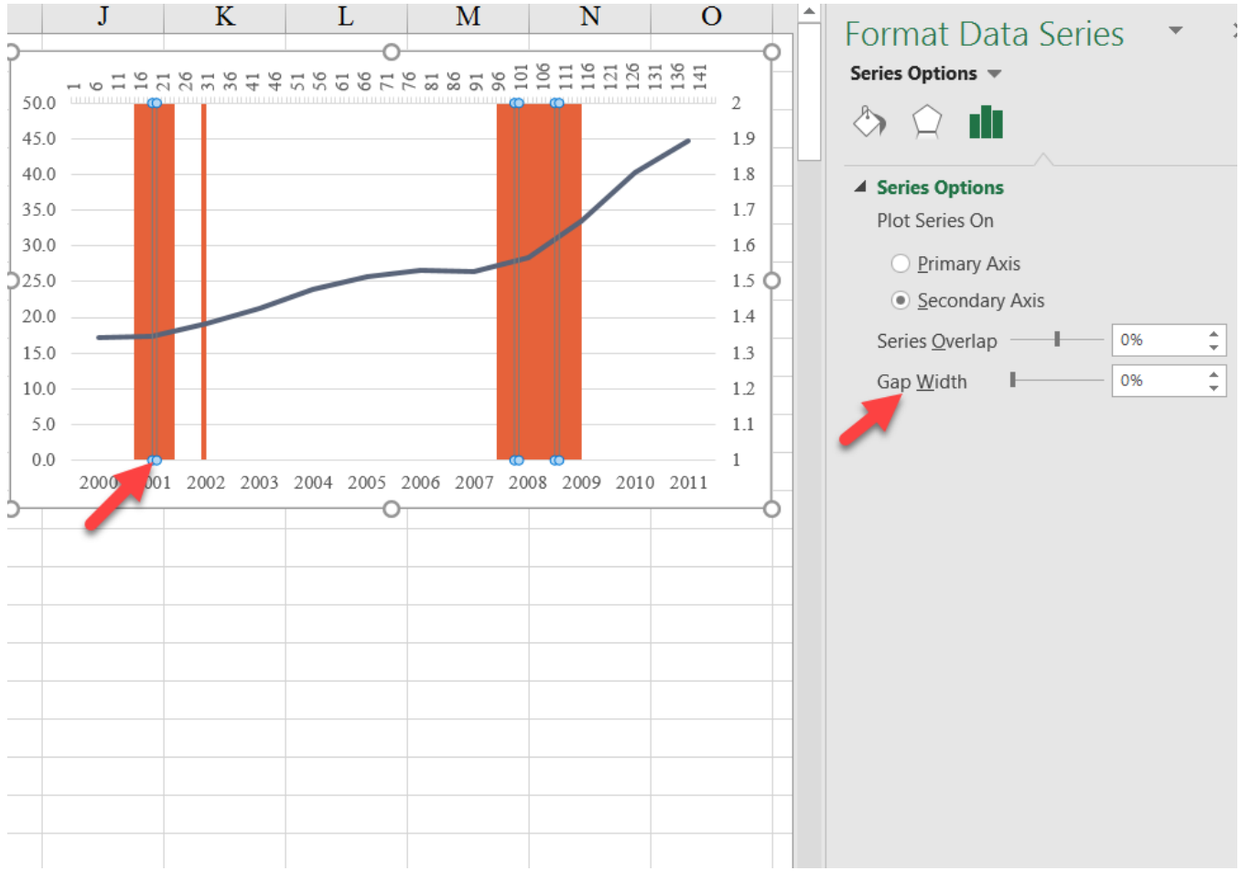
8. The **orange** column chart will seemingly flip to the secondary axis, and the **blue** line will stretch out as it did in the first step.



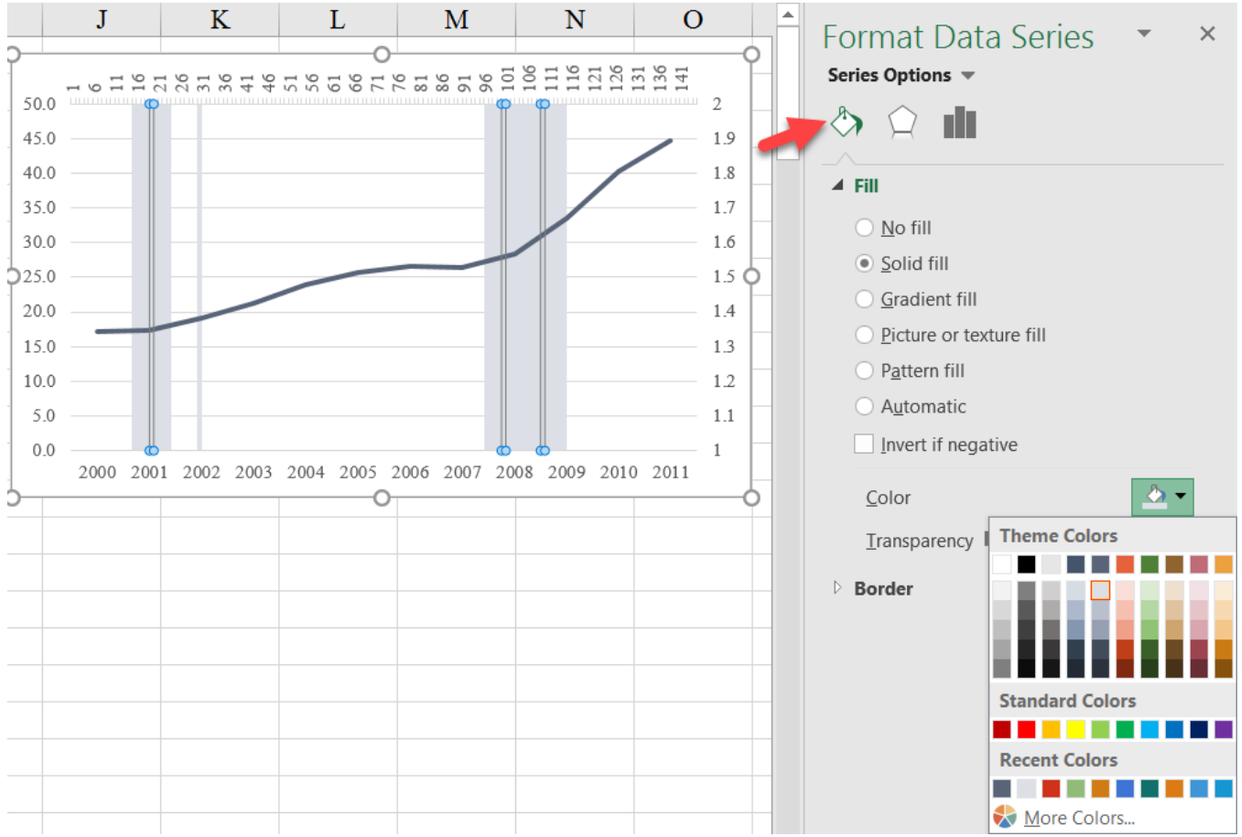
9. We want the bars to stretch along the entire vertical axis. So, format the secondary vertical axis (select it and right-click or CTRL-1), and under the "Axis Options" menu, change the "Minimum" value to 1 and the "Maximum" value to 2 (note that this works because the "Recession Dummy" series is set to 1; you can use a different number if you want, but these minimum/maximum values would then also change).



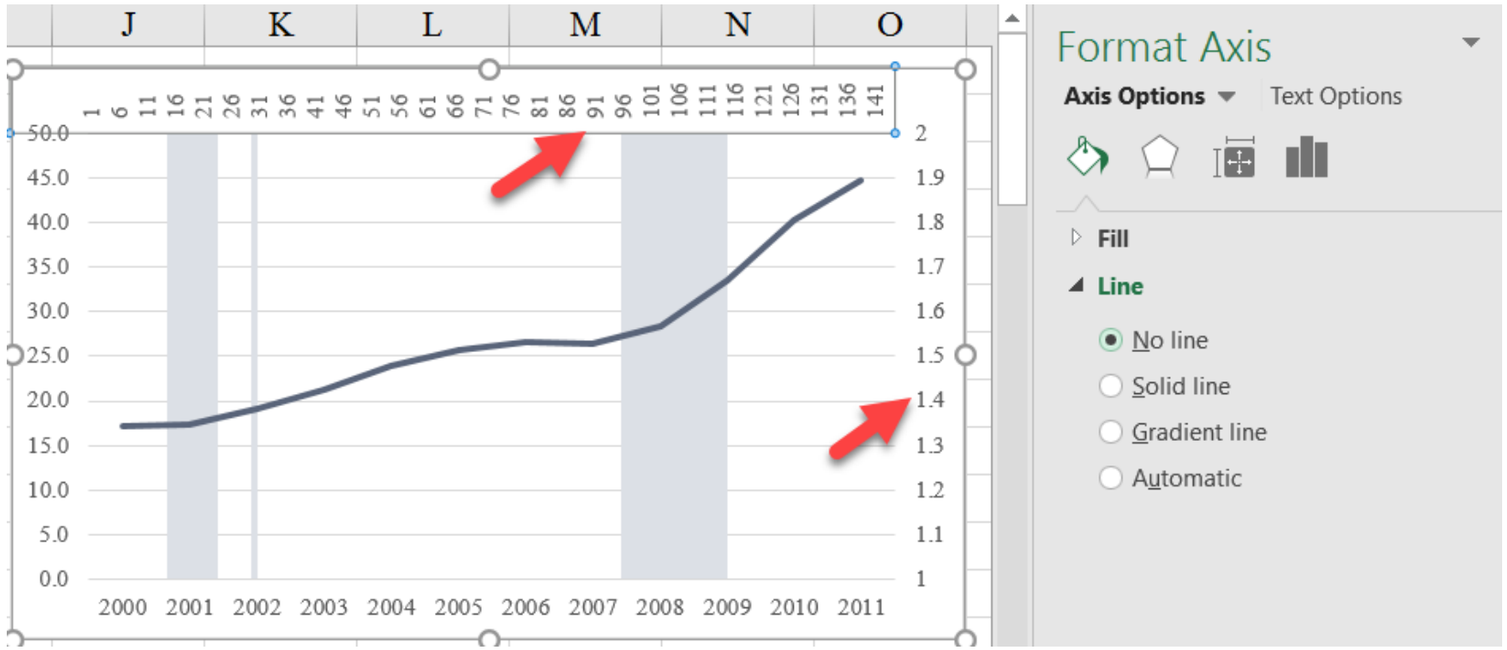
10. Format the column chart (by selecting and right-clicking or CTRL-1), and under the "Series Options" tab, change the "Gap Width" to 0%.

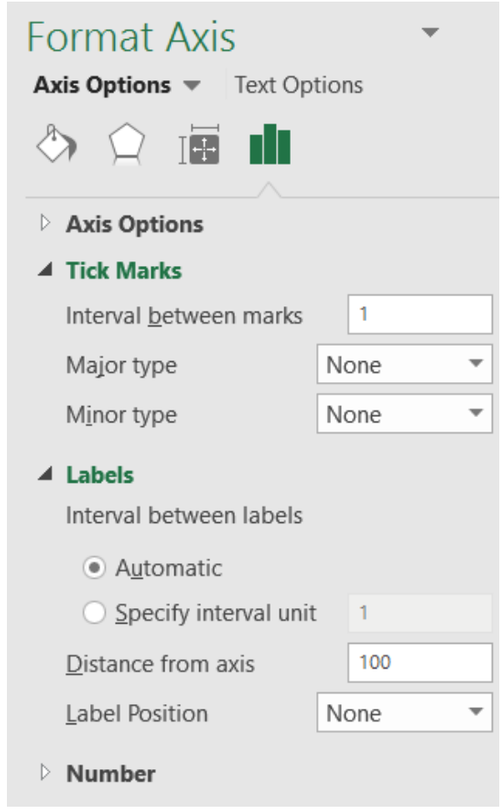


11. In that same menu, you can change the colors of the bars using the “Fill” section.

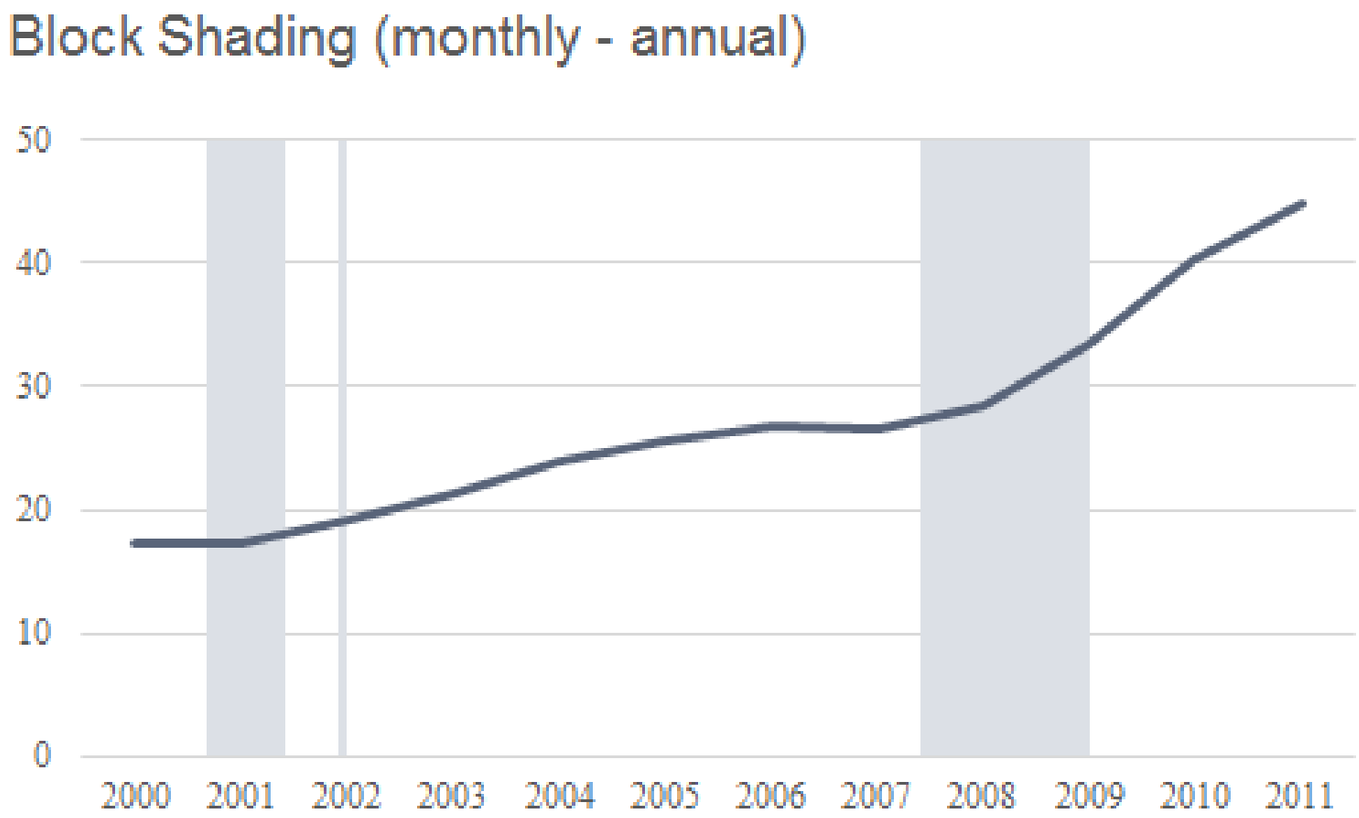


12. Turn off the secondary horizontal and vertical axes by setting the "Line color" to "No line" and "Tick Marks" and "Labels" to "None" in the "Axis Options" section of the "Format Axis" menu.



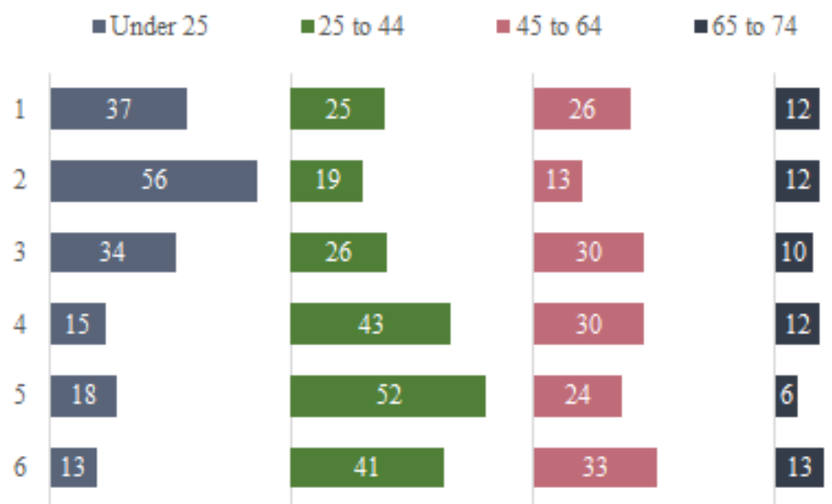
# Final Version with Styling



# Broken Stacked Bars

Stacked bar or column charts have the disadvantage that it can be difficult to compare series that do not lie on the same vertical axis. This tutorial shows how to break up a stacked bar chart so that each series sits on its own vertical axis.

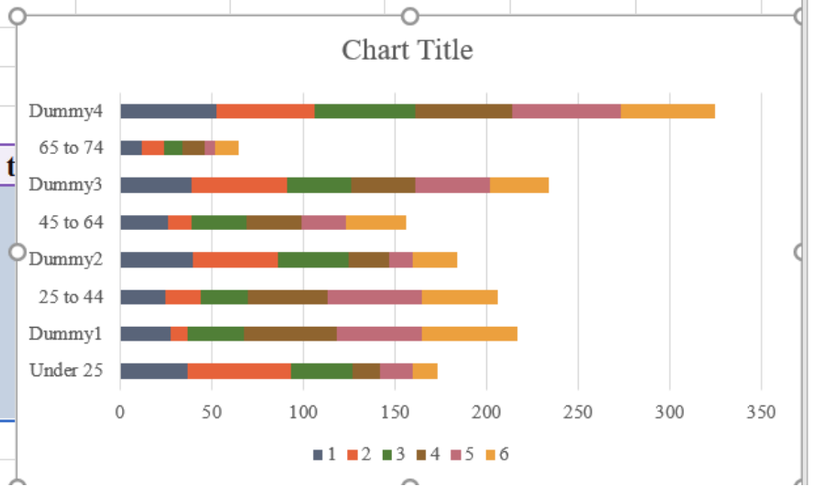
The data are set up in a particular way. You'll notice that I have the raw data sitting in the top table in rows 1-6. I've made a new data table below in rows 9-15. Interspersed between the data are "Dummy" data series; each one is equal to 65 minus (denoted in the formula using an absolute reference) the neighboring cell. 65 is used only because it is larger than the largest data value of 56; 70, 80, even 57 would also work. Use the *BrokenStackedBars tab* in the *Advanced Data Visualizations with Excel 2016 Hands-On.xlsx spreadsheet* to create the chart.



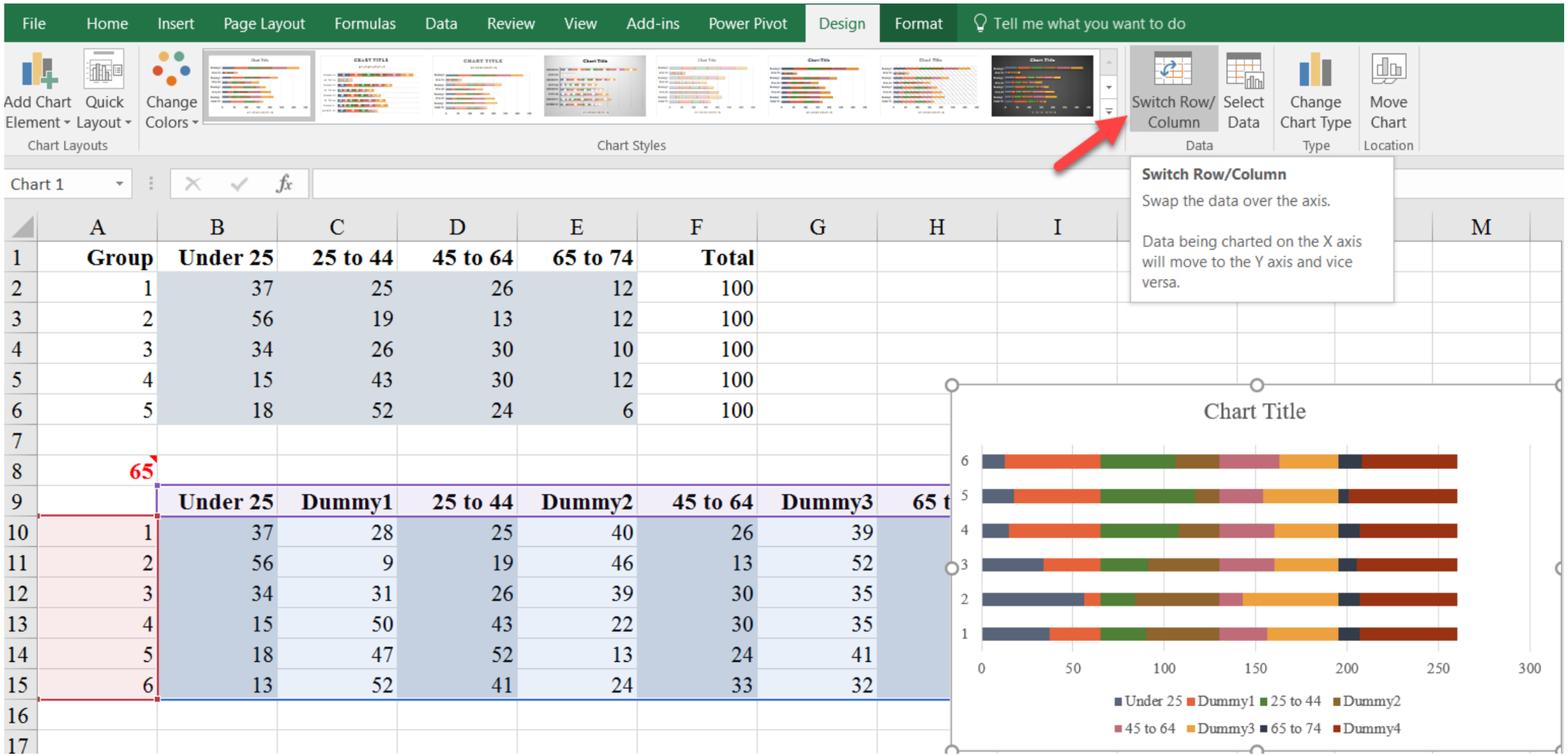
1. Create a stacked bar chart using the data in columns A9:I15. (Notice that I deleted the "Group" name in cell A9 before doing so; otherwise, Excel will plot the group numbers as a data series.) Notice how the chart is grouping the series by columns instead of by rows.

| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| 1 | **Group** | **Under 25** | **25 to 44** | **45 to 64** | **65 to 74** | **Total** |
| 2 | 1 | 37 | 25 | 26 | 12 | 100 |
| 3 | 2 | 56 | 19 | 13 | 12 | 100 |
| 4 | 3 | 34 | 26 | 30 | 10 | 100 |
| 5 | 4 | 15 | 43 | 30 | 12 | 100 |
| 6 | 5 | 18 | 52 | 24 | 6 | 100 |
| 7 | | | | | | |
| 8 | 65 | | | | | |

| | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| 9 | | **Under 25** | **Dummy1** | **25 to 44** | **Dummy2** | **45 to 64** | **Dummy3** |
| 10 | 1 | 37 | 28 | 25 | 40 | 26 | 39 |
| 11 | 2 | 56 | 9 | 19 | 46 | 13 | 52 |
| 12 | 3 | 34 | 31 | 26 | 39 | 30 | 35 |
| 13 | 4 | 15 | 50 | 43 | 22 | 30 | 35 |
| 14 | 5 | 18 | 47 | 52 | 13 | 24 | 41 |
| 15 | 6 | 13 | 52 | 41 | 24 | 33 | 32 |

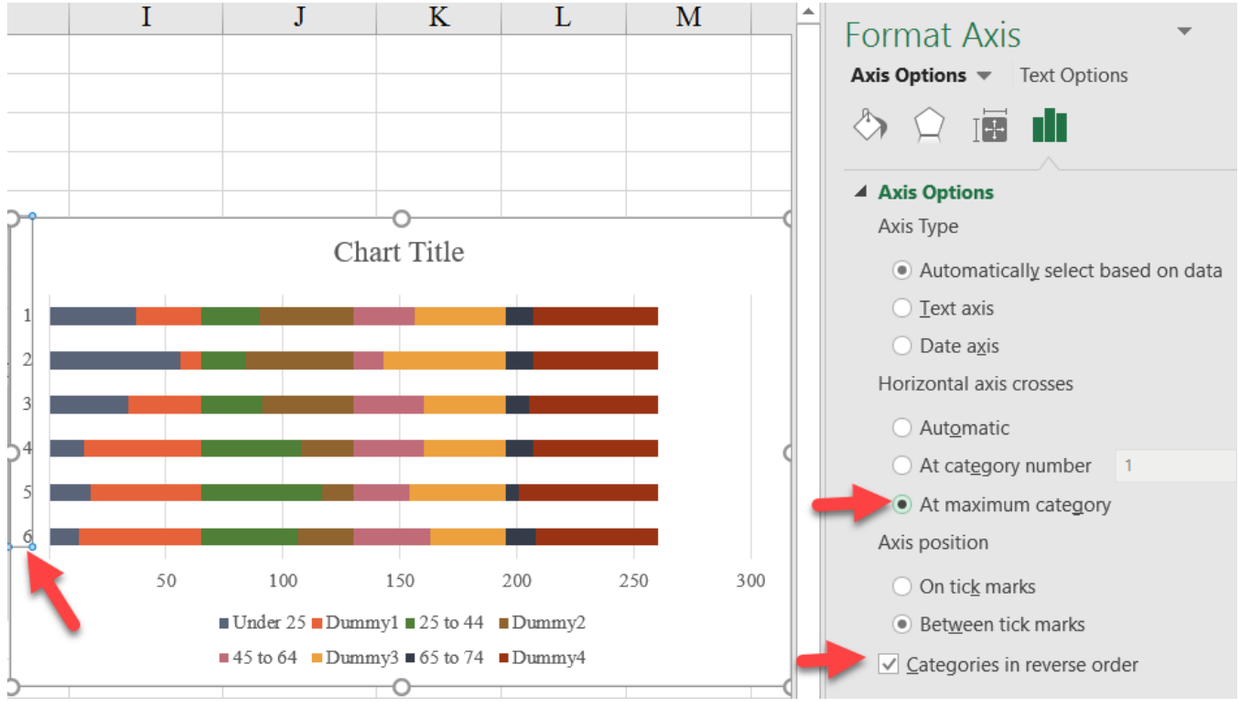


2. To switch this, select the “Switch Row/Column” button in the “Design” tab on the ribbon. The chart is now grouped by rows instead of columns.

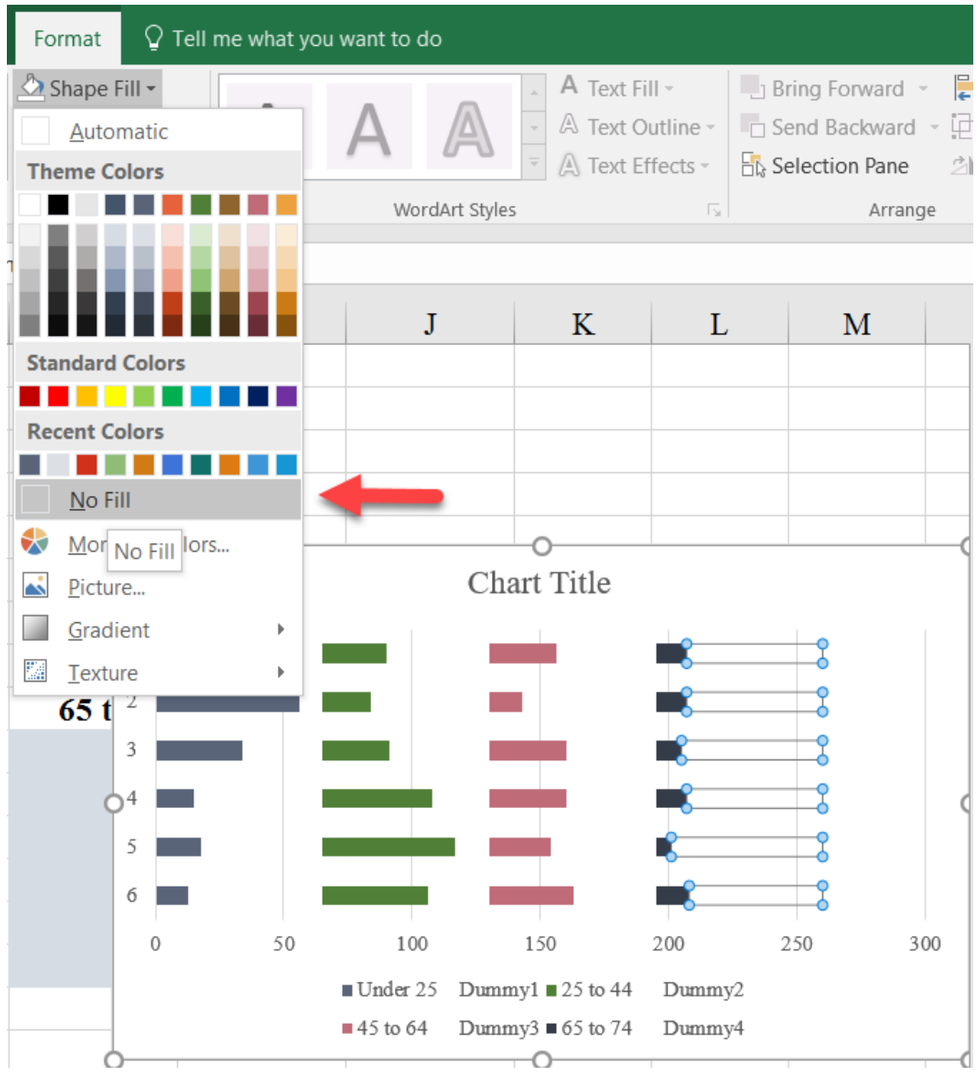



| | A | B | C | D | E | F | G | H | I | M |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Group | Under 25 | 25 to 44 | 45 to 64 | 65 to 74 | Total | | | | |
| 2 | 1 | 37 | 25 | 26 | 12 | 100 | | | | |
| 3 | 2 | 56 | 19 | 13 | 12 | 100 | | | | |
| 4 | 3 | 34 | 26 | 30 | 10 | 100 | | | | |
| 5 | 4 | 15 | 43 | 30 | 12 | 100 | | | | |
| 6 | 5 | 18 | 52 | 24 | 6 | 100 | | | | |
| 7 | | | | | | | | | | |
| 8 | 65 | | | | | | | | | |
| 9 | | Under 25 | Dummy1 | 25 to 44 | Dummy2 | 45 to 64 | Dummy3 | 65 t | | |
| 10 | 1 | 37 | 28 | 25 | 40 | 26 | 39 | | | |
| 11 | 2 | 56 | 9 | 19 | 46 | 13 | 52 | | | |
| 12 | 3 | 34 | 31 | 26 | 39 | 30 | 35 | | | |
| 13 | 4 | 15 | 50 | 43 | 22 | 30 | 35 | | | |
| 14 | 5 | 18 | 47 | 52 | 13 | 24 | 41 | | | |
| 15 | 6 | 13 | 52 | 41 | 24 | 33 | 32 | | | |
| 16 | | | | | | | | | | |
| 17 | | | | | | | | | | |

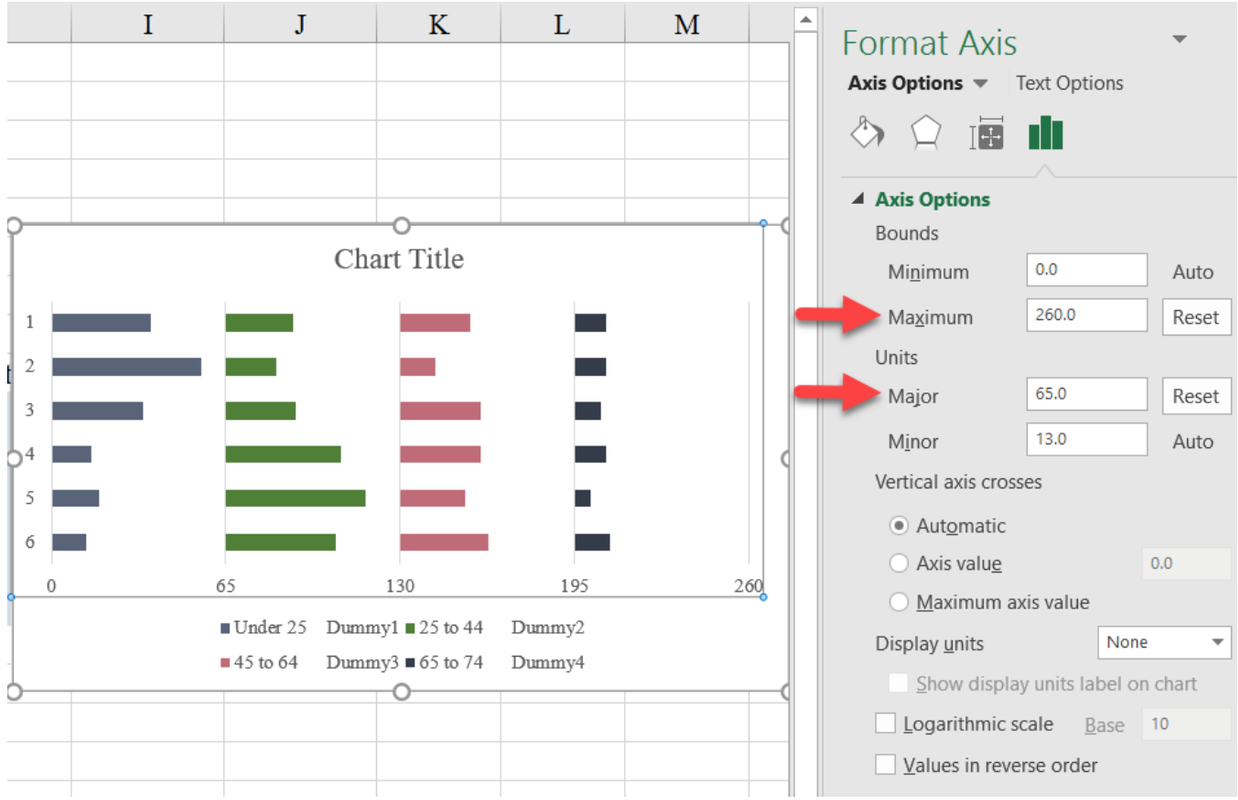
3. We've switched the plot, but Excel puts the 6th group at the top of the chart and the 1st group at the bottom. We'd like to have the order of the graph mimic the order of the data in the spreadsheet. To do so, format the y-axis (select the axis and right-click or hit CTRL-1) and in that menu, make two changes: In the "Axis Options" tab, check the box next to "Categories in reverse order" *and* change the "Horizontal axis crosses:" option to "At maximum category". The first change flips the order of the data, but it also moves the x-axis to the top of the chart; that's why the second step is needed.

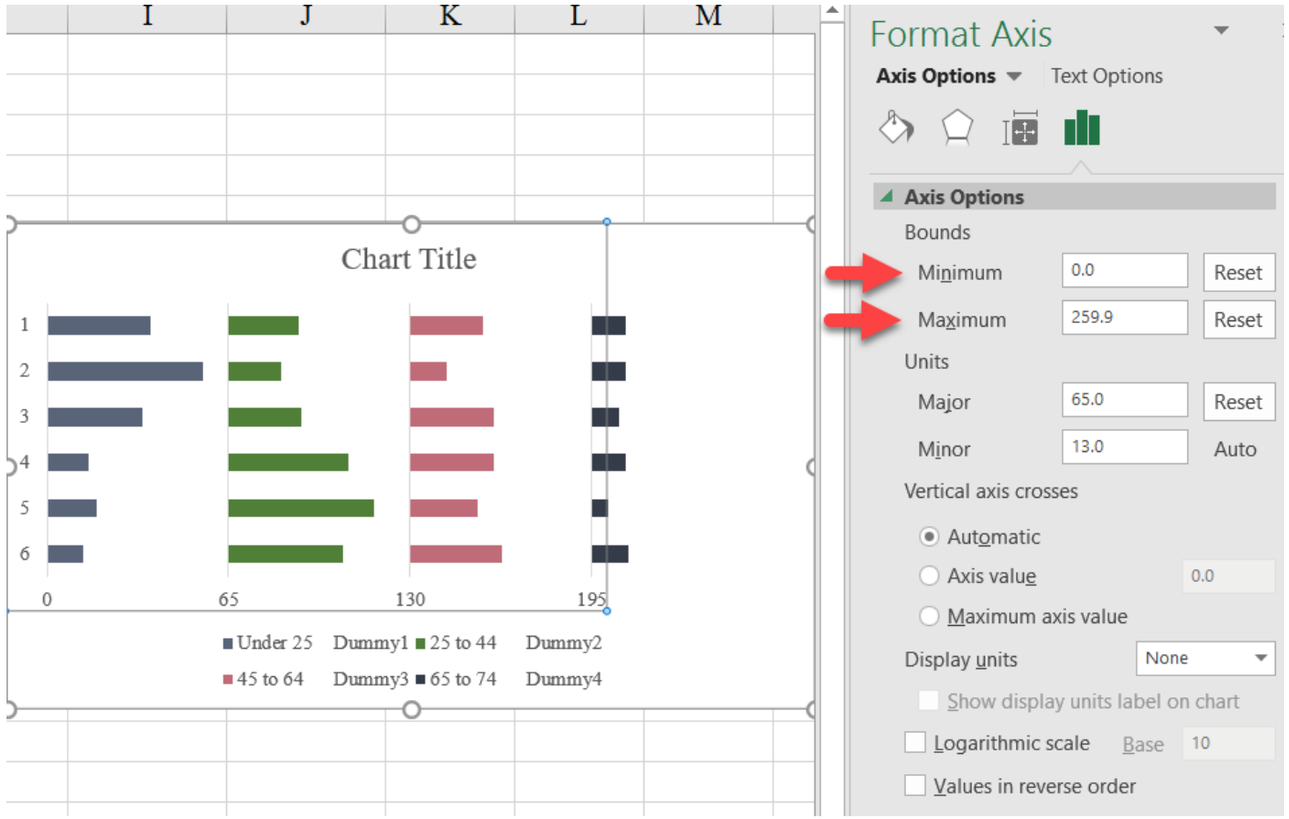


4. We now hide the “Dummy” series by changing their fill to “No Fill” using the “Format” menu.



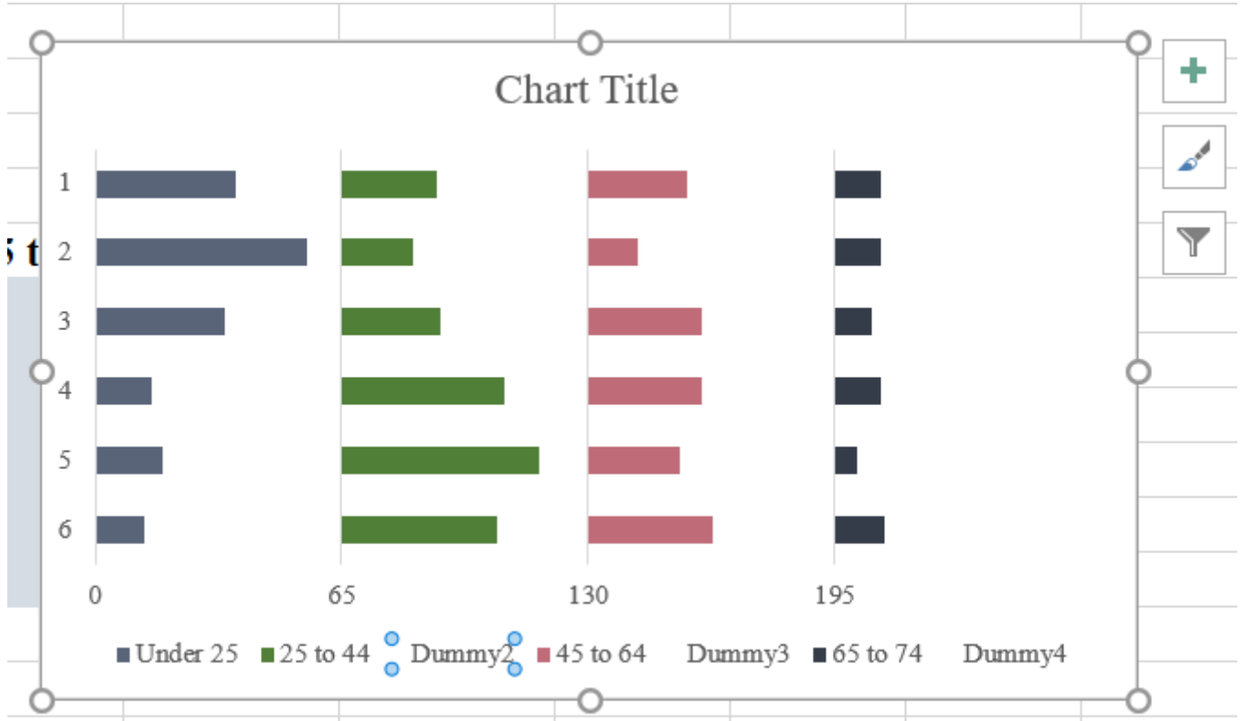
5. We now need to change the spacing of the vertical gridlines to match the vertical alignment of the data bars. Select the horizontal axis and right-click or CTRL-1 to format. Change the axis to span from 0 (in the "Minimum" section) to 260 (in the "Maximum" section), and change the "Major Unit" to 65 to match the variable used to construct the spacing.



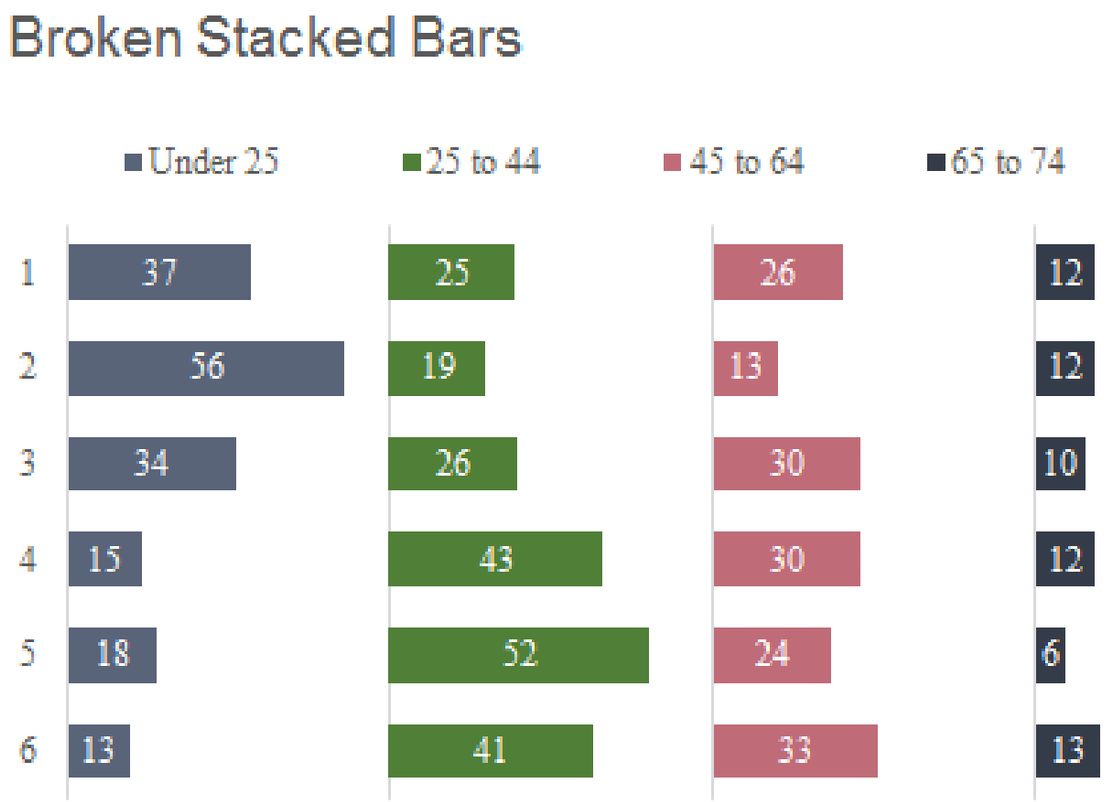



If you don't want that final gridline on the chart, you can cheat a bit and change the minimum value to 0 and the maximum value of the horizontal axis to 259.9.

6. You can delete the legend if you like. You can also delete just the four “Dummy” series labels in the legend by separately selecting and deleting each one. You can also delete the x-axis because the markers don’t make much sense at this point.

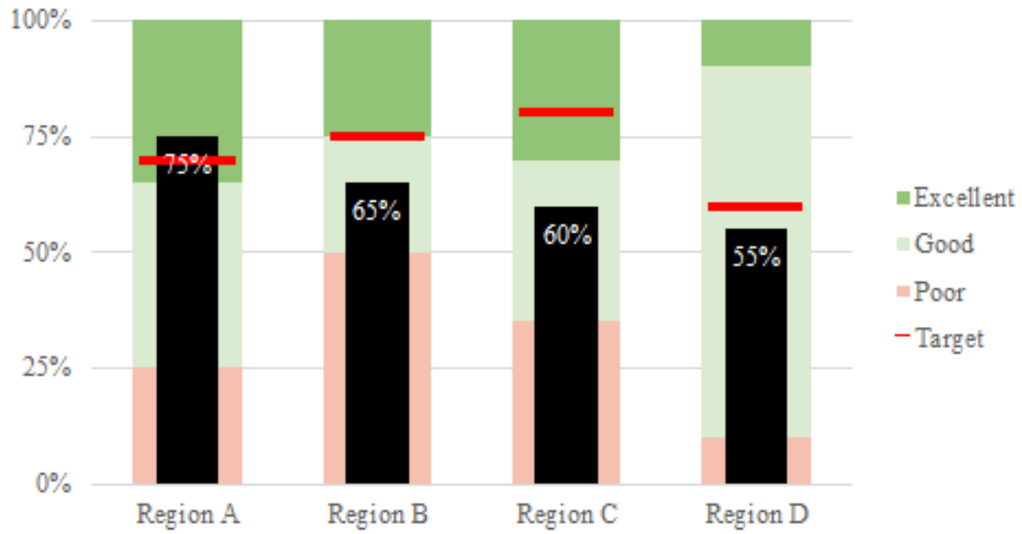


# Final Version with Styling



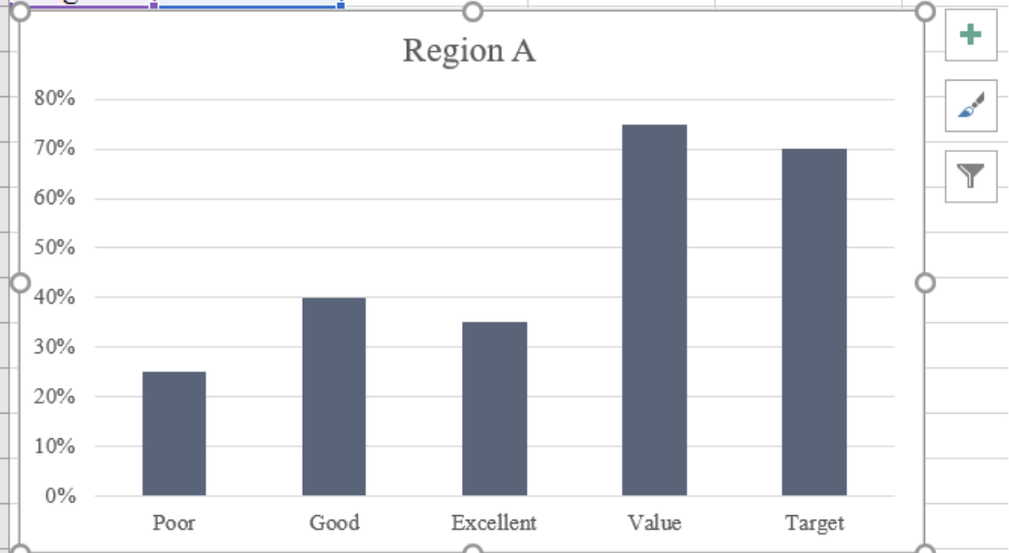
# Vertical Bullet

A bullet chart contains 5 data series: an observed (actual) value; a target value; and three (or more) ranges (e.g., poor, good, and excellent). This tutorial shows how to create a vertical bullet chart using a stacked bar chart and secondary axes. Use the *Vertical_Bullet tab* in the *Advanced Data Visualizations with Excel 2016 Hands-On.xlsx spreadsheet* to create the chart.

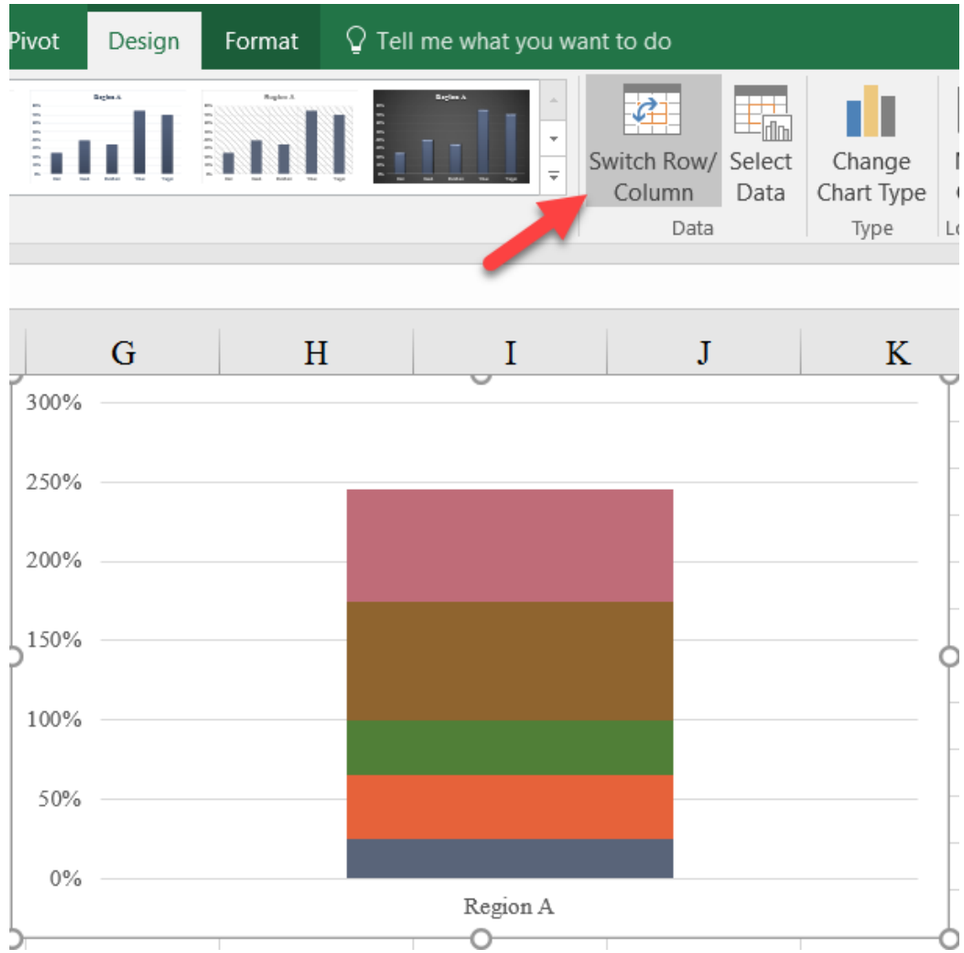


1. Create a stacked column chart using the data for Region A in column B.

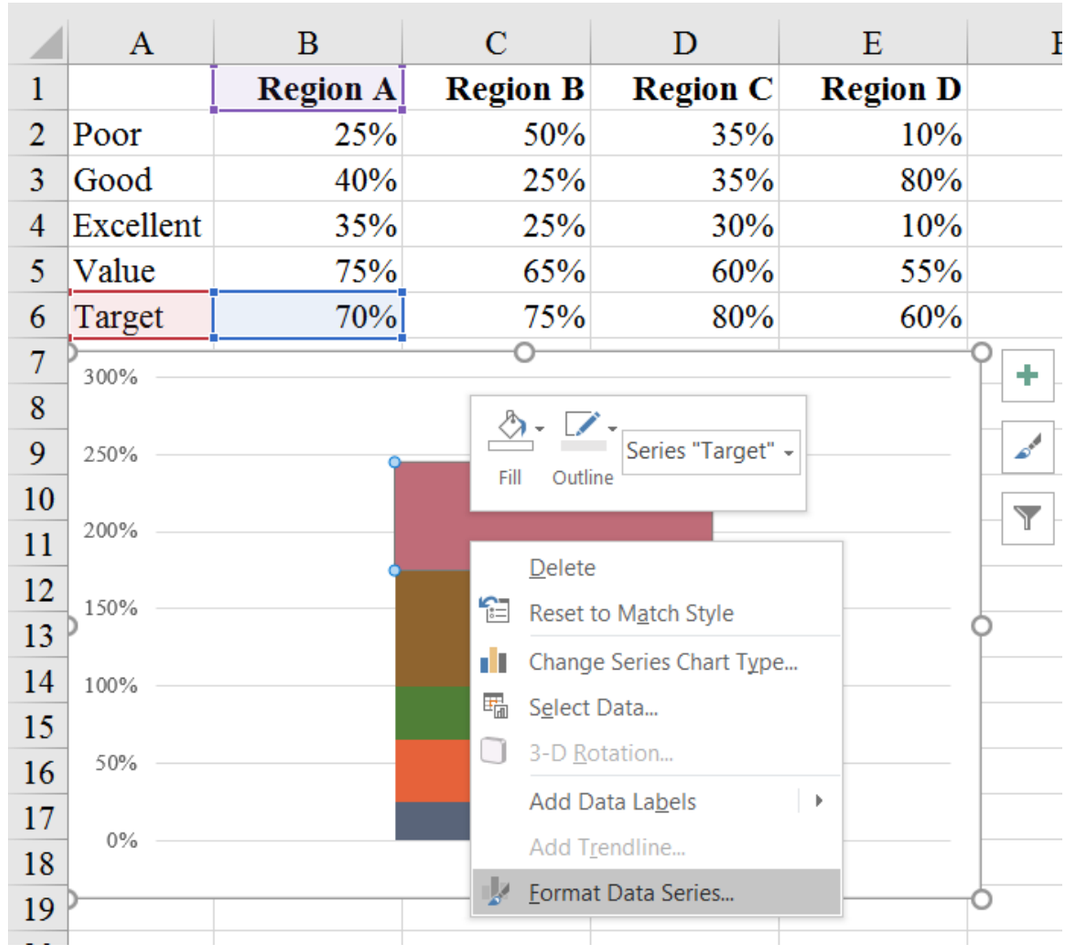
| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| 1 | | **Region A** | **Region B** | **Region C** | **Region D** | |
| 2 | Poor | 25% | 50% | 35% | 10% | |
| 3 | Good | 40% | 25% | 35% | 80% | |
| 4 | Excellent | 35% | 25% | 30% | 10% | |
| 5 | Value | 75% | 65% | 60% | 55% | |
| 6 | Target | 70% | 75% | 80% | 60% | |



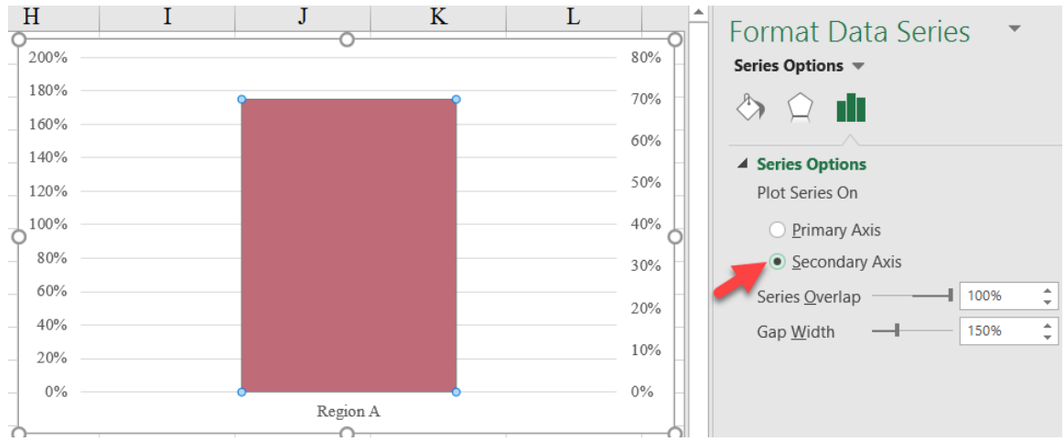
2. We want these series to be stacked, so you need to use the “Switch Row/Column” button in the “Design” tab.



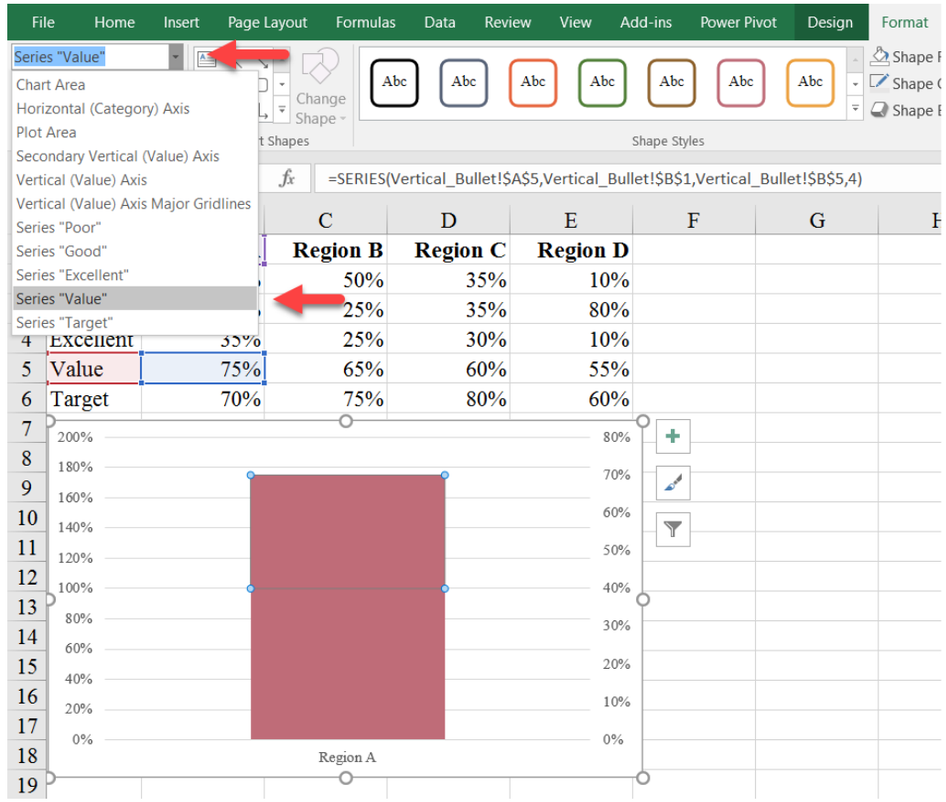
3. We'll move the Value and Target series to the secondary axis by selecting each, right-clicking (or CTRL-1), and selecting the "Format Data Series" option at the bottom of the menu.

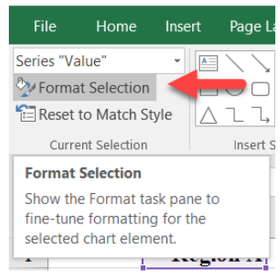


4. In the format menu, select “Secondary Axis” in the “Series Options” menu.

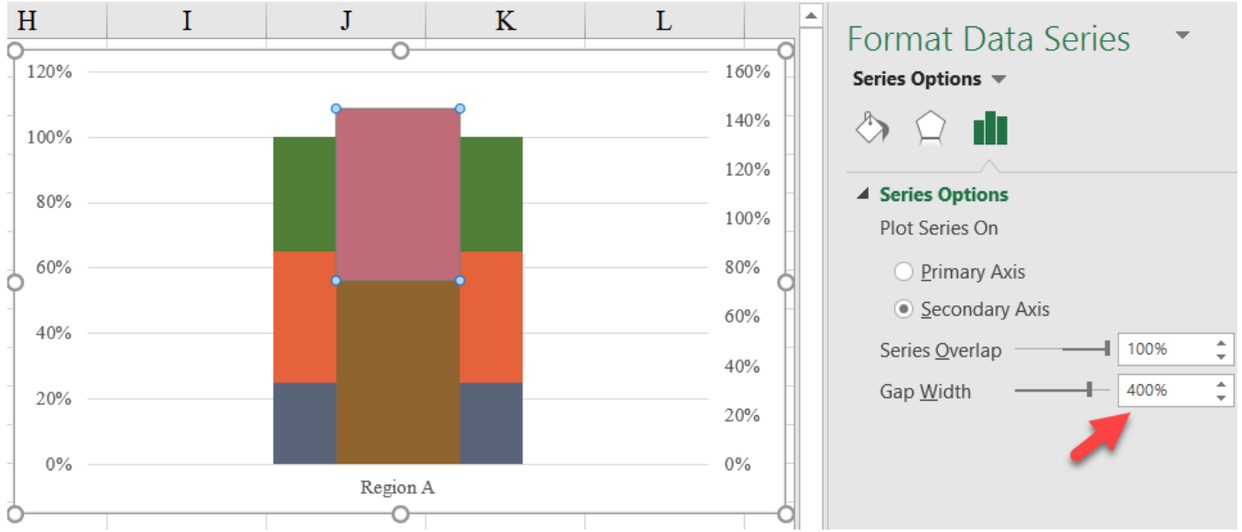


5. After you move the first series to the secondary axis, you won't be able to select the other series. To select the next series, use the dropdown menu in the far top-left section of the "Format" tab, then click Format Selection.

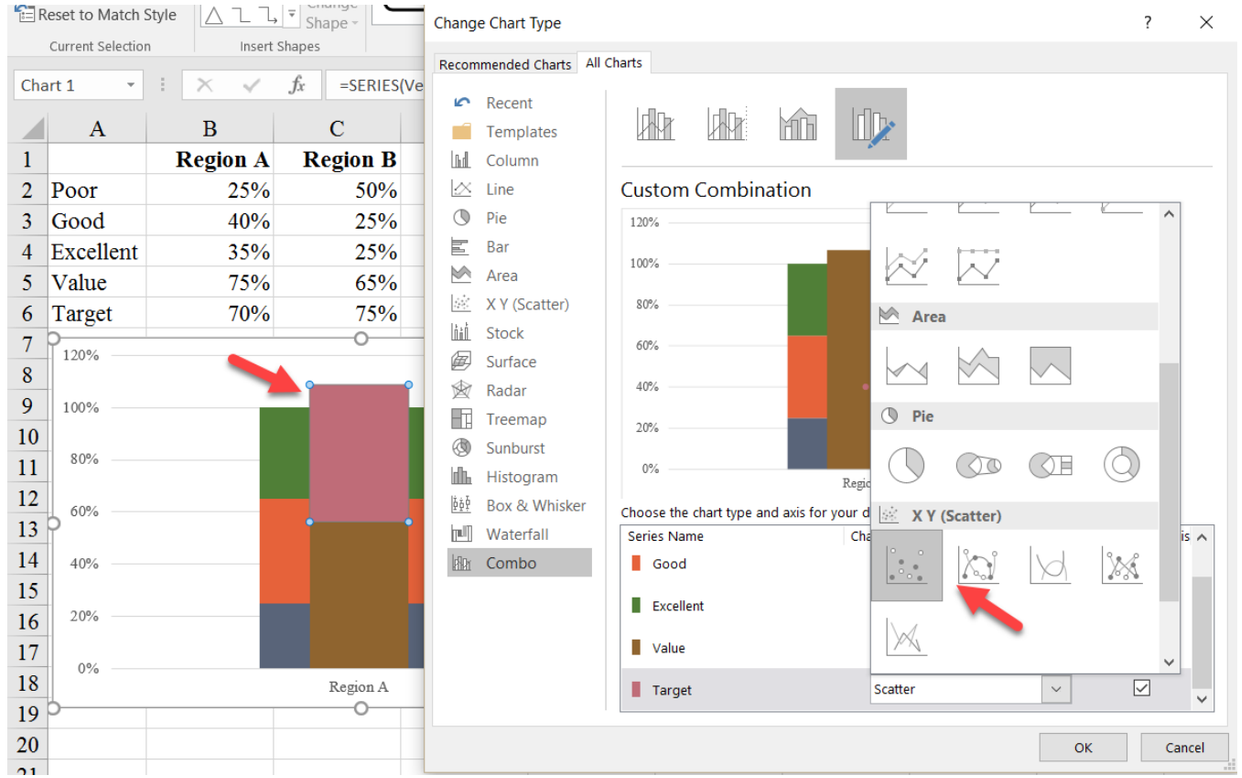


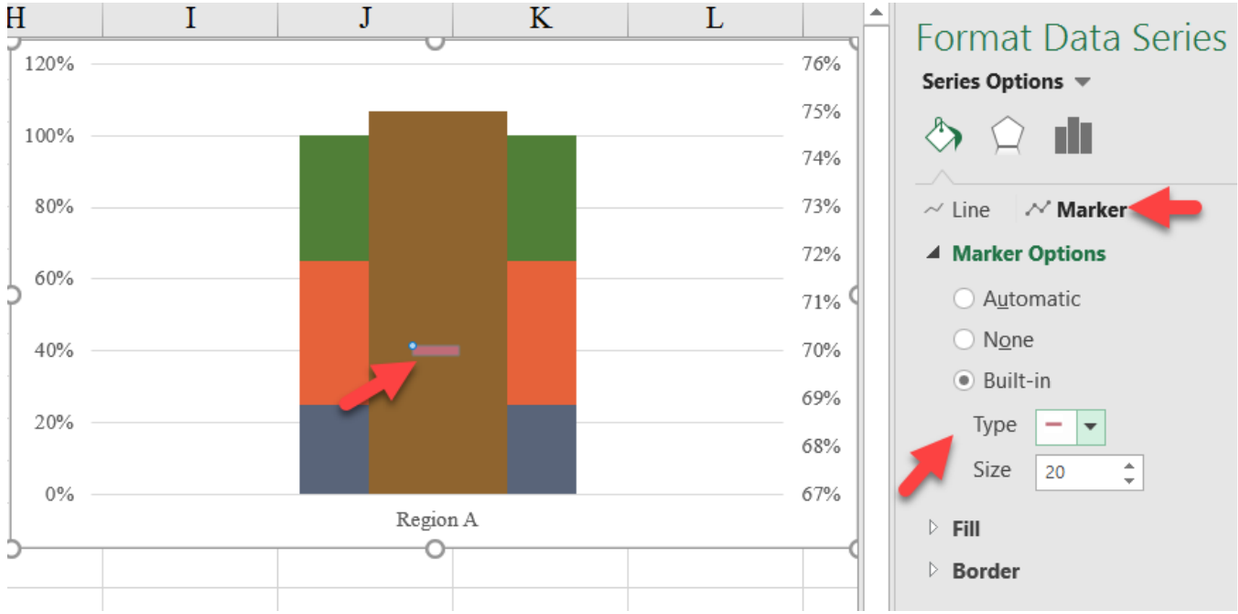
6. Once both series are moved to the secondary axis, format the series to change the "Gap Width" to 400% (you'll only need to do this for one of the series).



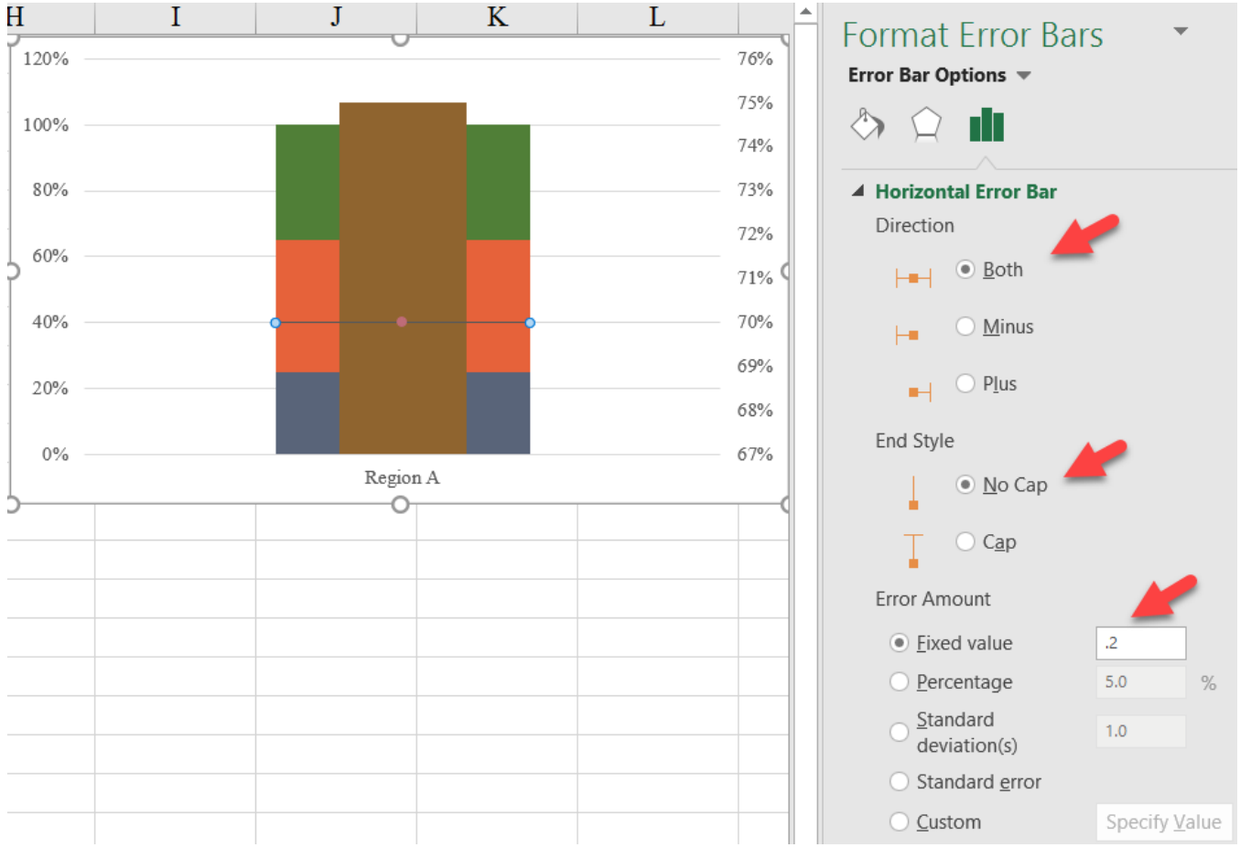
7. We'll now change the Target series to a scatterplot to create the marker. Select the Target series and then select the "Change Chart Type" menu in the "Design" tab. Use the dropdown menu to change the chart type for the Target series to "Scatter".



8. Now that it's a scatterplot, you can format as you like. Select the scatterplot point, format by right-clicking, and under "Marker Options" of the format menu, select the dash under the "Built-in" menu. You can also increase the size.



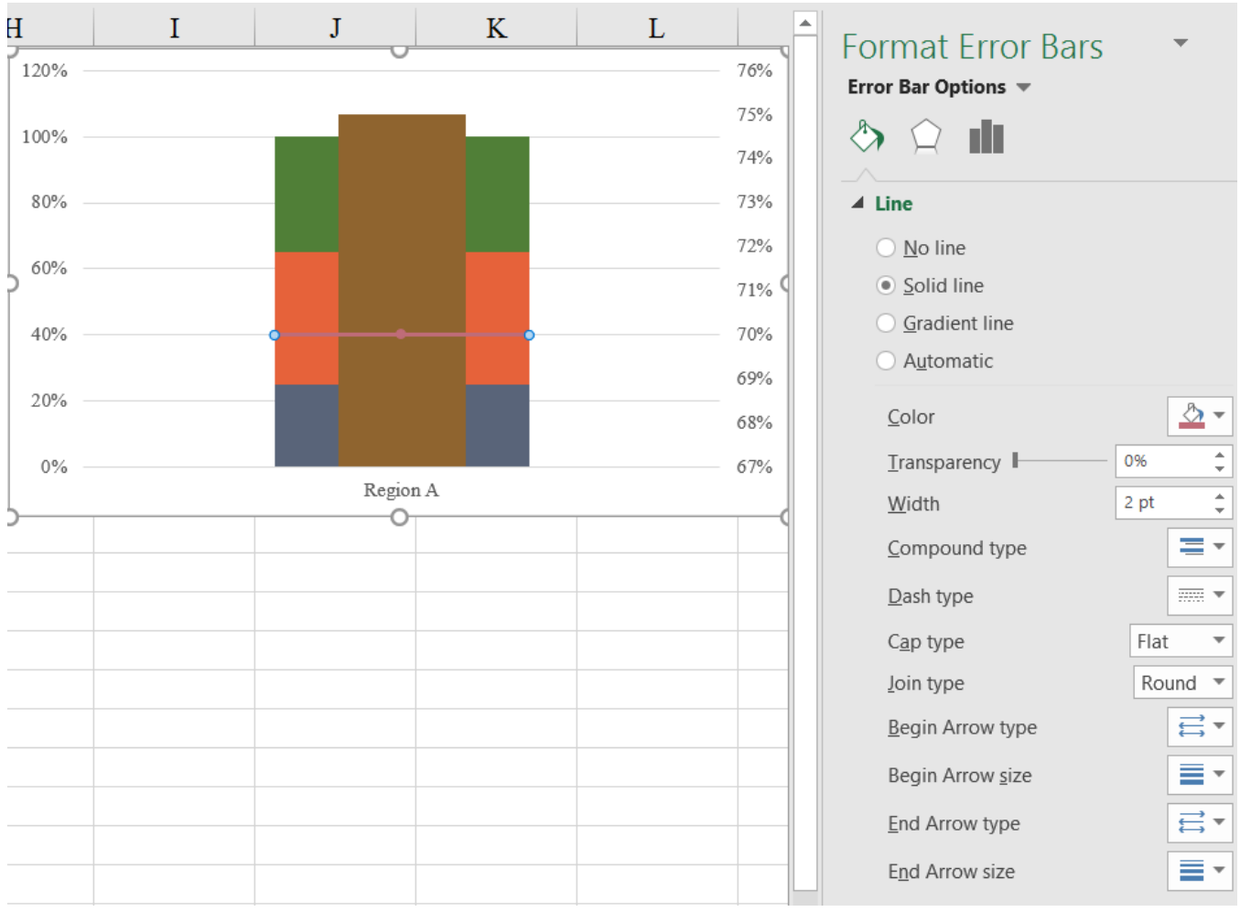
9. Alternatively, if you don't like the look of the scatterplot marker, you can change the marker to a circle and add a horizontal error bar to the point. To do so, select the point, and add an error bar using the "Error Bars" option in the "Chart Elements" menu. Delete the vertical error bar and format the horizontal error bar:
   a. Change the "Direction" to "Both";
   b. Change the "End Style" to "No Cap";
   c. Change the "Fixed value" to "0.2"



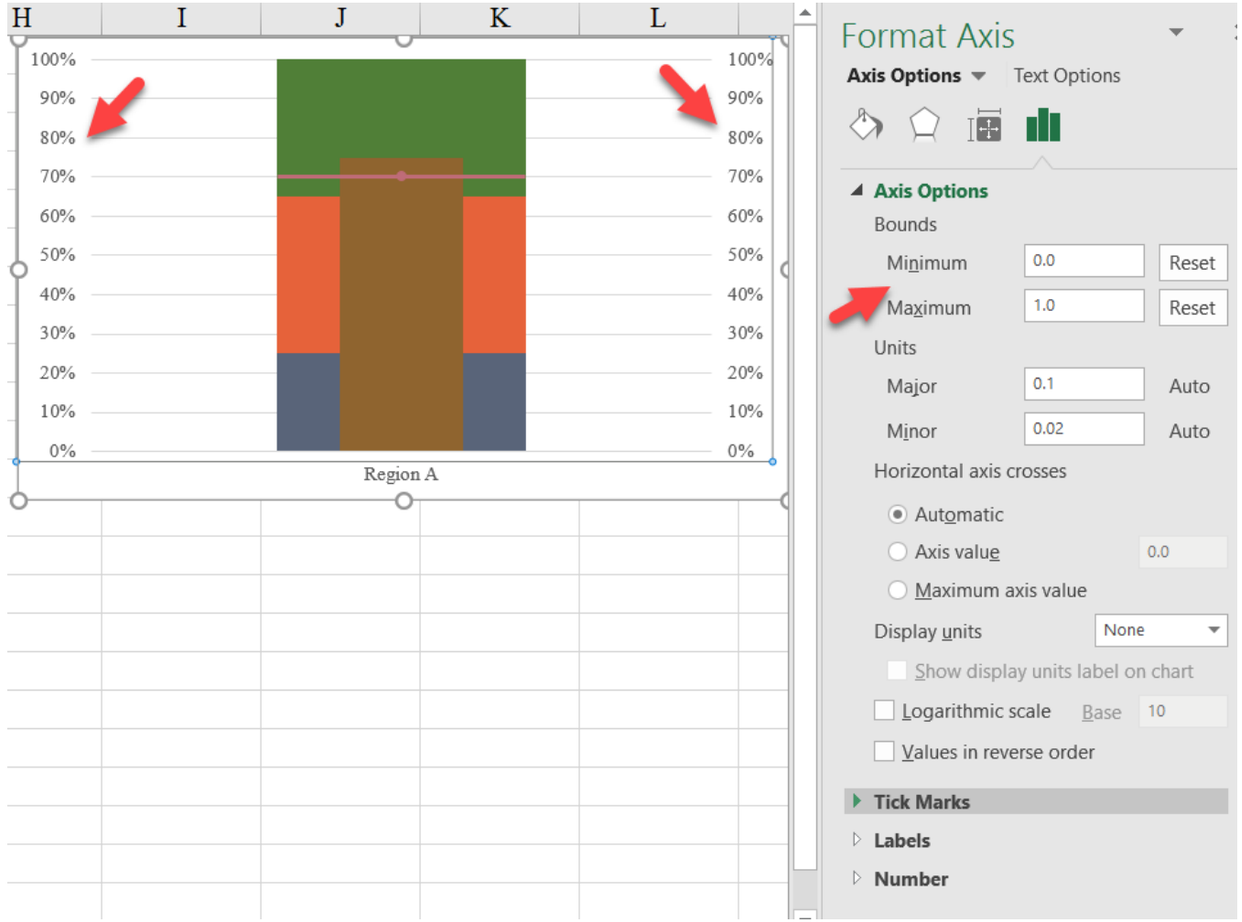
You can also change the appearance of the horizontal error bar:

e. In the "Line Style" menu, change the width (I've used 2 pt here)

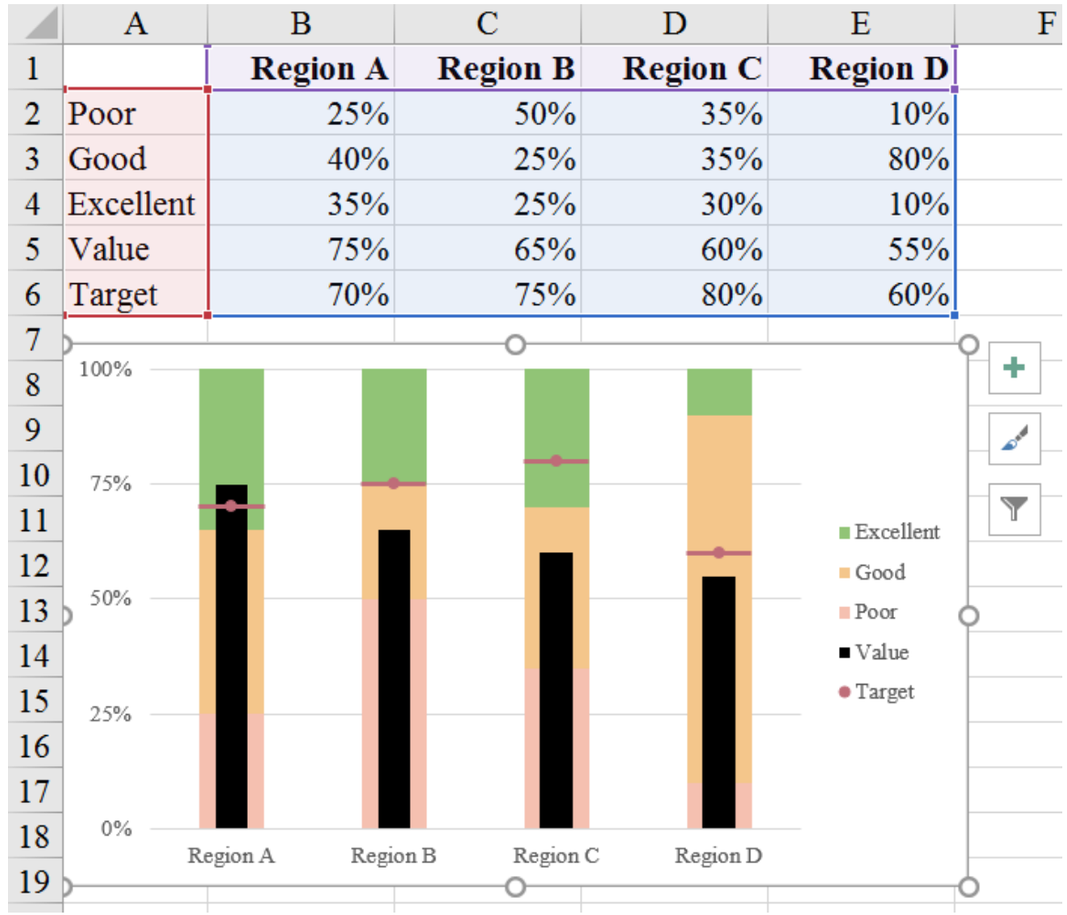
f. In the "Line Color" menu, change the color (I've used **pink** here).



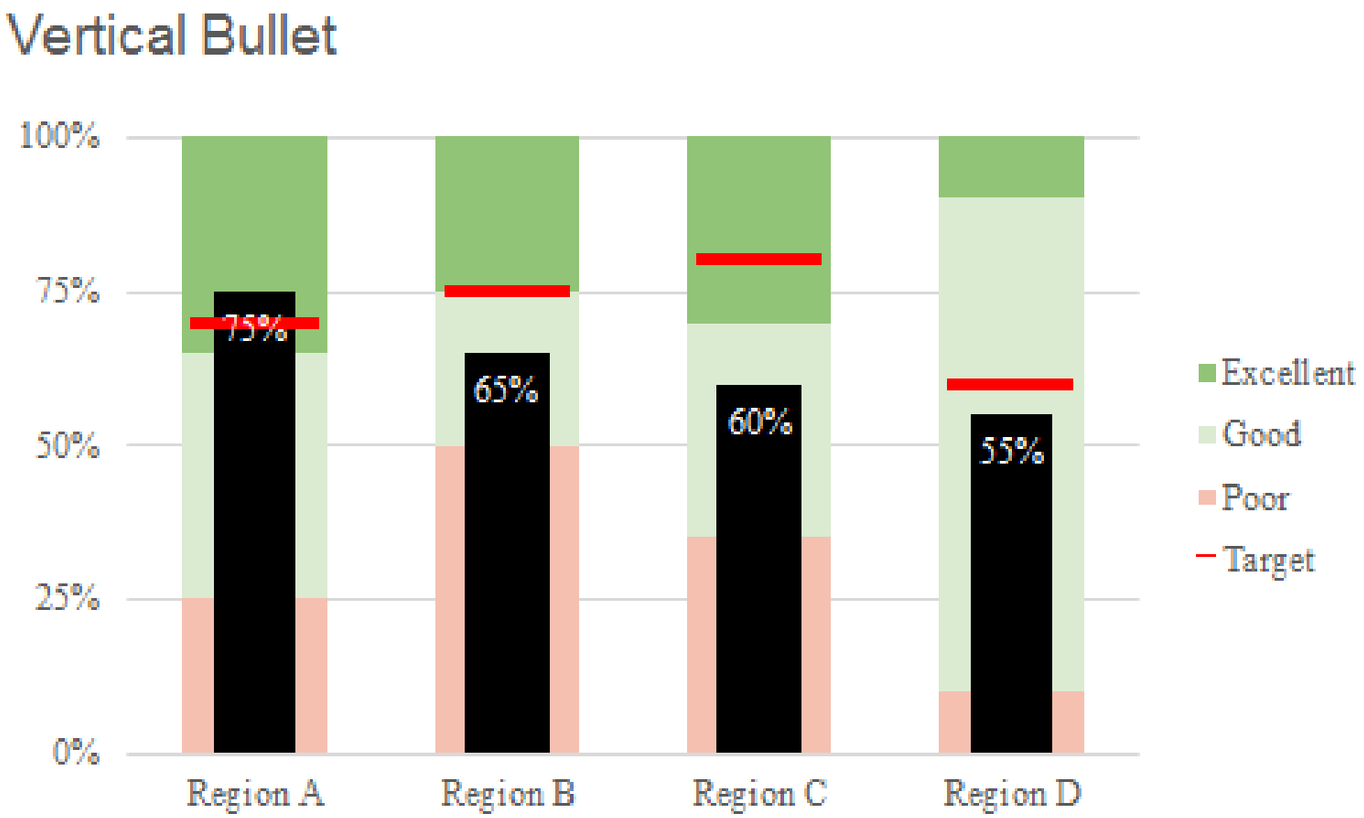
10. Be sure to set both y-axes to the same range with a minimum and maximum of 0% and 100%, respectively.



11. Recolor and format the different series as needed. To extend the series to include all four Regions, simply select the chart and drag the blue data box to the right.

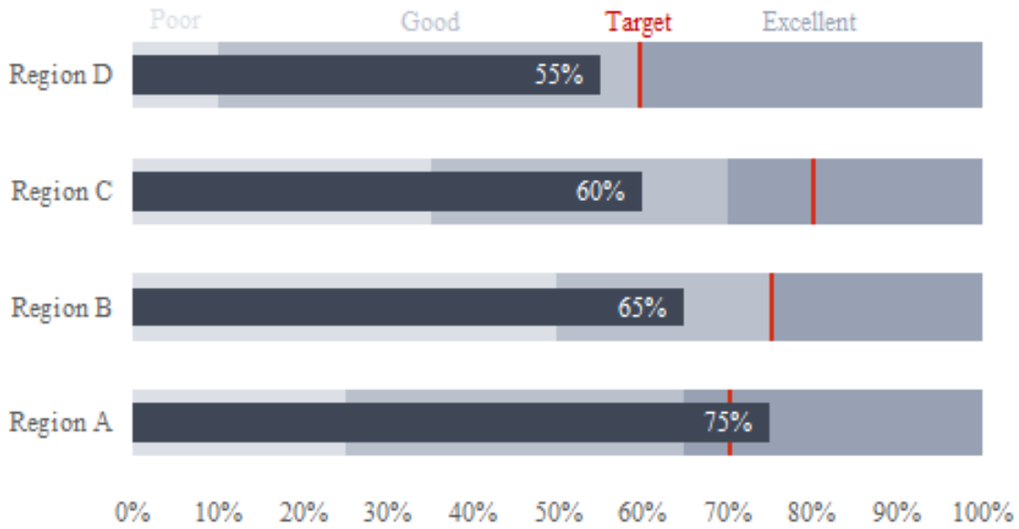


# Final Version with Styling



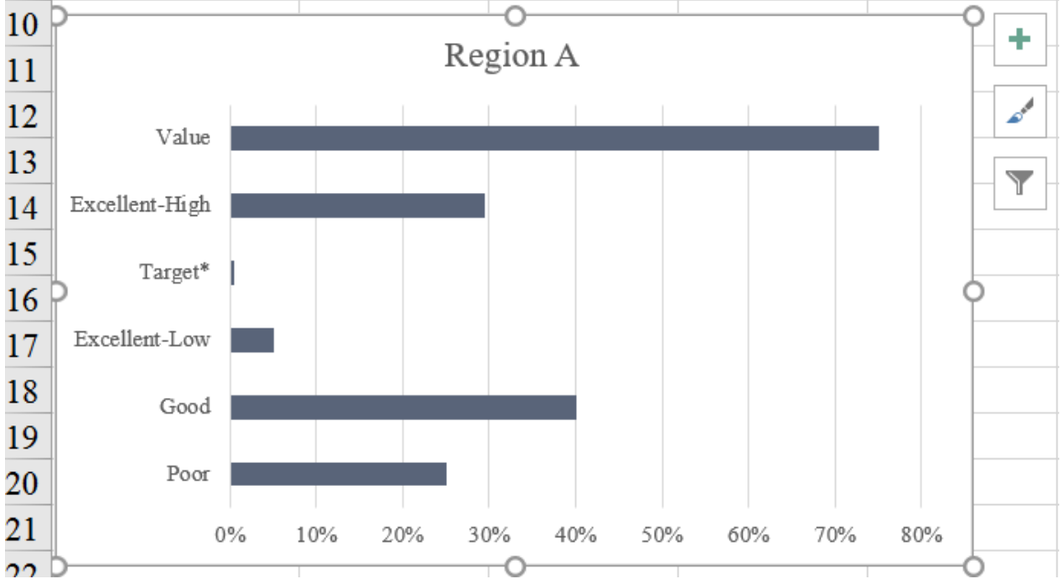
# Horizontal Bullet

The horizontal bullet chart presents the same data as in the vertical version, but this approach is slightly different (you could use the same approach for the vertical version, though it's more difficult to apply the vertical version to the horizontal bars). The somewhat tricky version of this approach is that you need to be careful with the data and where the Target sits in the different ranges. Use the *Horizontal_Bullet tab* in the *Advanced Data Visualizations with Excel 2016 Hands-On.xlsx spreadsheet* to create the chart.

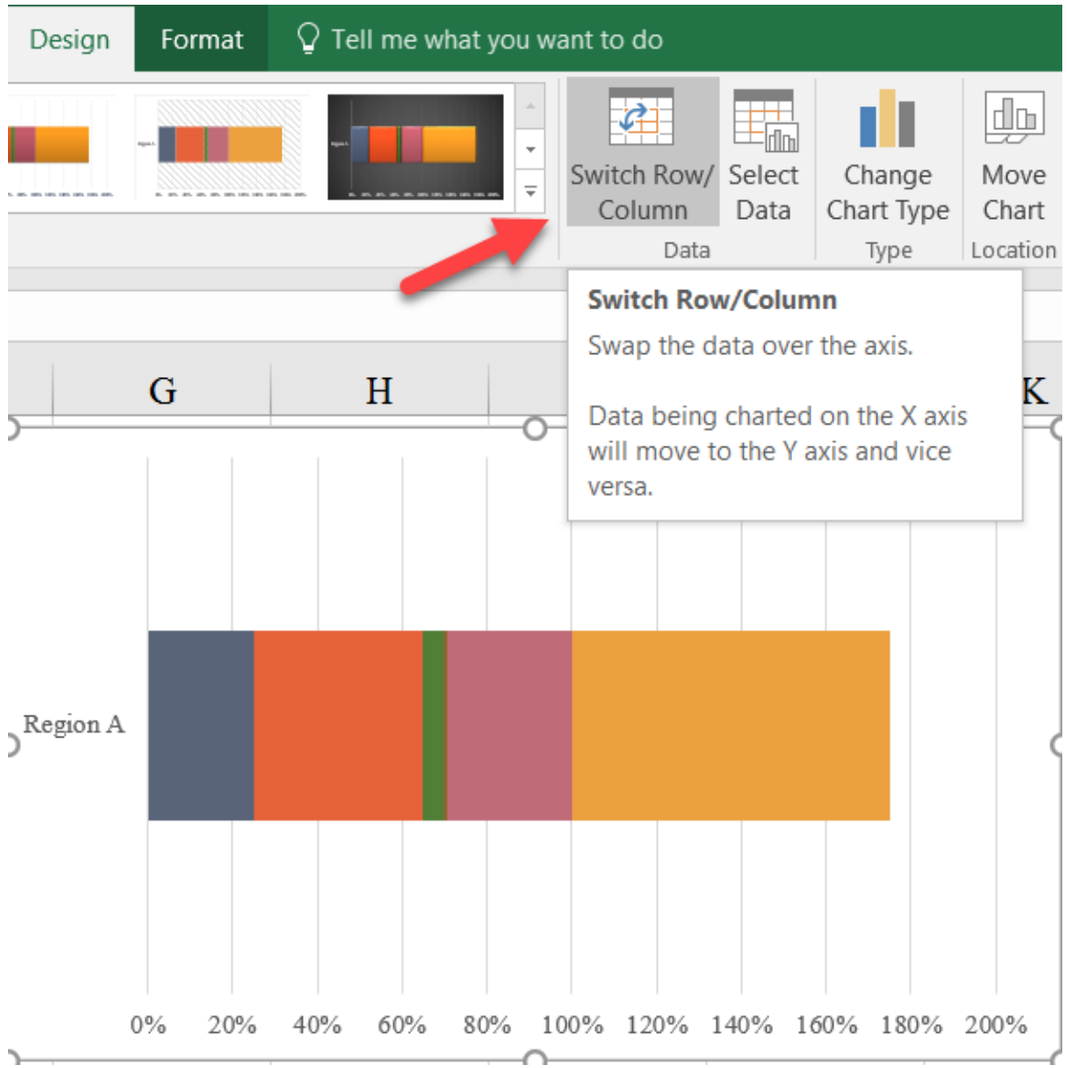


1. Begin by creating a stacked bar chart using cells A1:B7. Notice how the Target* series differs when it sits within the "Good" range instead of the "Excellent" range.

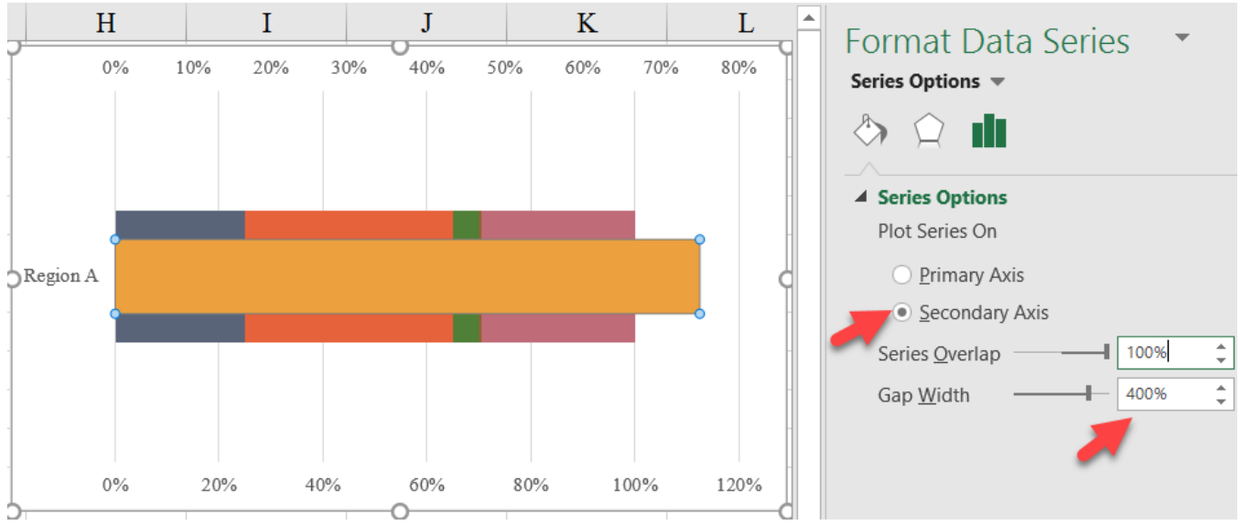
| | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | | **Region A** | **Region B** | **Region C** | **Region D** |
| 2 | Poor | 25% | 50% | 35% | 10% |
| 3 | Good | 40% | 25% | 35% | 50% |
| 4 | Excellent-Low | 5% | 0% | 10% | 0.5% |
| 5 | Target* | 0.5% | 0.5% | 0.5% | 30% |
| 6 | Excellent-High | 30% | 25% | 20% | 10% |
| 7 | Value | 75% | 65% | 60% | 55% |
| 8 | | | | | |
| 9 | Target | 70% | 75% | 80% | 60% |



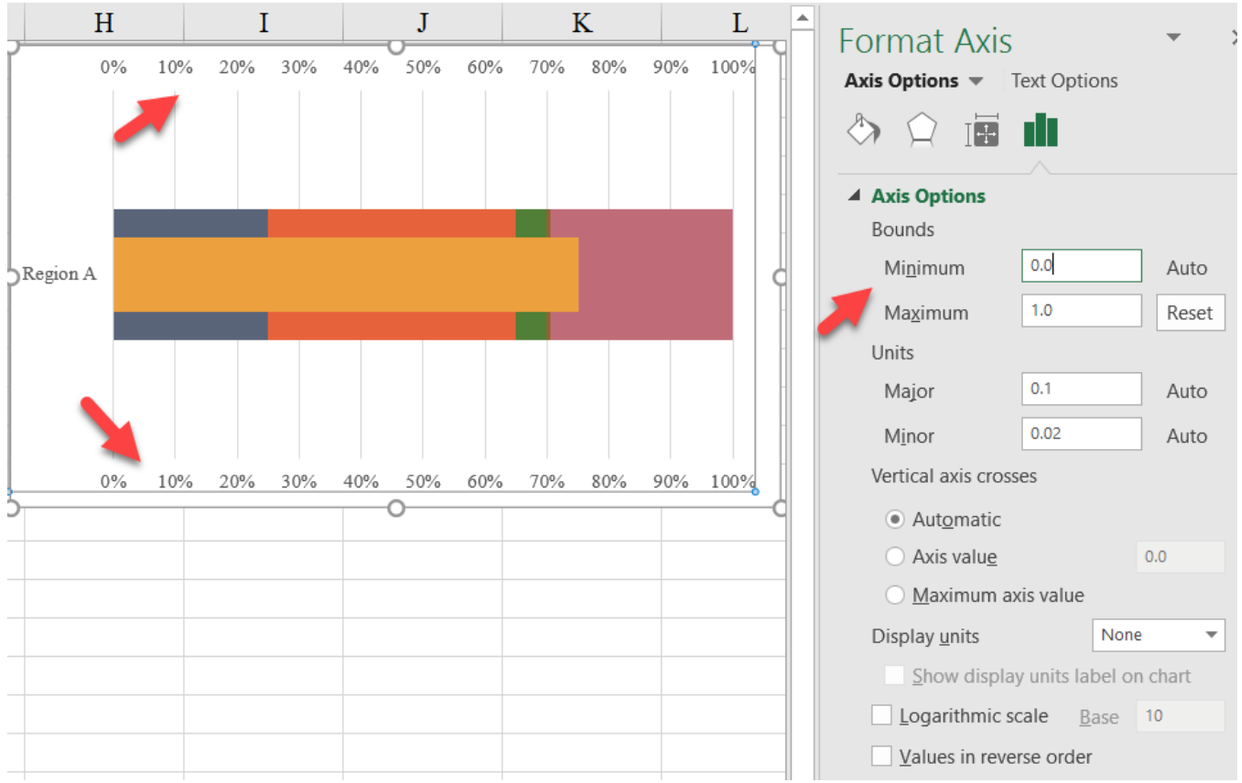
2. If you select the first option in the “Insert Chart” menu, you’ll notice that you get a Clustered Bar Chart instead of a Stacked Bar Chart. To change, select the “Switch Row/Column” button in the “Design” tab of the ribbon. You can also select this chart option directly in the Insert Chart menu by selecting the option to the right.



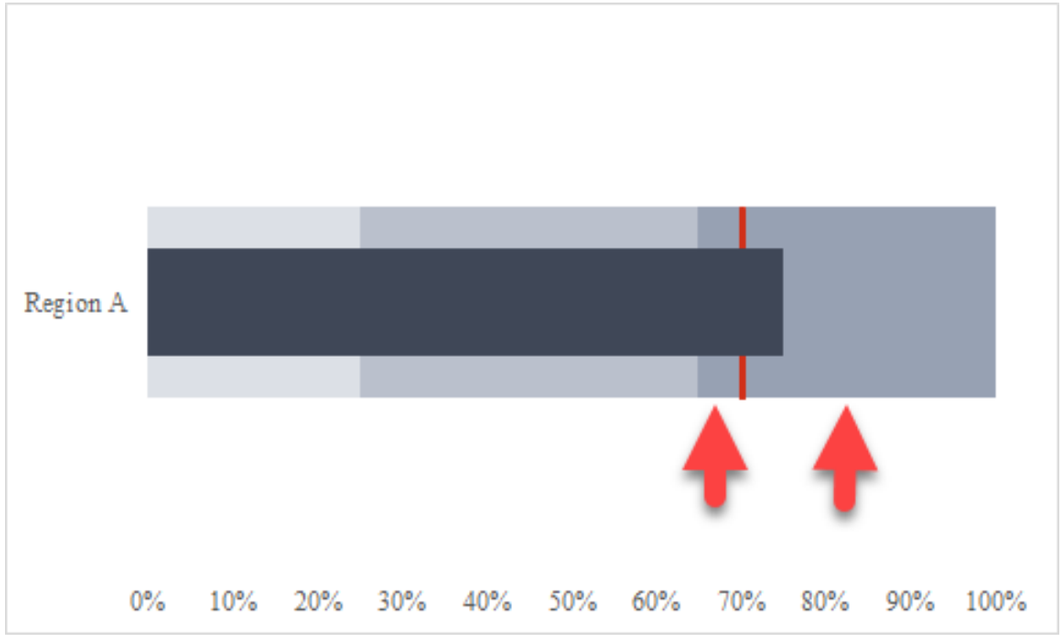
3. Move the Value (gold) series to the secondary axis by selecting and formatting (either by right-clicking or CTRL-1). Move the series to the "Secondary Axis" under the "Series Options" tab and change the "Gap Width" to 400%.



4. Fix both sets of horizontal axes to go from 0%-100%.

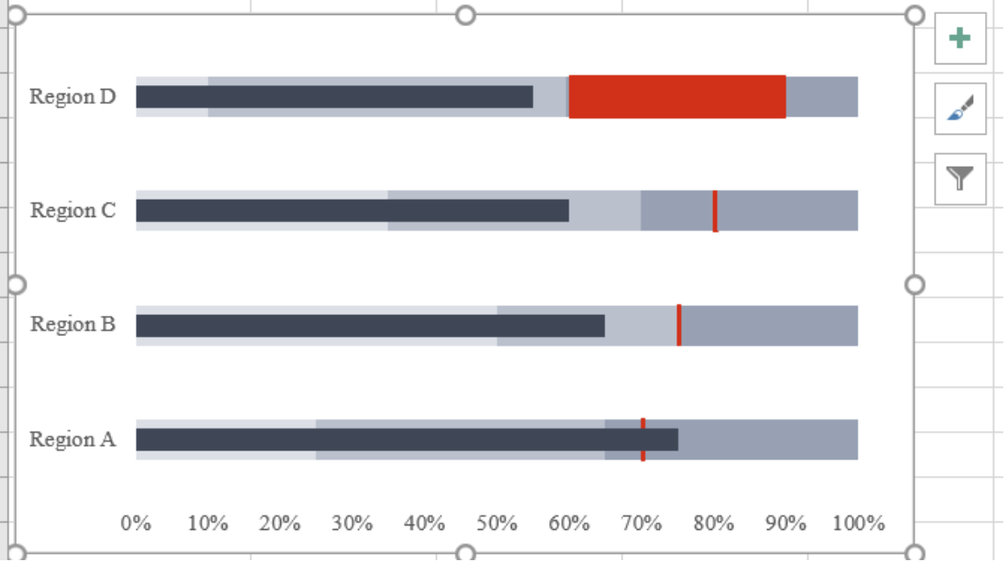


5. Delete the secondary horizontal axis, legend, and gridlines. Format the different series to the desired colors. Notice that the "Excellent" series is broken into two groups—to the left and right of the "Target" series—so be careful to give those two series the same color.

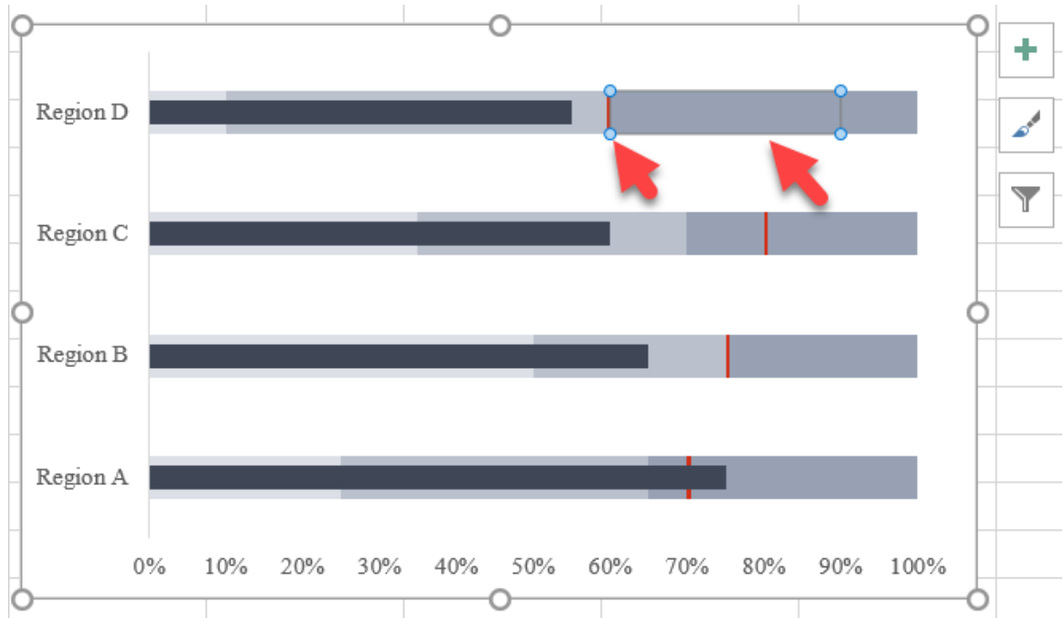


6. You can now select the chart and drag the blue data box to extend the chart to cover all four Regions.

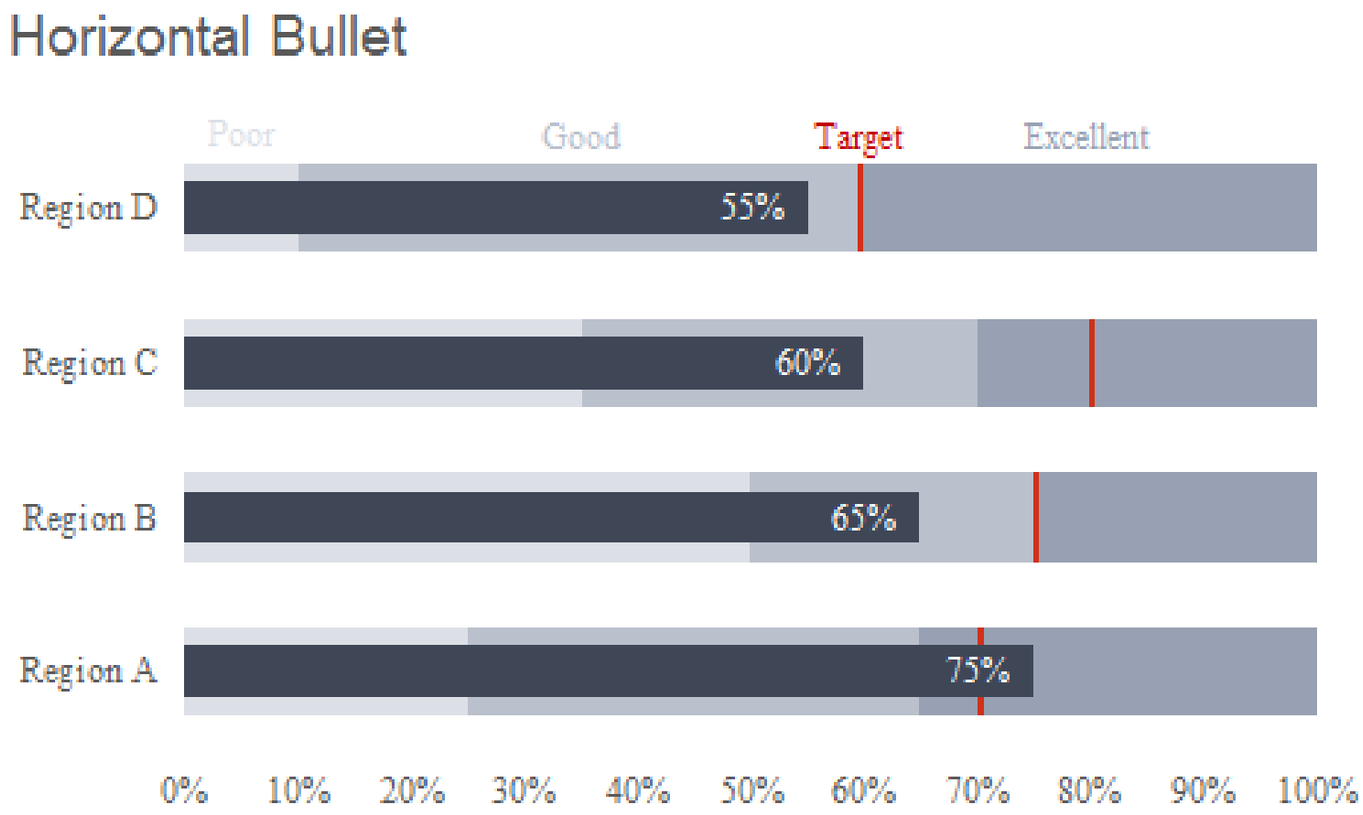
| | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | | **Region A** | **Region B** | **Region C** | **Region D** |
| 2 | Poor | 25% | 50% | 35% | 10% |
| 3 | Good | 40% | 25% | 35% | 50% |
| 4 | Excellent-Low | 5% | 0% | 10% | 0.5% |
| 5 | Target* | 0.5% | 0.5% | 0.5% | 30% |
| 6 | Excellent-High | 30% | 25% | 20% | 10% |
| 7 | Value | 75% | 65% | 60% | 55% |
| 8 | | | | | |
| 9 | Target | 70% | 75% | 80% | 60% |



7. Notice how this approach generates a large red box for the Target* series in Region D. You need to do some manual work here to recolor the that segment. Select that segment (not the entire series) and color as needed. Color the Excellent-Low segment as your target color.

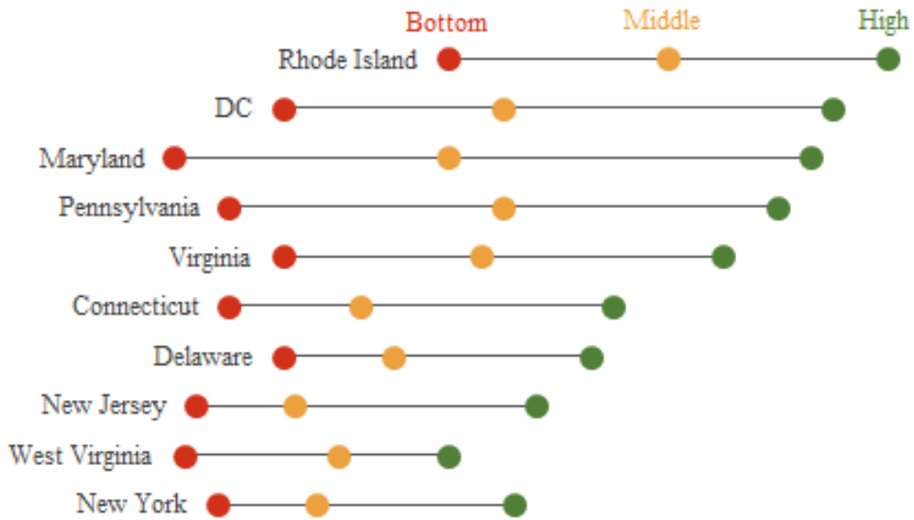


## Final Version with Styling

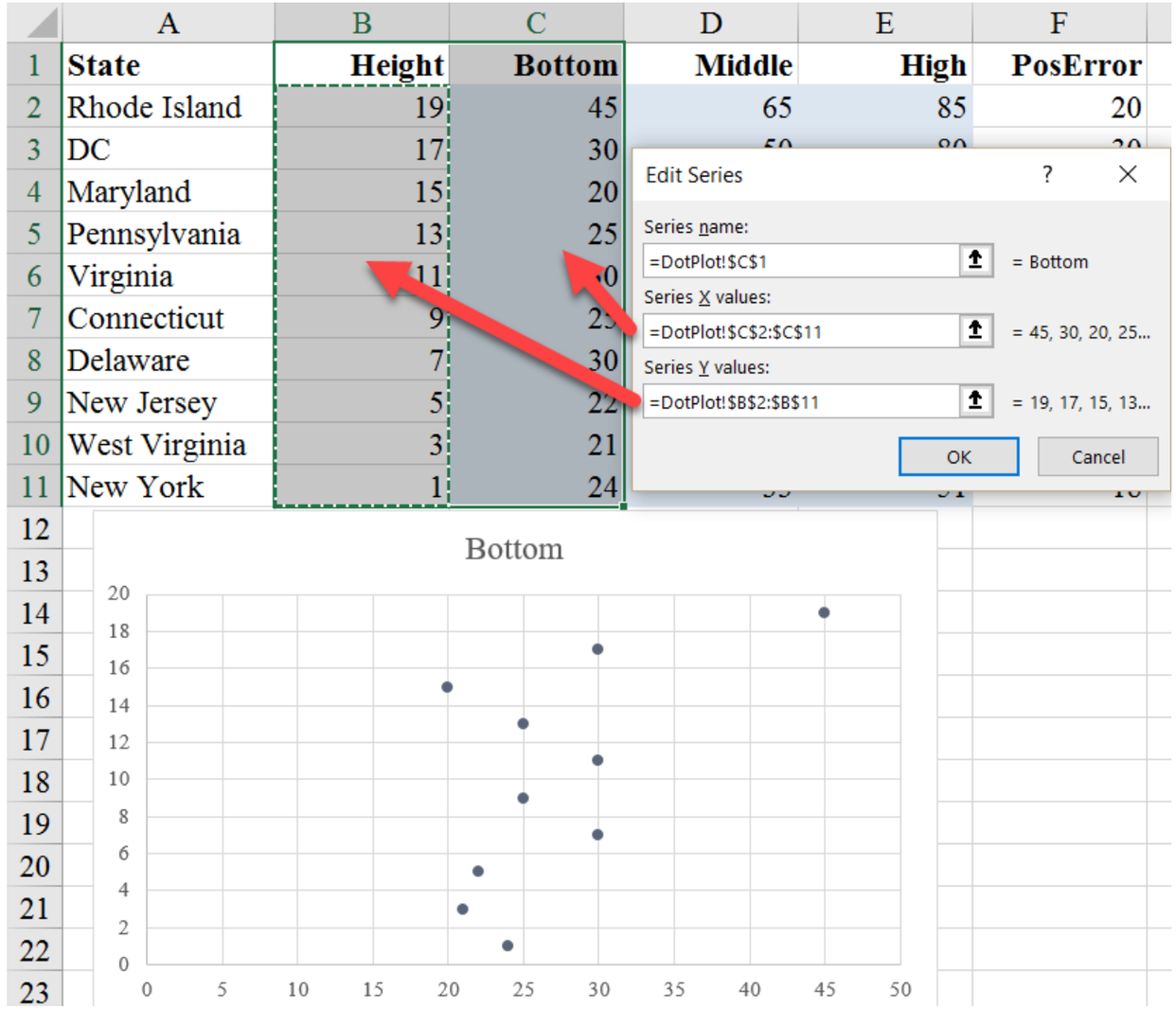


# Dot Plot

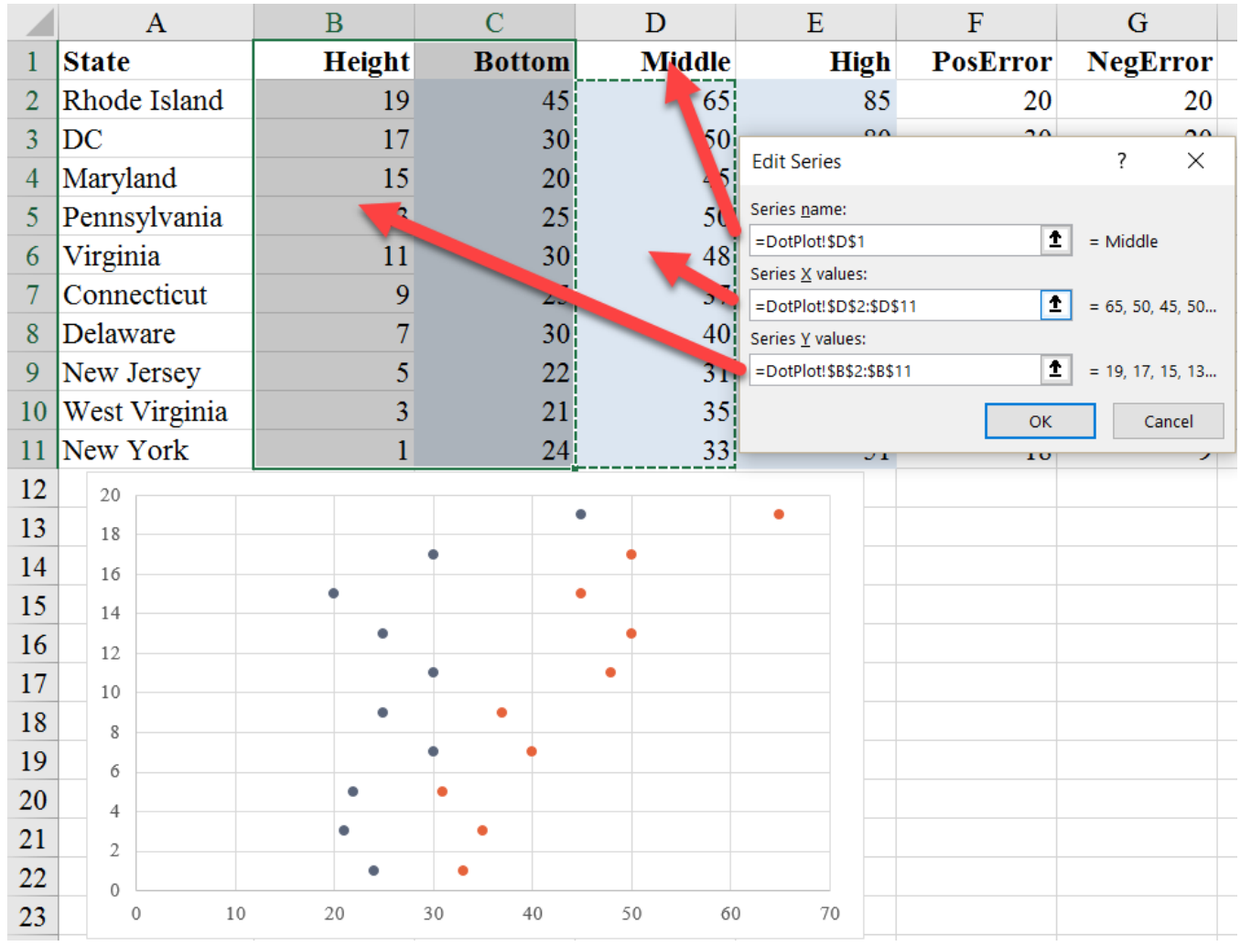
The dot plot is a nice alternative to a paired or stacked column/bar chart where you want to compare values for different categories. Use the *DotPlot tab* in the *Advanced Data Visualizations with Excel 2016 Hands-On.xlsx spreadsheet* to create the chart.



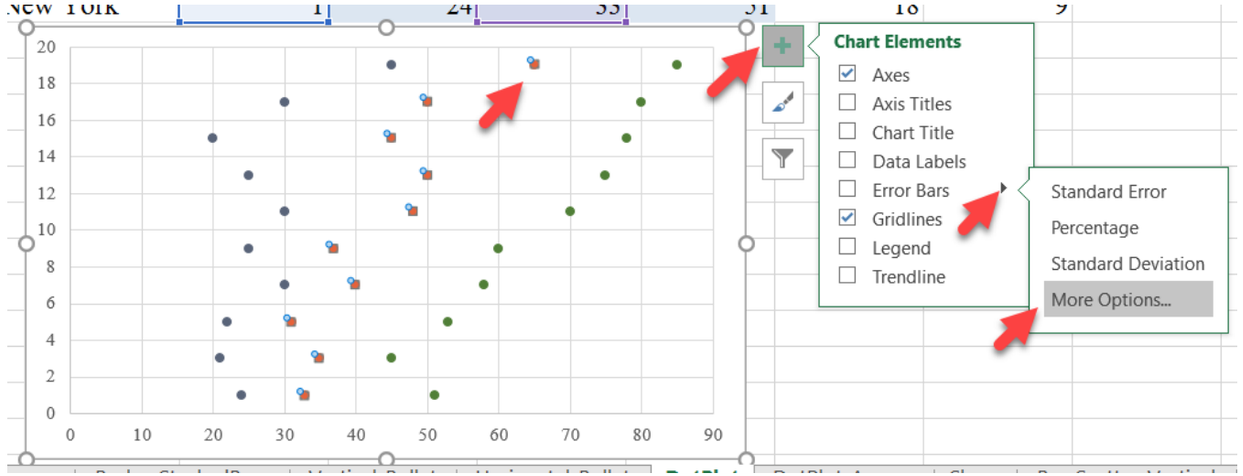
1. Creating a Dot Plot in Excel 2016 consists of a series of scatterplots. To start, create a scatterplot from cells B1:C11. The data are set up in such a way to keep the three data series (Bottom, Middle, High) next to each other, but this also means we need to switch how Excel plots the x- and y-series. So, after having inserted the scatterplot, right-click on the chart, choose "Select Data", select the "Bottom" series and then the "Edit" button. Here, switch the data—the "Height" series (B2:B11) should go in the "Series Y values:" box and the "Bottom" series (C2:C11) should go in the "Series X values:" box.



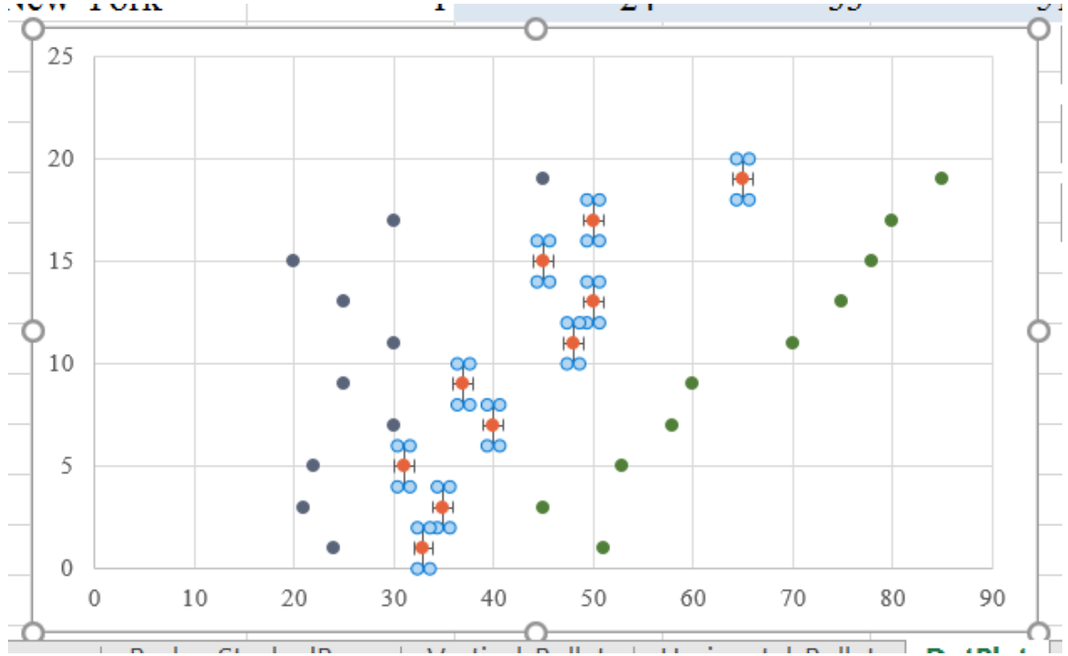
2. Add the “Middle” and “High” series by right-clicking on the chart and choosing the “Select Data” option. Select the “Add” option and fill in the menu options—for the “Middle” series, fill in the “Series name:” box with cell D1; the “Series X values:” with cells D2:D11; and the “Series Y values:” with cells B2:B11. Repeat for the “High” series. (If you haven’t noticed, the “Height” series is used for all three series here because it doesn’t (and shouldn’t) change.)



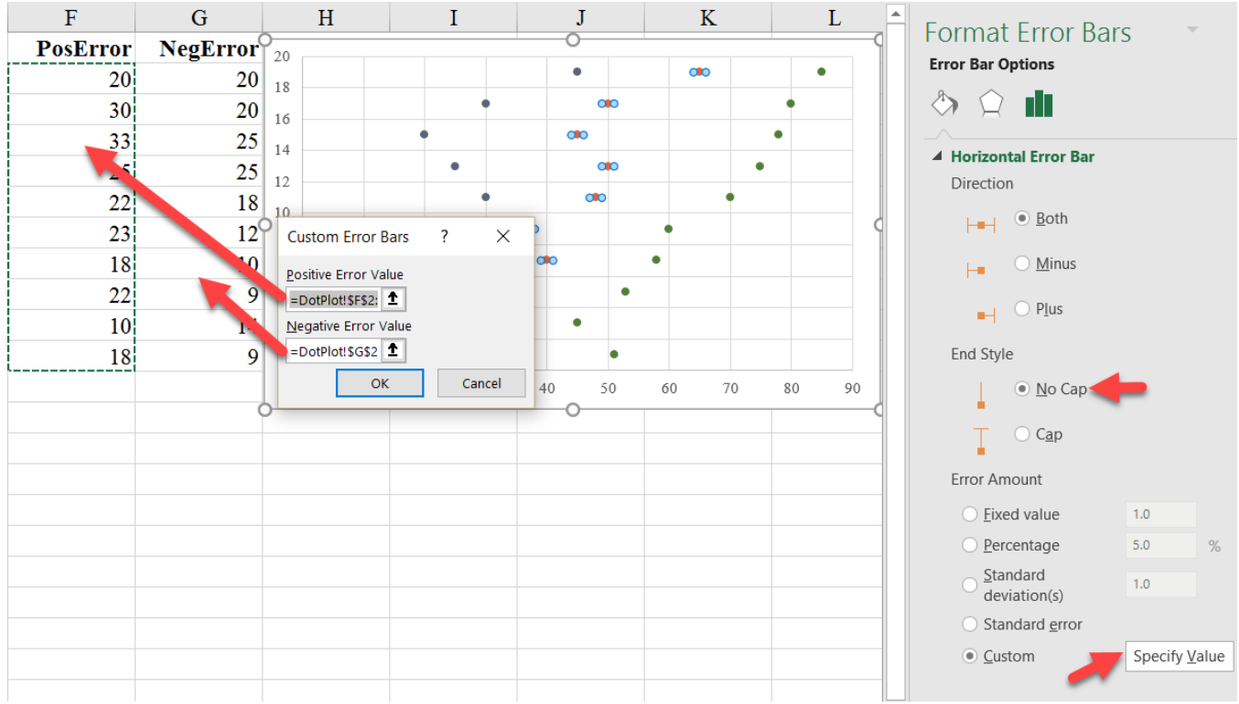
3. We are going to use Error Bars to add the horizontal lines that connect the points. To do so, select the **orange** "Middle" series in the chart, and then the "More Options" in the "Error Bars" dropdown menu in the "Chart Elements" menu that appears when you select the chart.



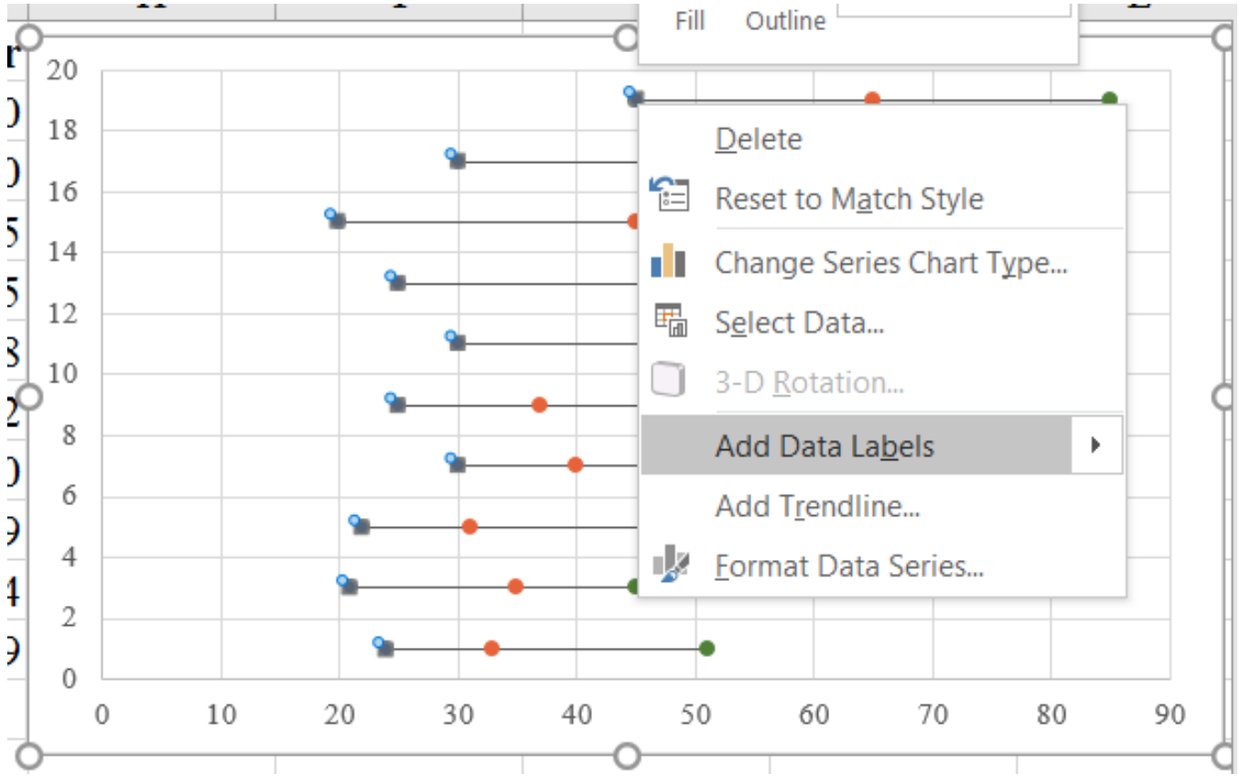
4. You'll notice that the first set of error bars you are prompted to format are the vertical error bars. We don't need these error bars, so you can select and delete them.



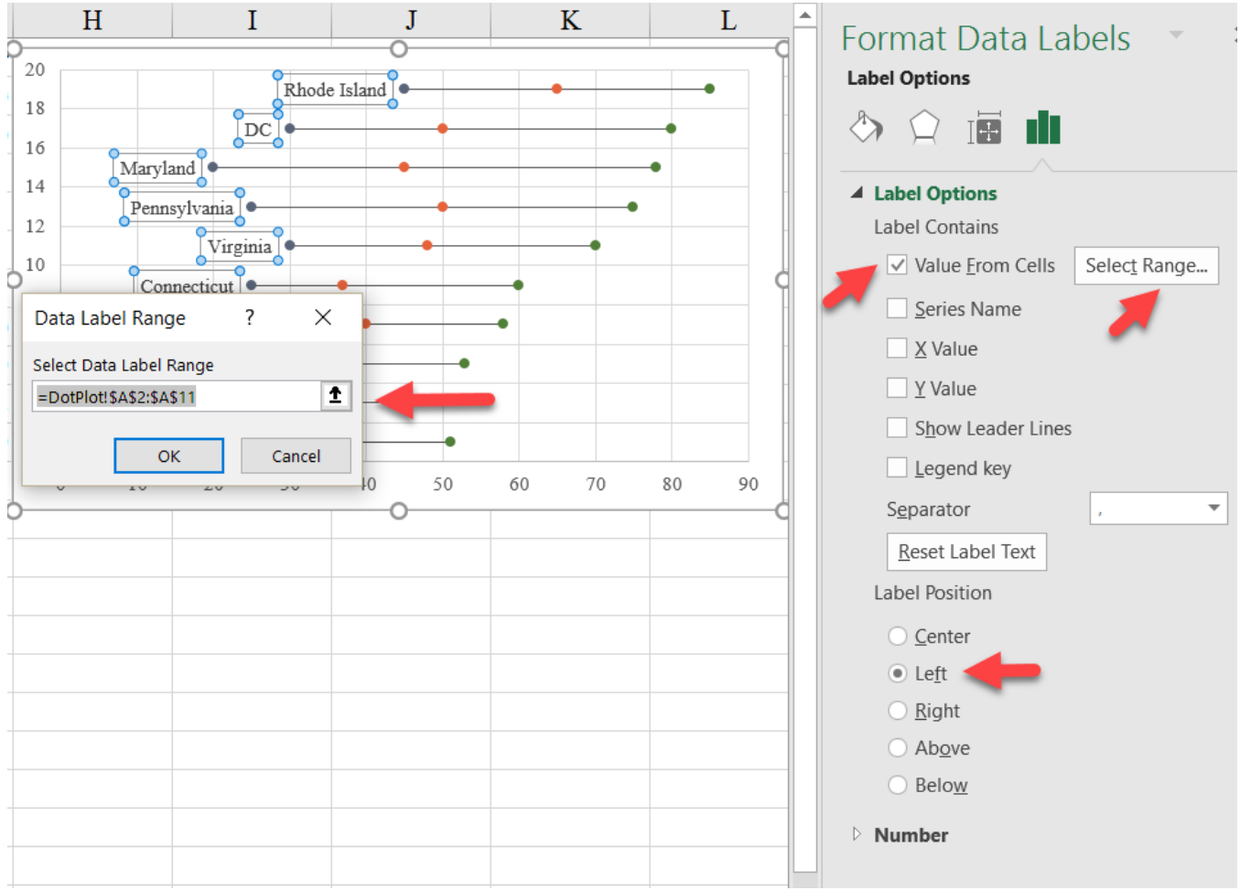
5. Then, select and format the *horizontal error bars* (by selecting and then right-clicking or CTRL-1). In the menu, choose "No Cap" in the "End Style" section of the menu. Then, select the button for "Custom" for the "Error Amount". For the "Positive Error Value", insert the reference for the "PosError" series in cells F2:F11. For the "Negative Error Value", insert the reference for the "NegError" series in cells G2:G11.



6. We now move to setting up the labels so that they sit next to the **blue** points (the "Bottom" series). To do so, we can use the "Value From Cells" feature in the Data Labels options menu (not available in versions prior to Excel 2016). Select the "Bottom" series, right-click and select the "Add Data Labels" option in the menu.

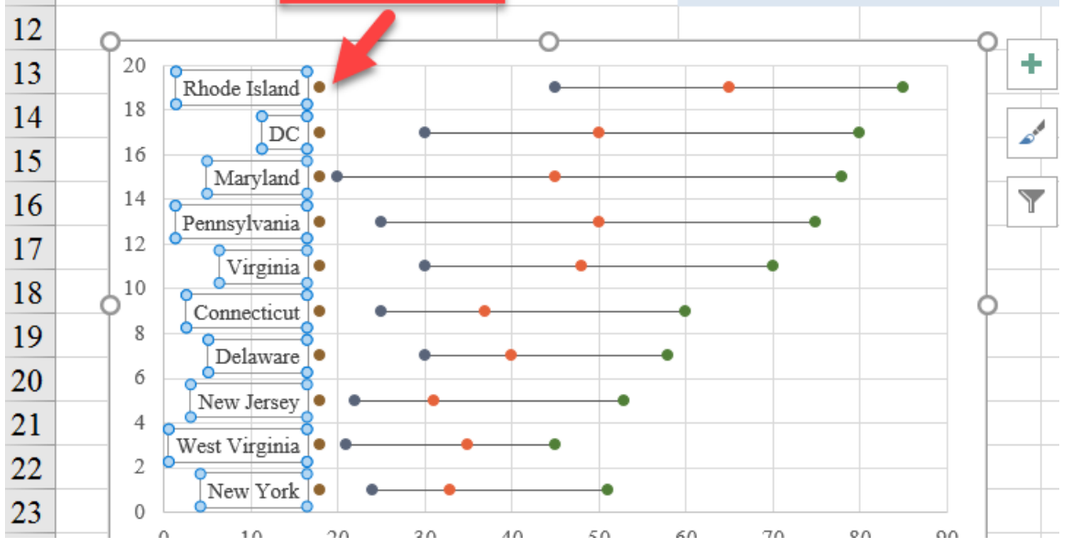


7. Format the data labels by selecting them and right-clicking or using the CTRL+1 keyboard shortcut. In the “Label Options” menu, check the box next to the “Value From Cells” option. In the pop-up box, select the state names from cells A2:A11. Uncheck the box next to the “Y Value” label and in the “Label Position” section of the menu below, select the option next to “Left” to move the labels over.

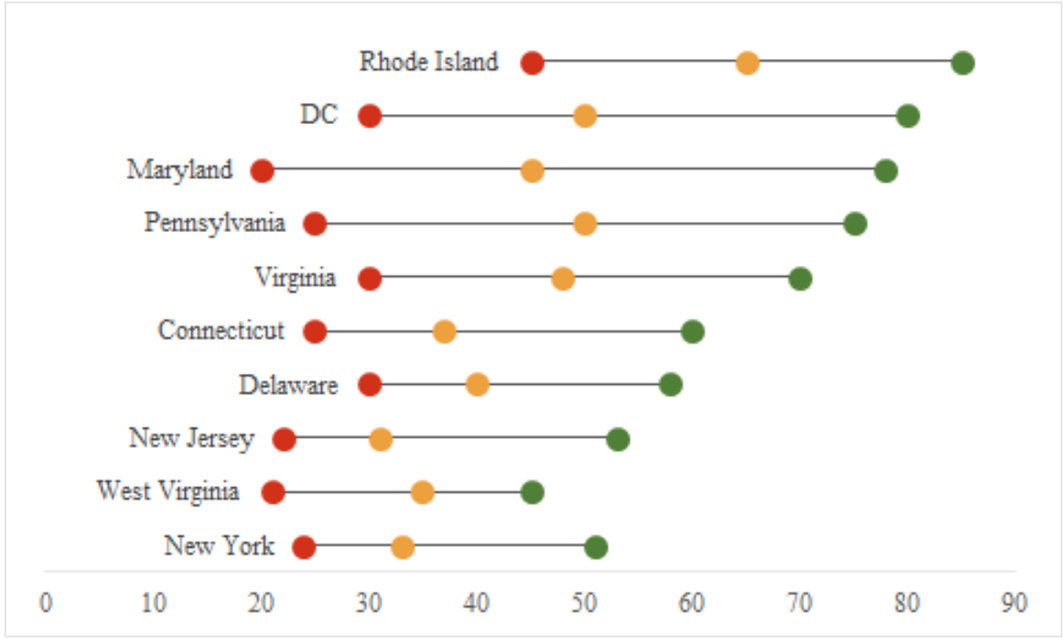


8. If you'd rather have the labels further away from the data and right-aligned, you can add a new scatterplot series with the y-values equal to the "Height" series and the x-values equal to a constant (in this example, the number 18 works). Then, again, add the data labels using the "Value from Cells" option and place them to the left of the points. Now hide the markers by right-clicking and changing the "Marker Option" to "None".

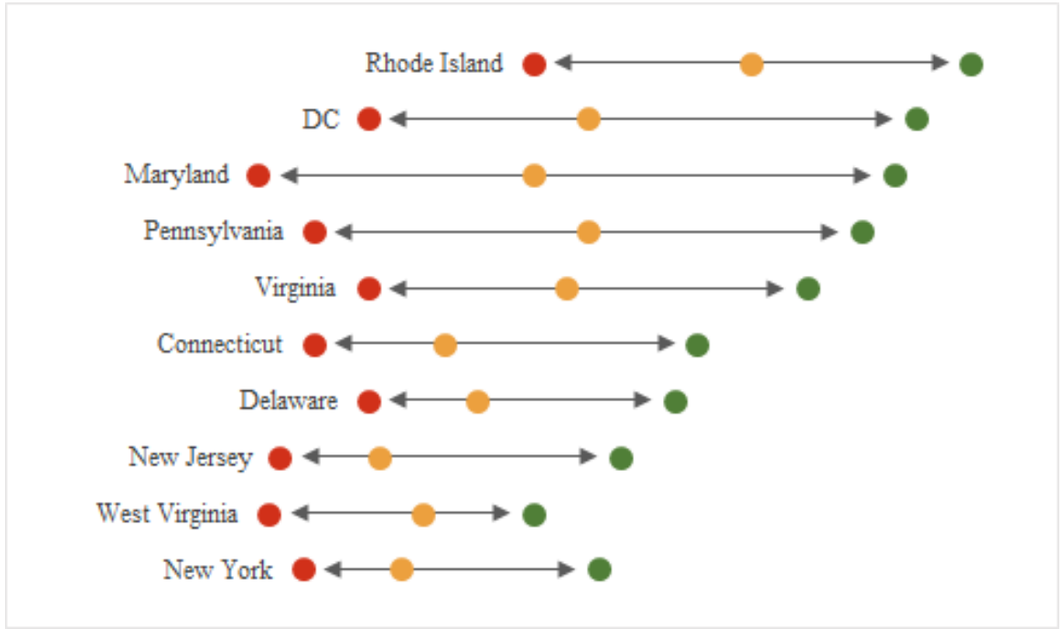
| | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | **State** | **Label** | **Height** | **Bottom** | **Middle** |
| 2 | Rhode Island | 18 | 19 | 45 | 65 |
| 3 | DC | 18 | 17 | 30 | 50 |
| 4 | Maryland | 18 | 15 | 20 | 45 |
| 5 | Pennsylvania | 18 | 13 | 25 | 50 |
| 6 | Virginia | 18 | 11 | 30 | 48 |
| 7 | Connecticut | 18 | 9 | 25 | 37 |
| 8 | Delaware | 18 | 7 | 30 | 40 |
| 9 | New Jersey | 18 | 5 | 22 | 31 |
| 10 | West Virginia | 18 | 3 | 21 | 35 |
| 11 | New York | 18 | 1 | 24 | 33 |
| 12 | | | | | |
| 13 | | | | | |
| 14 | | | | | |
| 15 | | | | | |
| 16 | | | | | |
| 17 | | | | | |
| 18 | | | | | |
| 19 | | | | | |
| 20 | | | | | |
| 21 | | | | | |
| 22 | | | | | |
| 23 | | | | | |



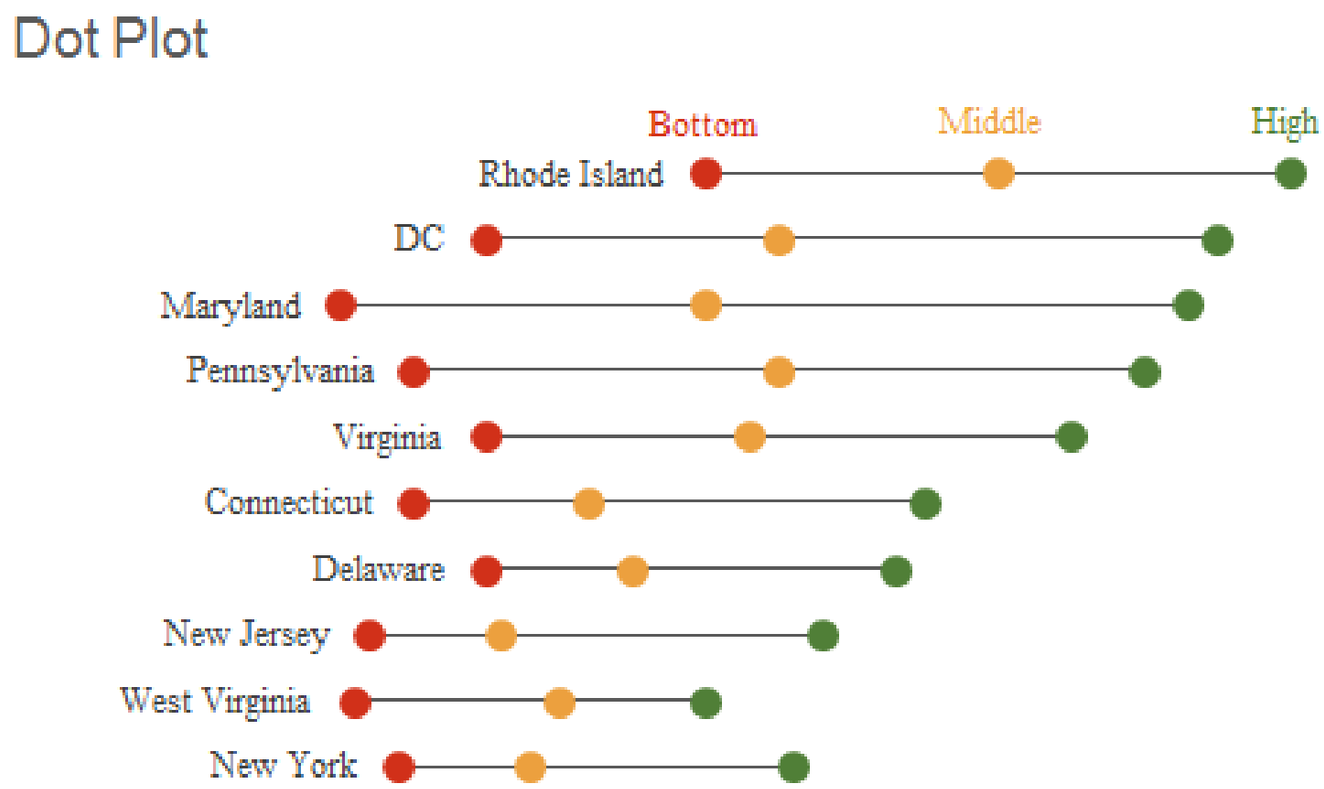
9. Complete the formatting by changing the shapes and colors of the points and deleting gridlines and y-axis, as desired.



10. If you want to add arrows to the error bars—as shown in the *DotPlot_Arrows tab* in the *Advanced Data Visualizations with Excel 2016 Hands-On.xlsx spreadsheet*—you can add another "Middle" series. From the first "Middle" series, add a horizontal error bar that goes to the left (Minus); from the new "Middle" series, add a horizontal error bar that goes to the right (Plus). Use Left Arrow for the custom negative error values and Right Arrow values for the custom positive error values. In the "Line Style" tab of the "Format Error Bars" menu, select the "Arrow settings" as you see fit.

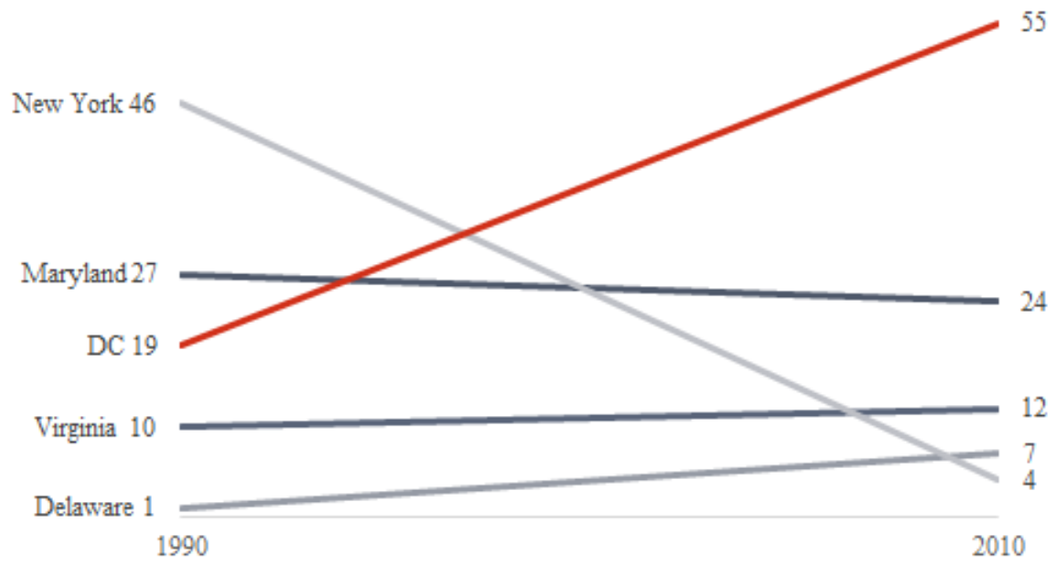


# Final Version with Styling



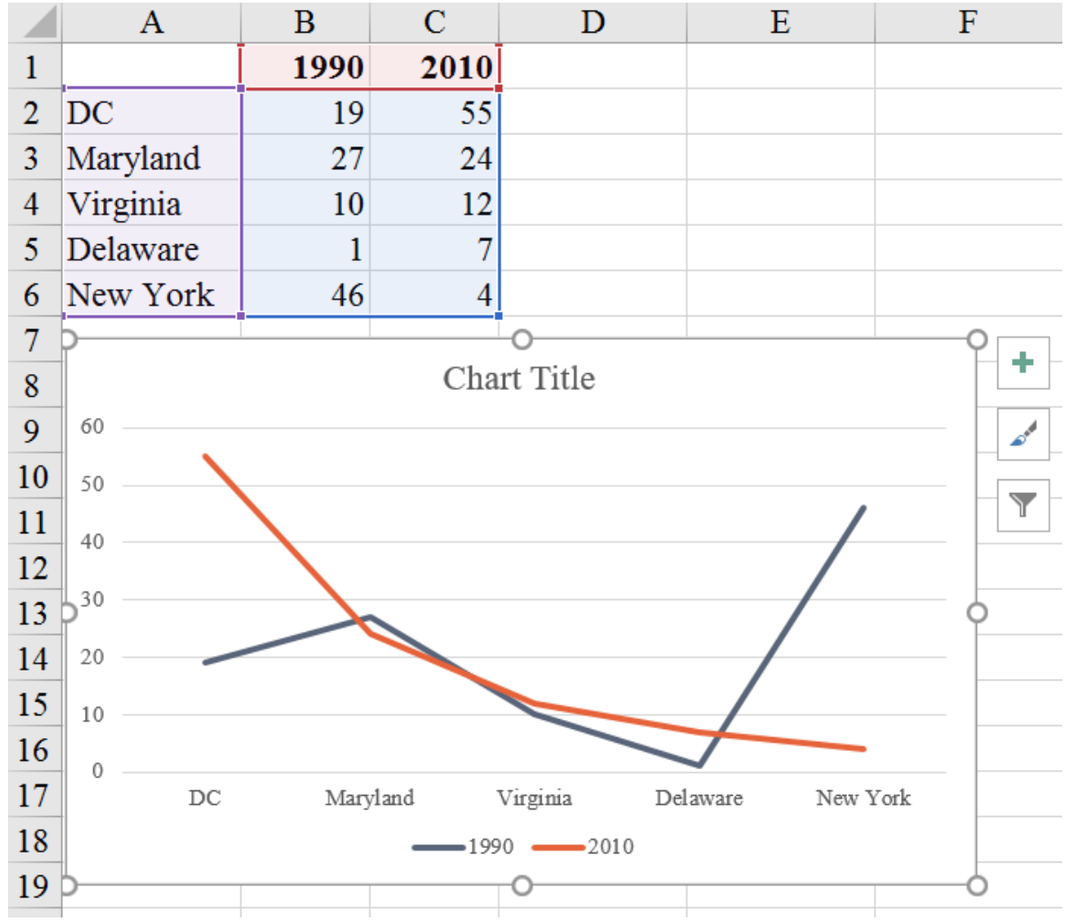
# Slope

The slope chart uses lines to enable comparisons of different categories. It is most effective when comparing multiple series with only 1-3 data points.

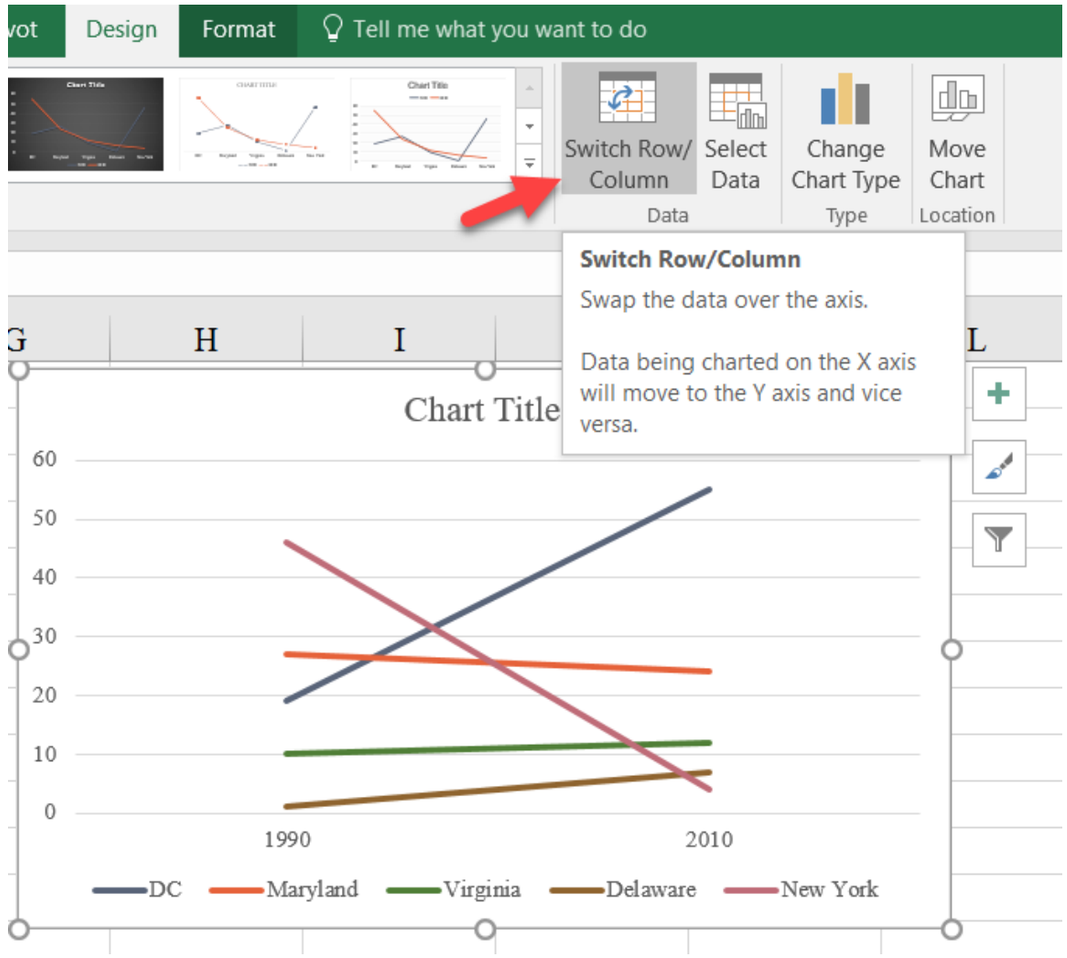



Use the *Slope tab* in the *Advanced Data Visualizations with Excel 2016 Hands-On.xlsx spreadsheet* to create the chart.

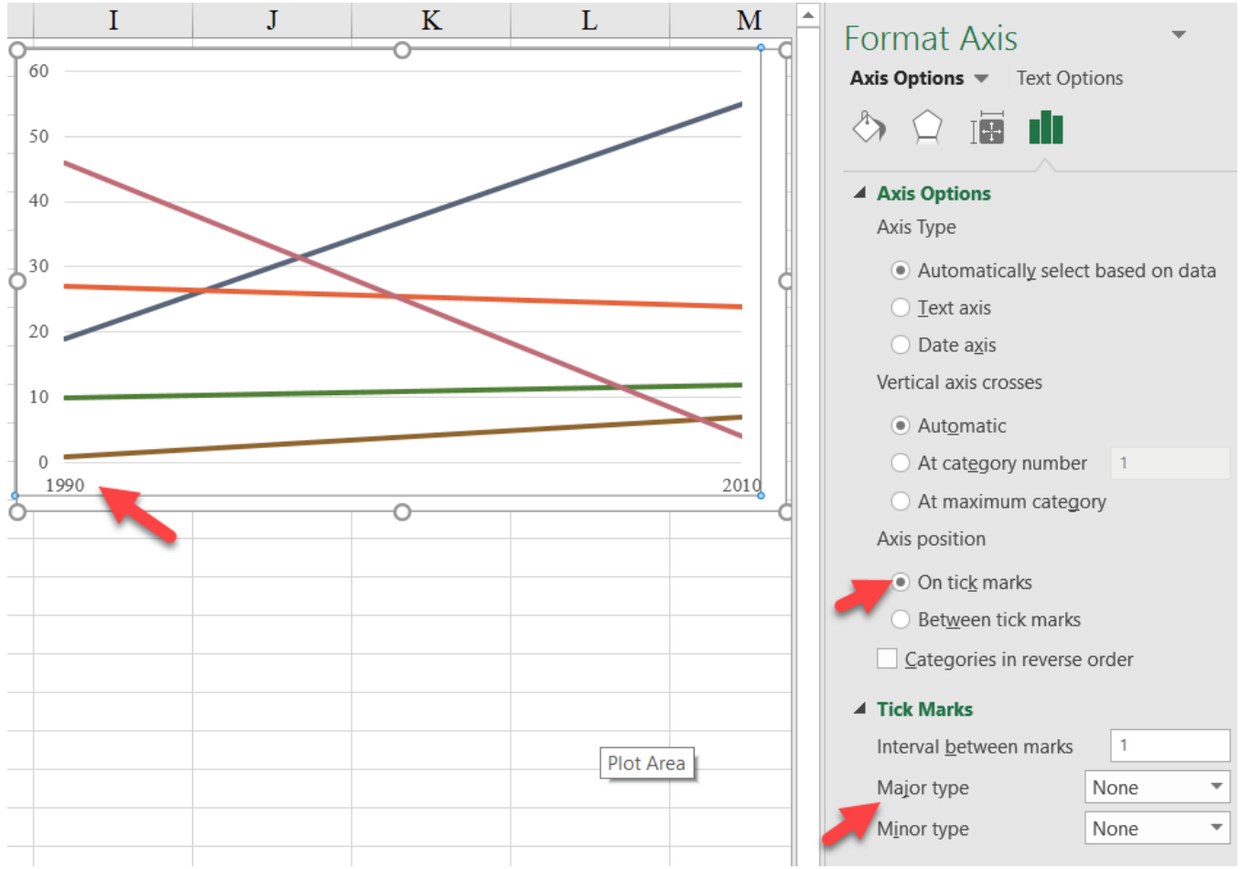
1. Start by creating a line chart using the data provided in cells A1:C6.



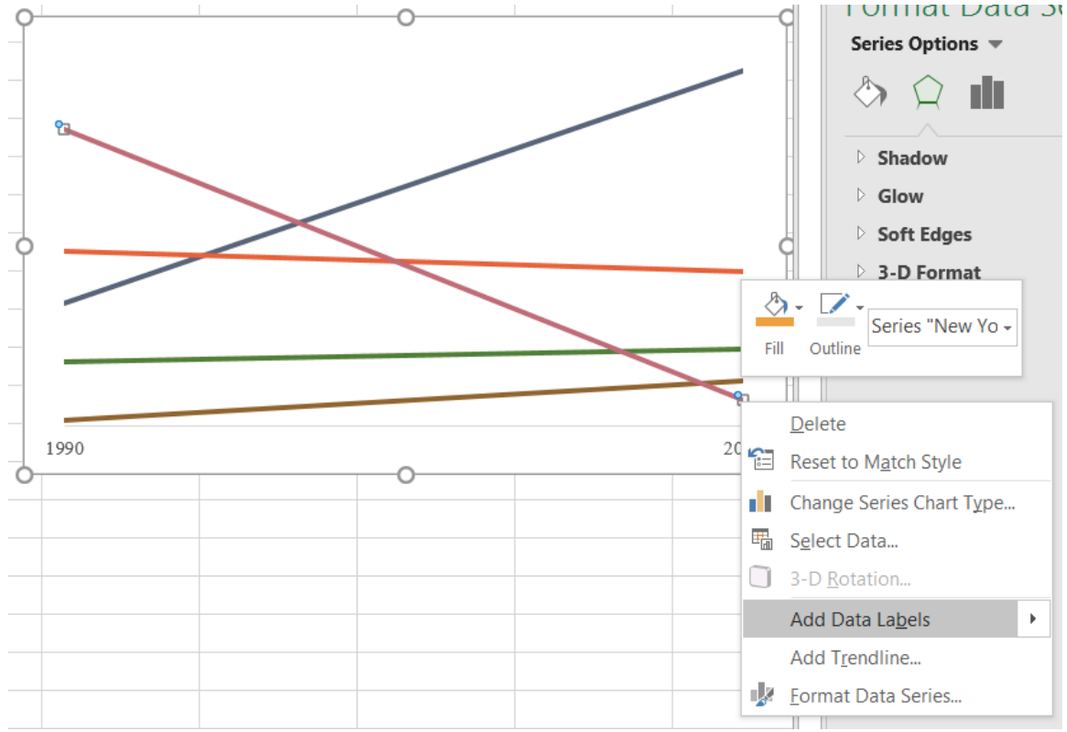
2. Excel will create a line chart along the columns here, but we want to flip that. Select the chart and then select the “Switch Row/Column” button in the “Design” tab on the ribbon.



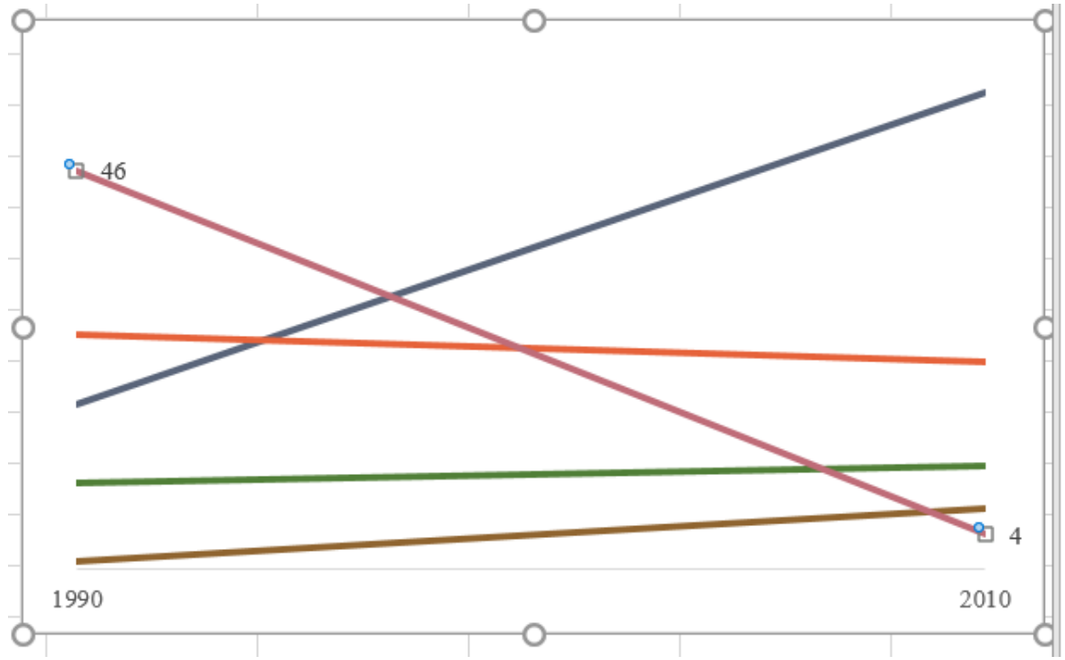
3. It's now a matter of styling and adding the data labels. To get the lines to fill up the entire chart space, first delete the legend. Then, format the x-axis (select and right-click or CTRL-1): In the "Format Axis" menu, select the "On tick marks" button at the bottom under the "Axis position" section of the menu. This lines up the data markers with the tick marks and thus takes up the whole chart space. You can also turn off the tick marks by selecting "None" in the "Major type" dropdown menu under "Tick Marks", and turn off the line in the "Line Color" tab. Press "Close" and you can then delete the vertical axis and horizontal gridlines.



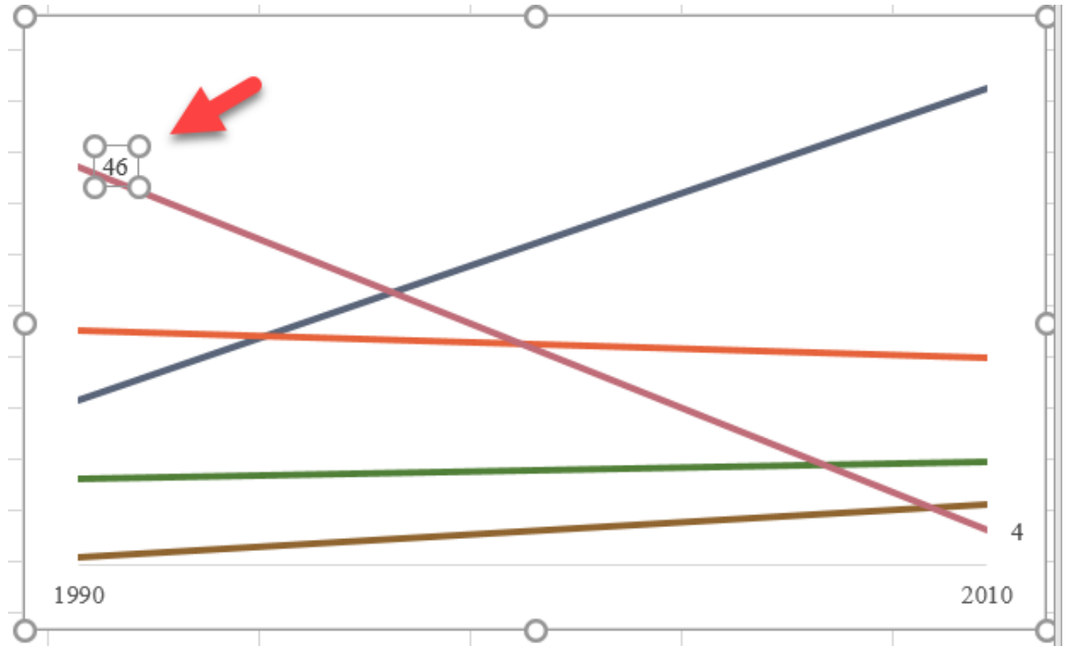
4. Now to add the data markers. Begin by selecting the **pink** line, right-click, and select “Add Data Labels” in the menu.



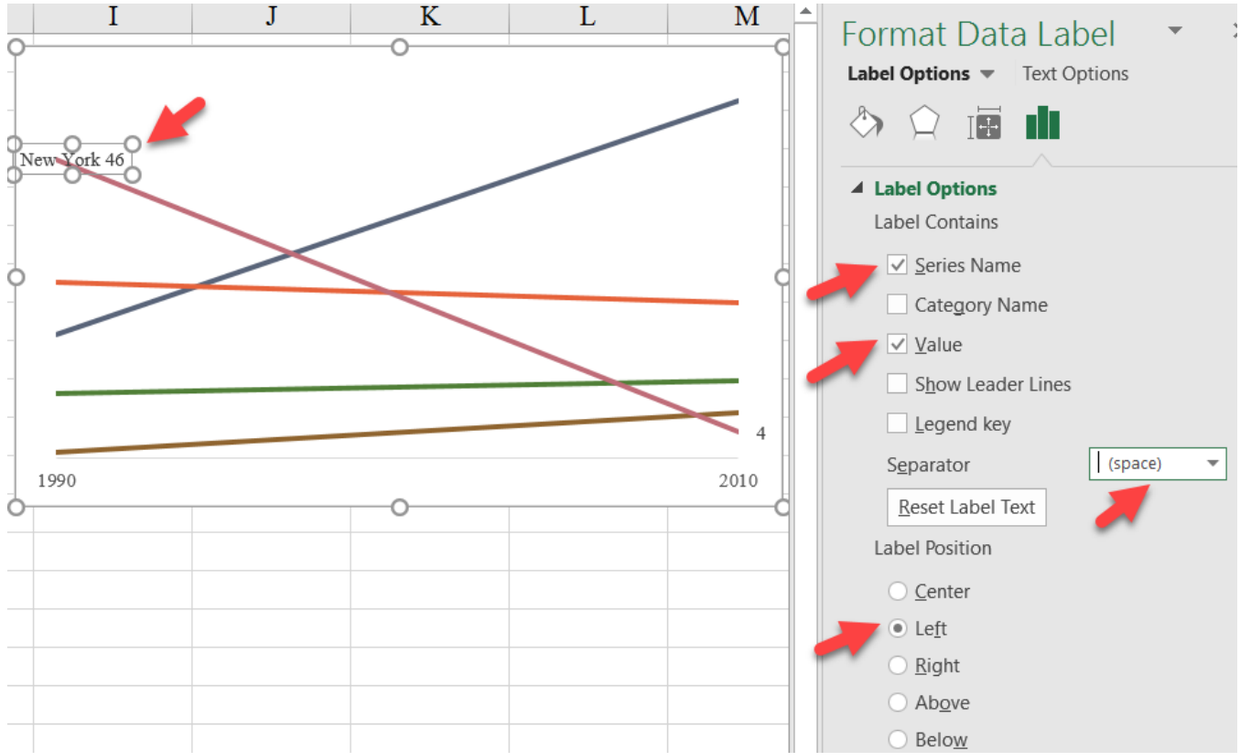
5. This will add a data label to either end of the line. Notice how they are both aligned to the right of the point and consist of the value of the point. This is fine for the point on the right, but for the point on the left, we want the data marker to be to the left of the point and to include the state name.



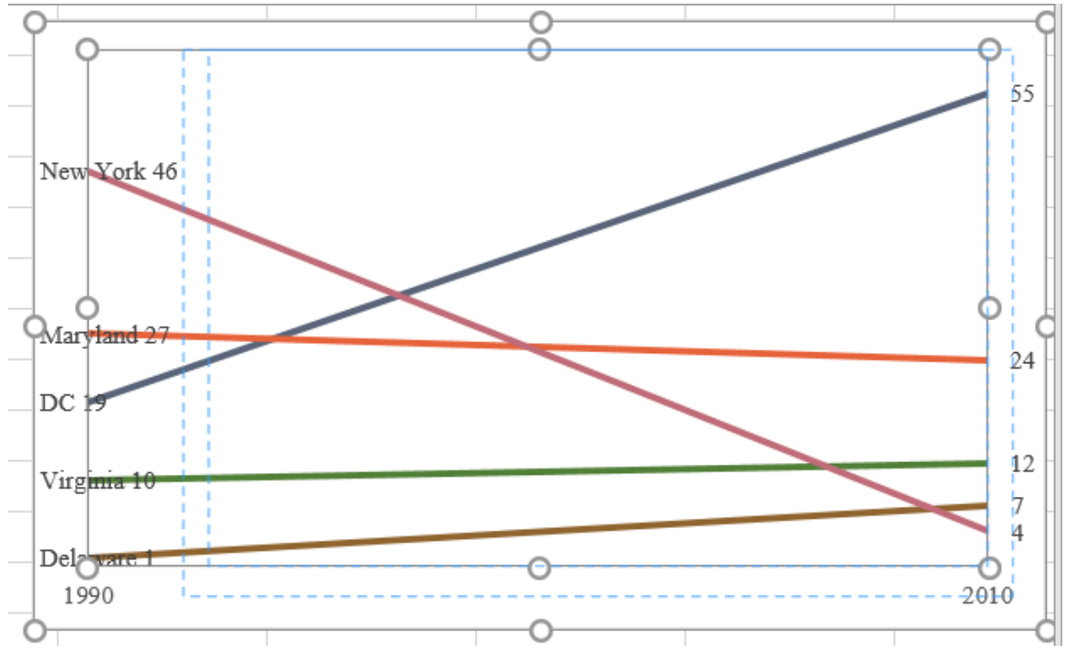
6. Select the data labels—this will select both—so select the left label again so that only that label is selected.



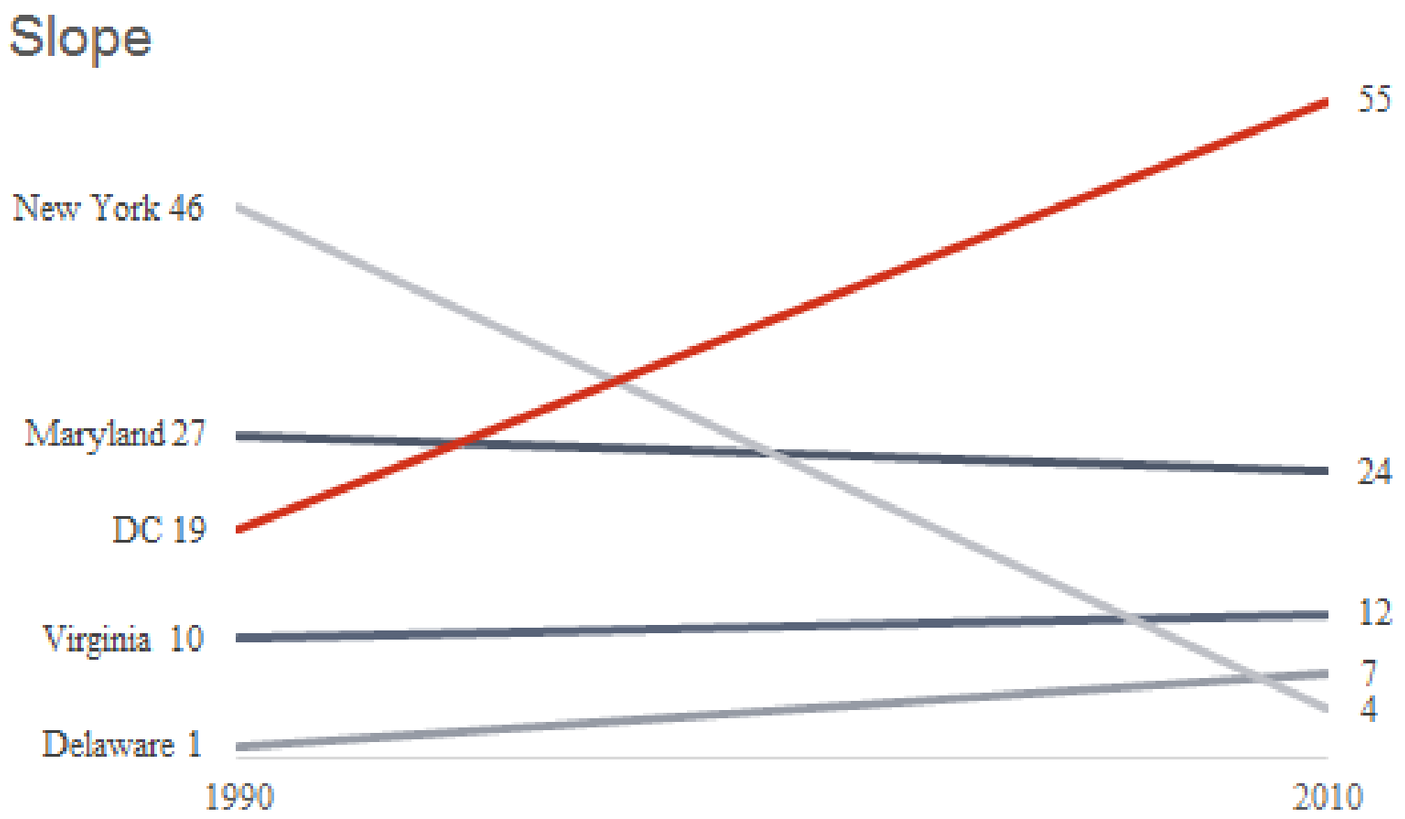
7. Right-click and select the “Format Data Label” option in the menu. Here, you can check the box next to “Series Name” (in addition to the “Value” box that is already selected), and select the “Left” option under the “Label Position” section of the menu. You can also change the separator from a comma to a (space) if you want. Repeat for the remaining lines.



8. The advantage of making these selections through the menu is that the labels will all be aligned together. With text boxes, you would need to do that alignment manually. You can now select the plot area and resize it so that the labels fit on the chart. Style chart as desired.

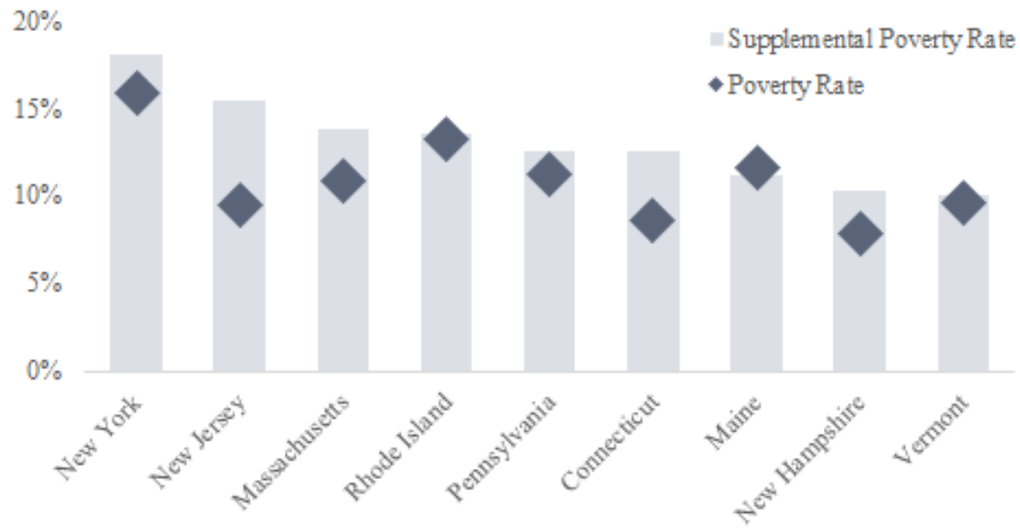


# Final Version with Styling



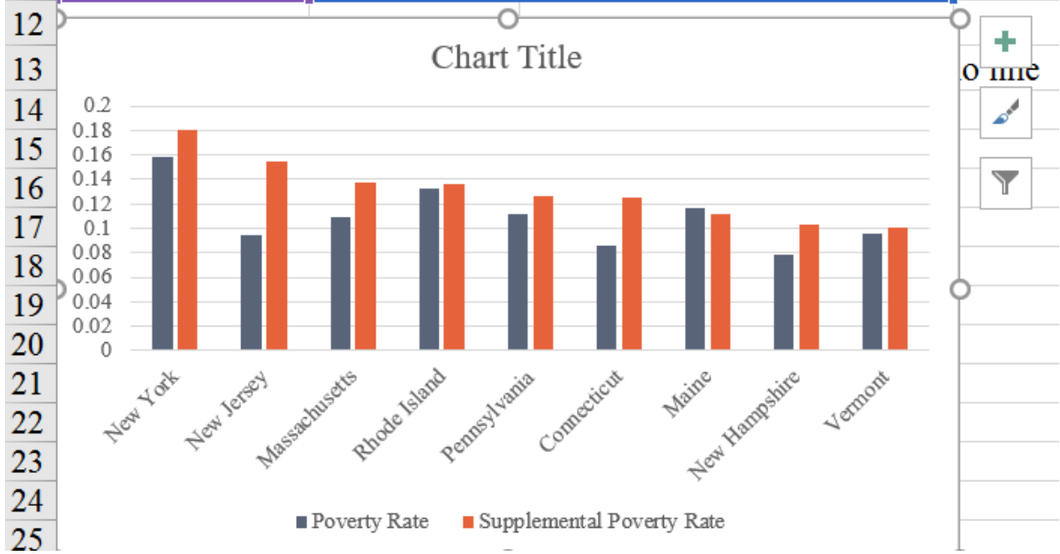
# Vertical Bar-Scatter

In this chart, we combine a column chart and a scatterplot for comparing values. Use the *Bar-Scatter_Vertical tab* in the *Advanced Data Visualizations with Excel 2016 Hands-On.xlsx spreadsheet* to create the chart

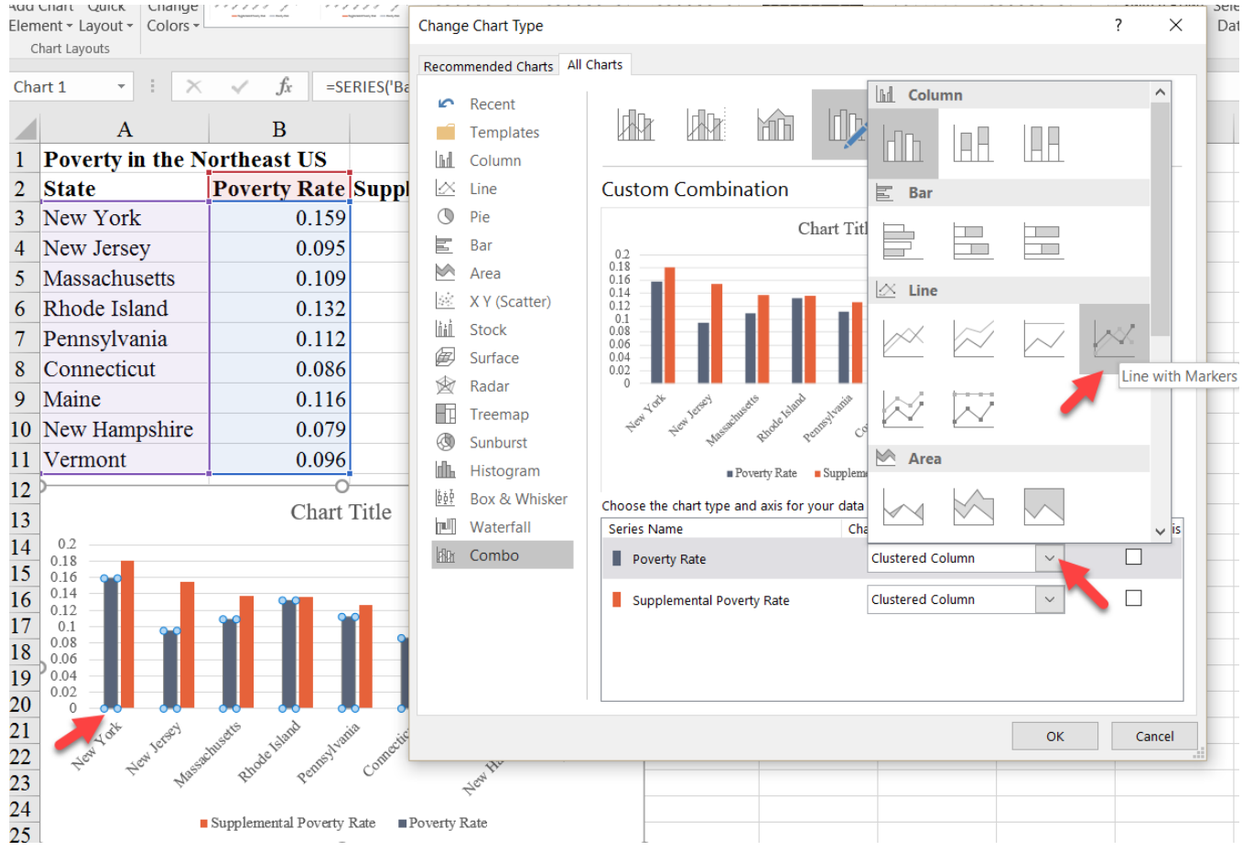


1. Create a clustered column chart using the poverty rate data in A2-C11.

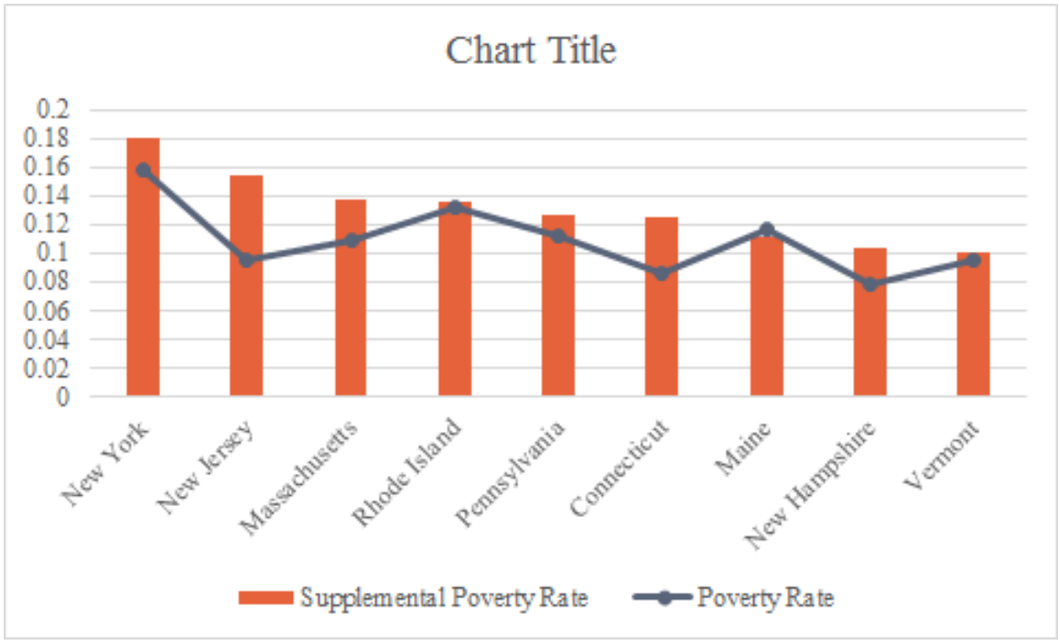
| | A | B | C |
|---|---|---|---|
| 1 | **Poverty in the Northeast US** | | |
| 2 | **State** | **Poverty Rate** | **Supplemental Poverty Rate** |
| 3 | New York | 0.159 | 0.181 |
| 4 | New Jersey | 0.095 | 0.155 |
| 5 | Massachusetts | 0.109 | 0.138 |
| 6 | Rhode Island | 0.132 | 0.136 |
| 7 | Pennsylvania | 0.112 | 0.126 |
| 8 | Connecticut | 0.086 | 0.125 |
| 9 | Maine | 0.116 | 0.112 |
| 10 | New Hampshire | 0.079 | 0.103 |
| 11 | Vermont | 0.096 | 0.101 |



2. Select the Poverty Rate series (the **blue** bars) and change the chart type to a "Line with Markers" by using the dropdown menu in the "Change Chart Type" menu in the "Design" tab of the ribbon.

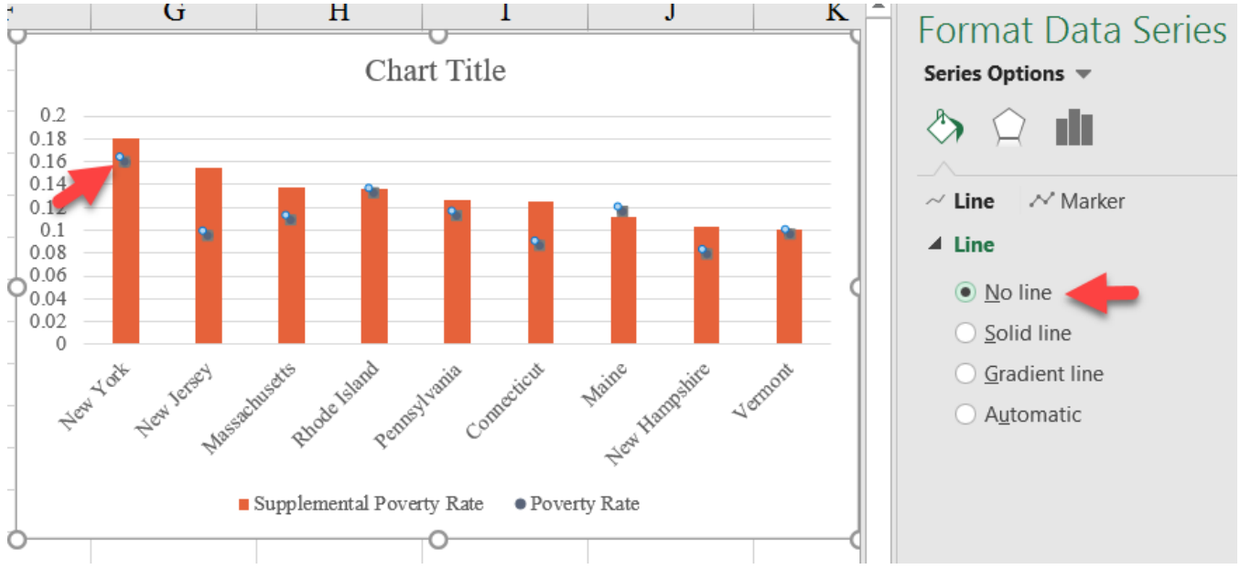



| | A | B |
|---|---|---|
| 1 | **Poverty in the Northeast US** | |
| 2 | **State** | **Poverty Rate** |
| 3 | New York | 0.159 |
| 4 | New Jersey | 0.095 |
| 5 | Massachusetts | 0.109 |
| 6 | Rhode Island | 0.132 |
| 7 | Pennsylvania | 0.112 |
| 8 | Connecticut | 0.086 |
| 9 | Maine | 0.116 |
| 10 | New Hampshire | 0.079 |
| 11 | Vermont | 0.096 |

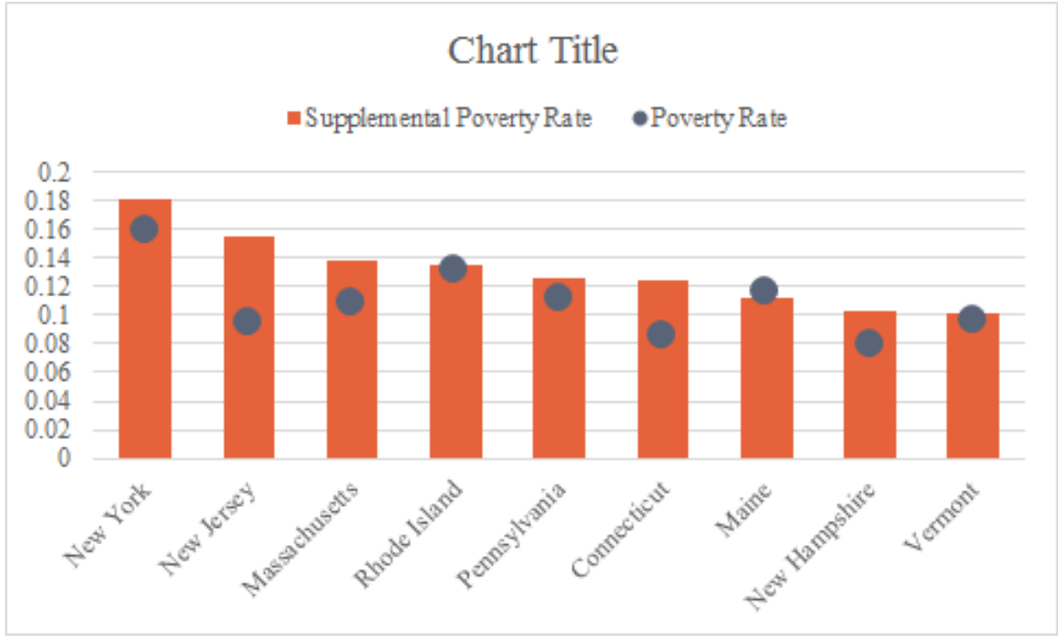



This will give you a marked line on top of the column chart.

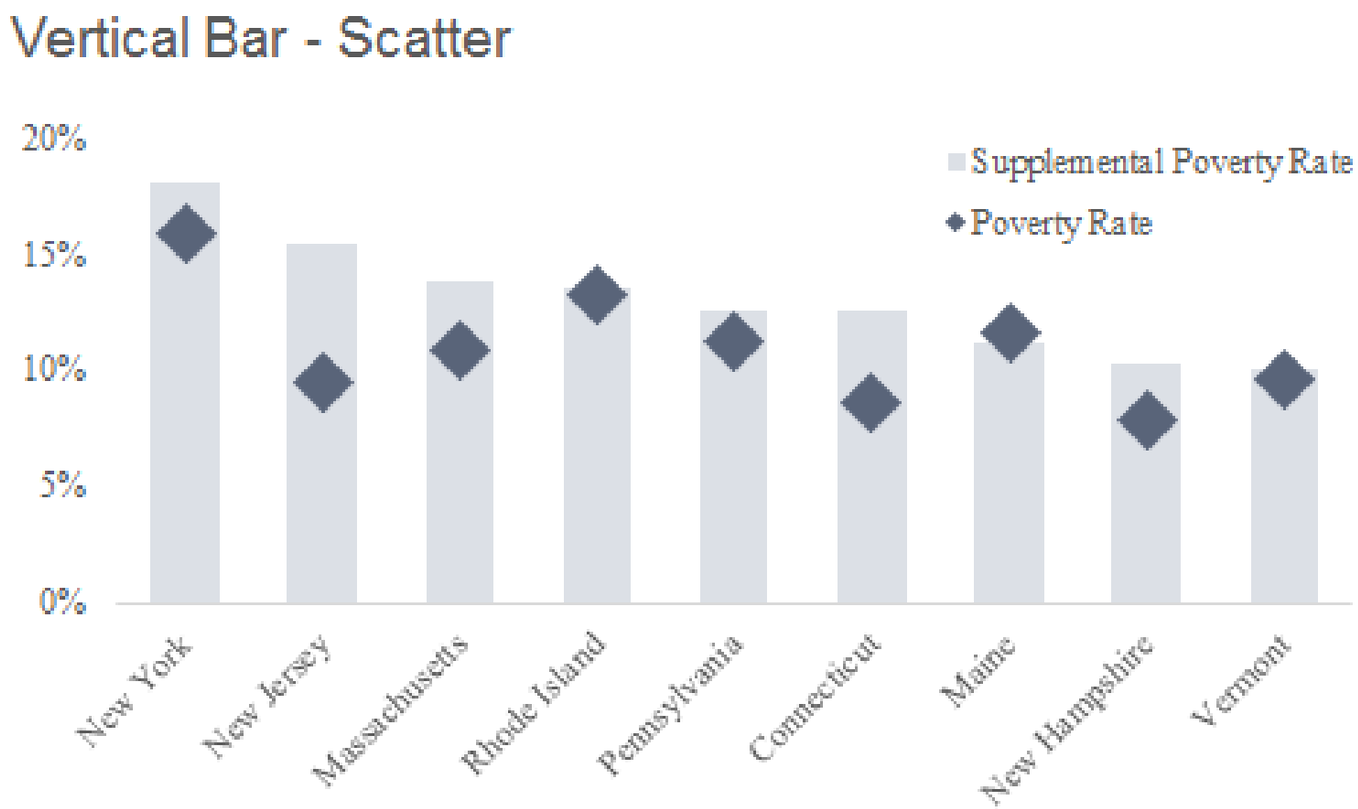
3. To get rid of the line, format the Poverty Rate series by selecting and right-clicking (or CTRL-1). In the format menu, change the “Line Color” to “No line”. That will make the line disappear, but the markers will remain.



4. Style the chart elements as you like.

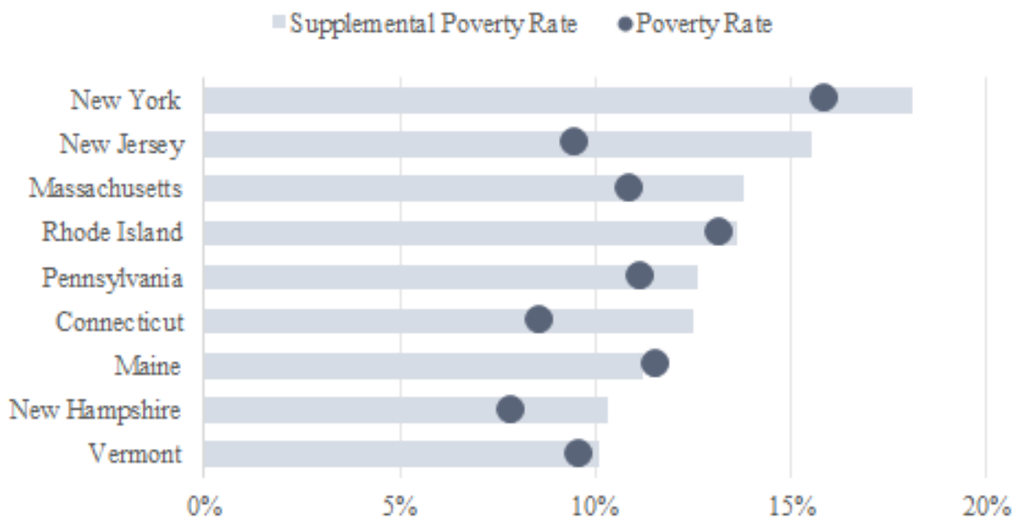


## Final Version with Styling



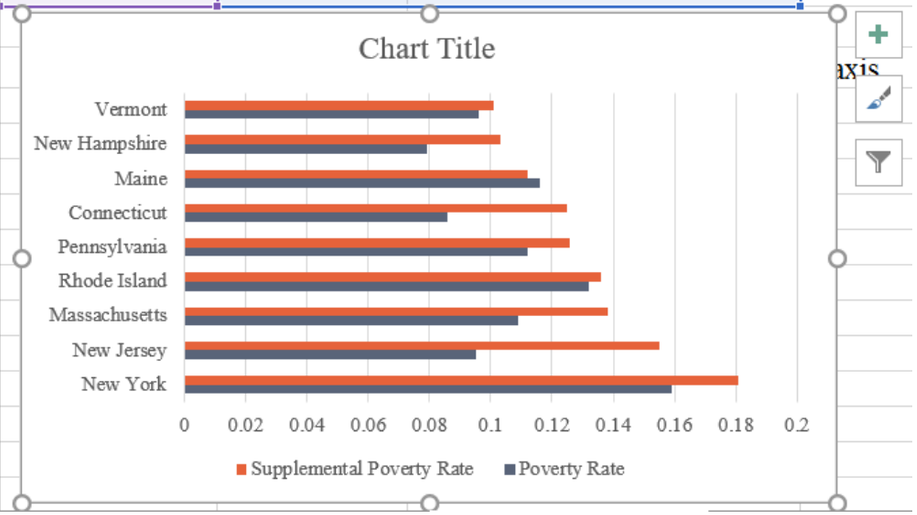
# Horizontal Bar-Scatter

In this chart, we combine a bar chart and a scatterplot for comparing values. Use the *Bar-Scatter_Horizontal tab* in the *Advanced Data Visualizations with Excel 2016 Hands-On.xlsx spreadsheet* to create the chart.

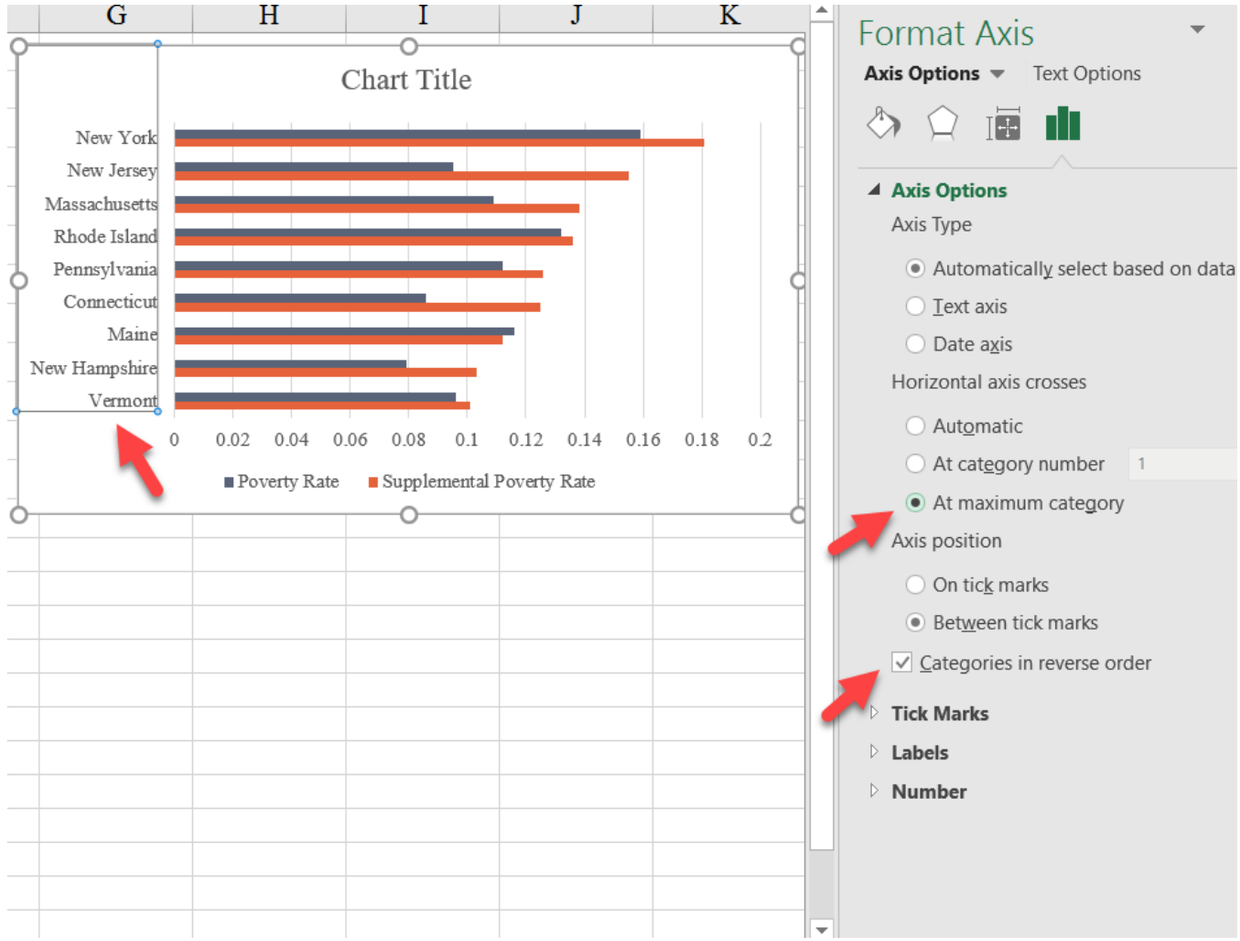


1. Create a bar chart using the poverty rate data in A2-C11.

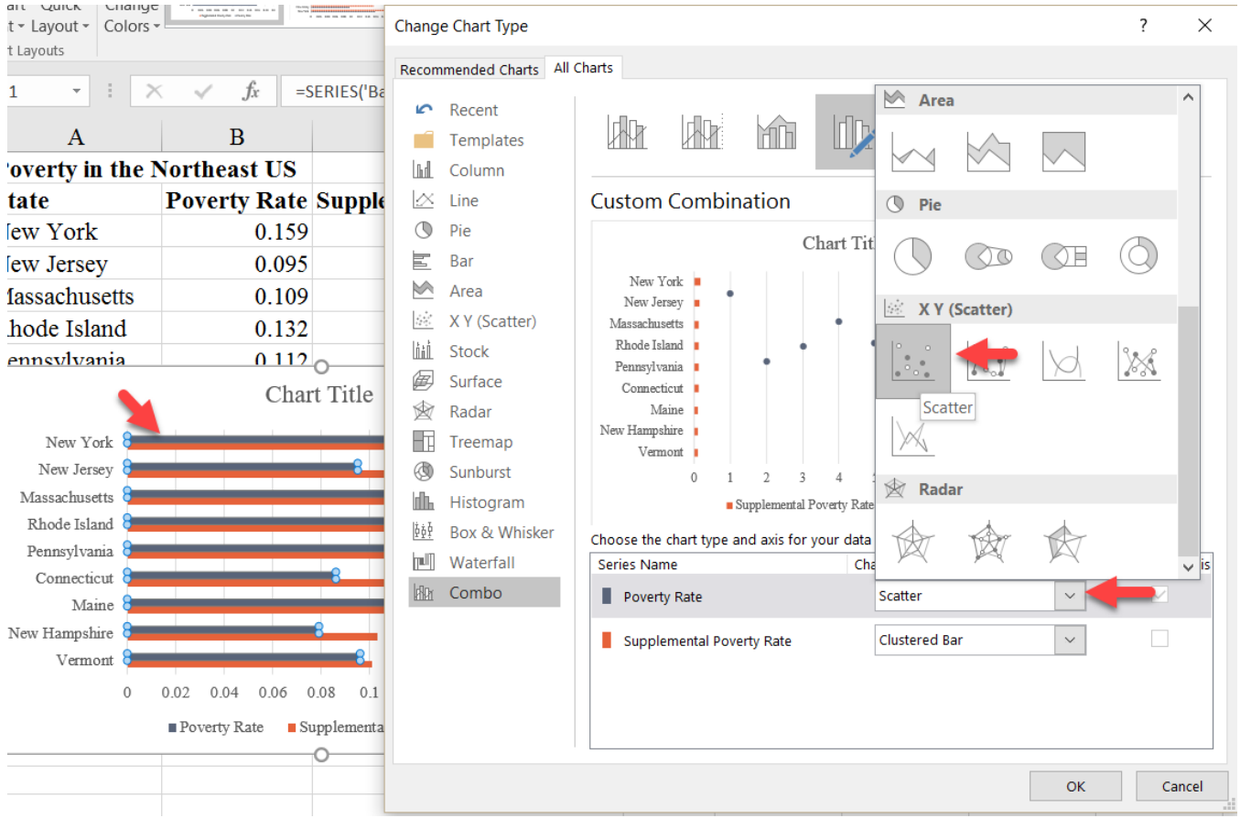
| | A | B | C | D |
|---|---|---|---|---|
| 1 | **Poverty in the Northeast US** | | | |
| 2 | **State** | **Poverty Rate** | **Supplemental Poverty Rate** | **Y-series** |
| 3 | New York | 0.159 | 0.181 | 17 |
| 4 | New Jersey | 0.095 | 0.155 | 15 |
| 5 | Massachusetts | 0.109 | 0.138 | 13 |
| 6 | Rhode Island | 0.132 | 0.136 | 11 |
| 7 | Pennsylvania | 0.112 | 0.126 | 9 |
| 8 | Connecticut | 0.086 | 0.125 | 7 |
| 9 | Maine | 0.116 | 0.112 | 5 |
| 10 | New Hampshire | 0.079 | 0.103 | 3 |
| 11 | Vermont | 0.096 | 0.101 | 1 |

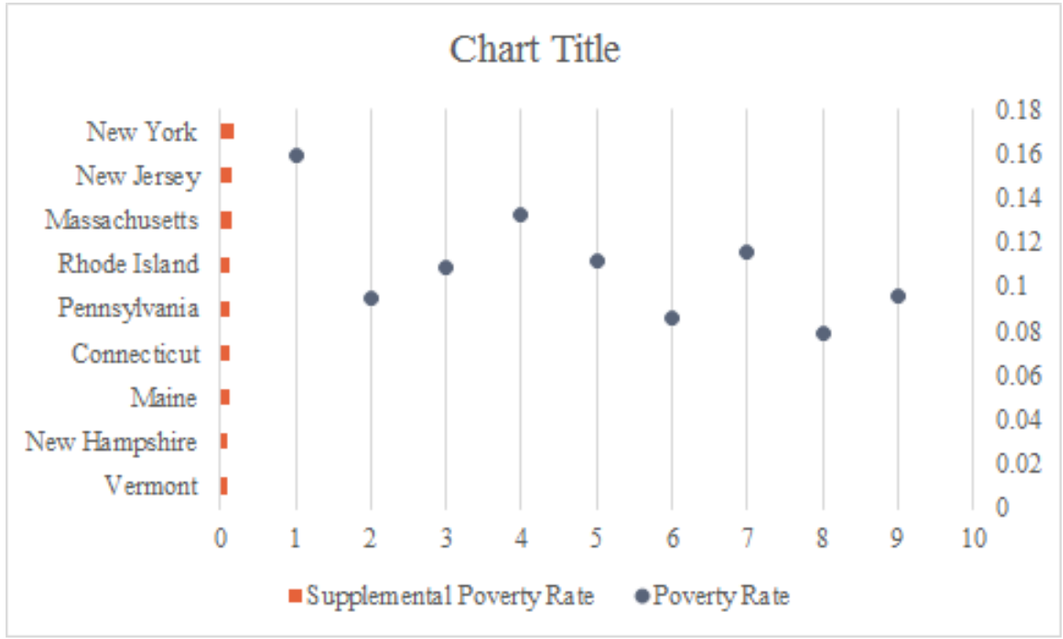


2. Notice that the order of the data in the chart differ from those in the spreadsheet. We want those to be the same, especially for this chart. Format the y-axis: In the “Format Axis” menu (use the CTRL+1 keyboard shortcut), check the box next to “Categories in reverse order” *and* change the “Horizontal axis crosses:” option to “At maximum category”.



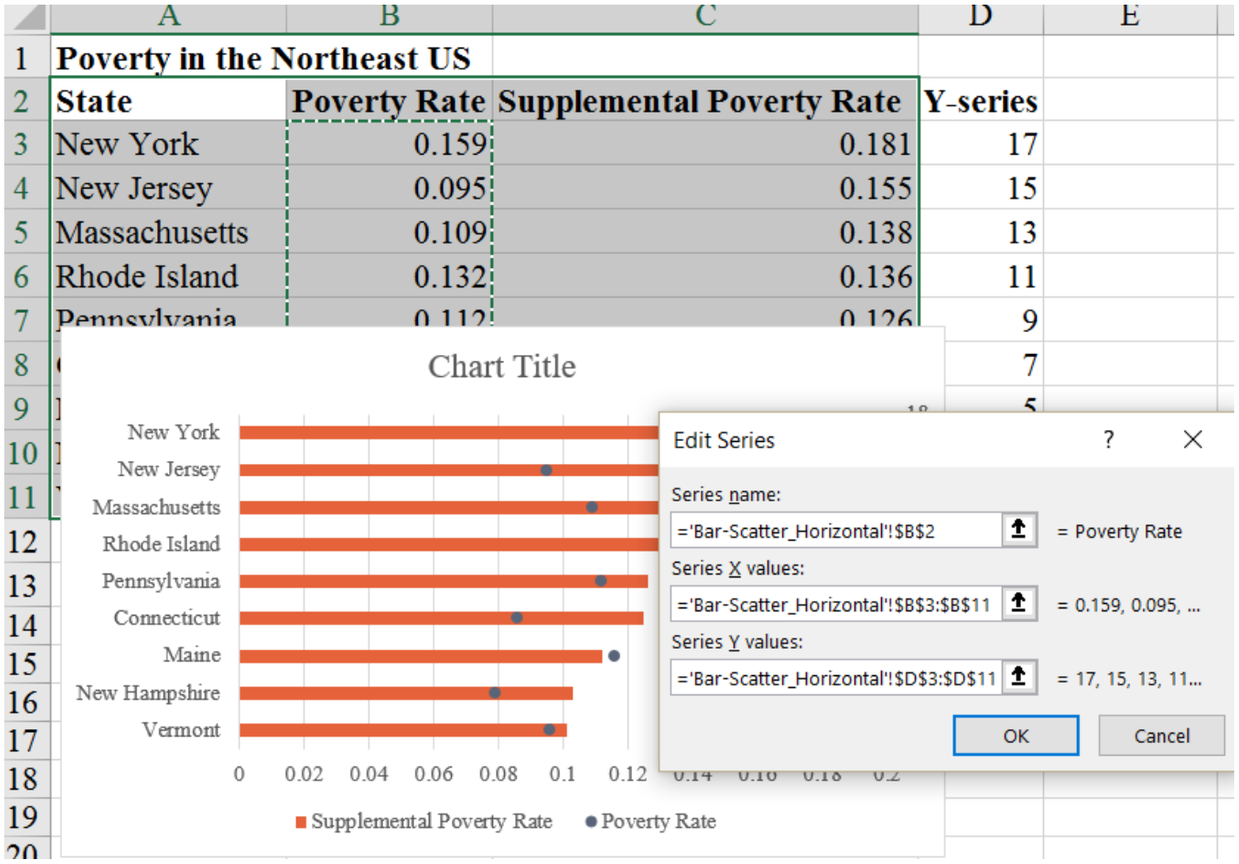
3. We are now going to change the poverty rate (**blue**) series to a scatterplot. Select the **blue** series and select the scatterplot option in the dropdown menu in the “Change Chart Type” menu found under the “Design” tab on the ribbon.





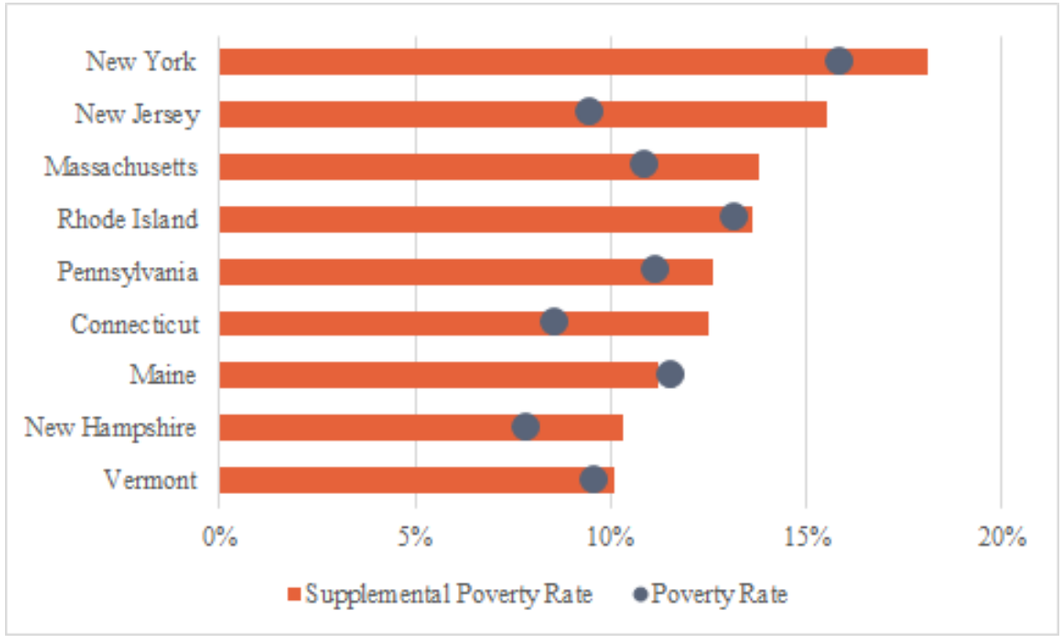

When you change the series to a scatterplot, the graph is going to look very weird. This is because Excel is filling it its own values for the x- and y-series.

4. We need to now go in and assign them to the right position. So, right-click on the chart and choose “Select Data.” Select the Poverty Rate series and select the “Edit” button. Assign the correct series to the x- and y-positions: the x series is the Poverty Rate (cells B3:B11), and the y series is the “Y-series” data shown in Column D (D2:D11).

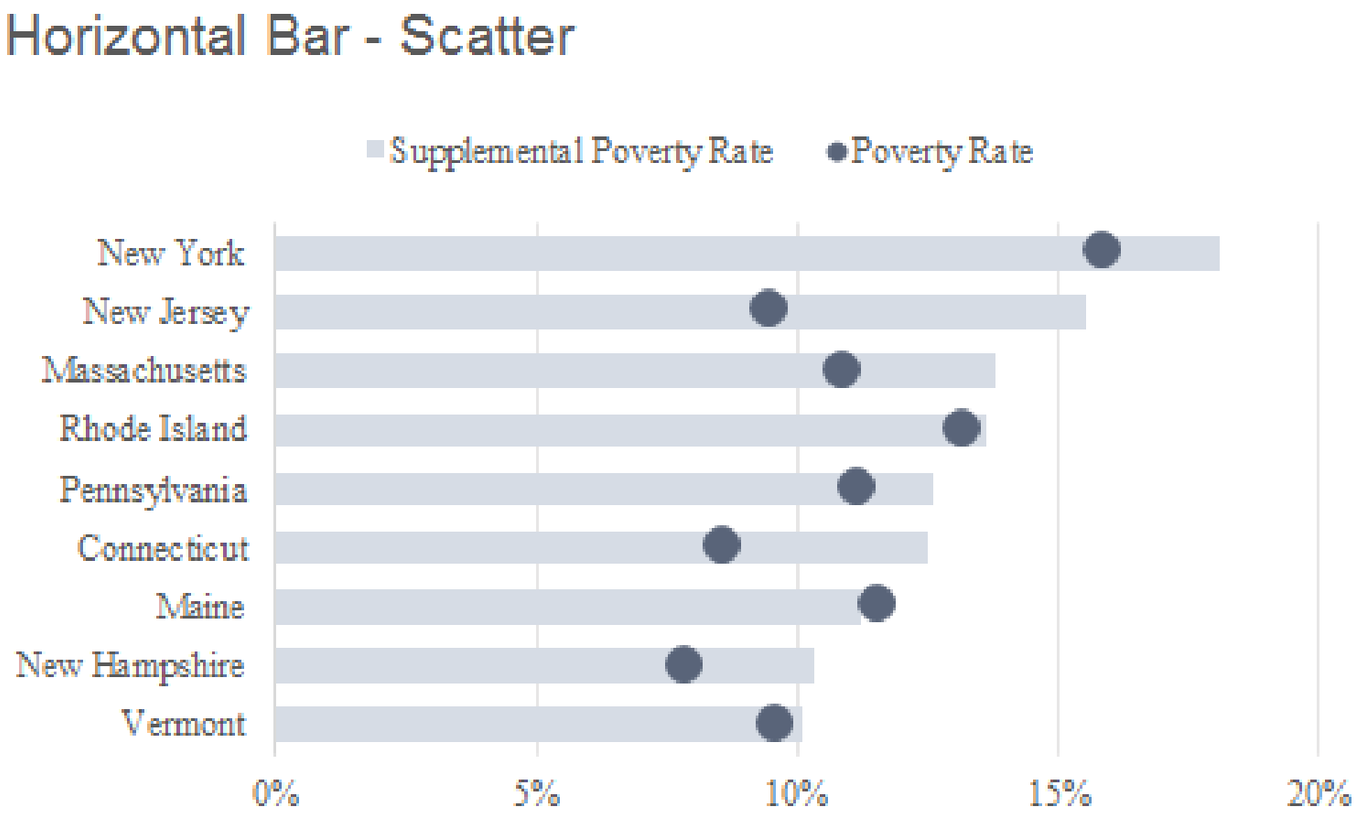



The Y-series is created in such a way that the points are aligned with the center of the bars. This approach works because, by default, Excel won’t let you plot data at the maximum of the vertical axis, so it will round up from the maximum value. We take advantage of this by using odd numbers and thus getting the data markers to line up with the bars.

5. With the data now in the correct order, you can delete the y-axis, legend, and format the two series as desired.

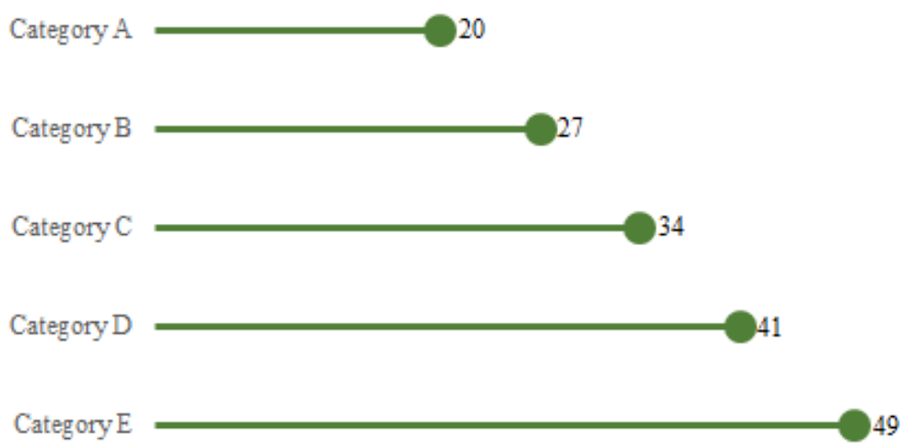


# Final Version with Styling

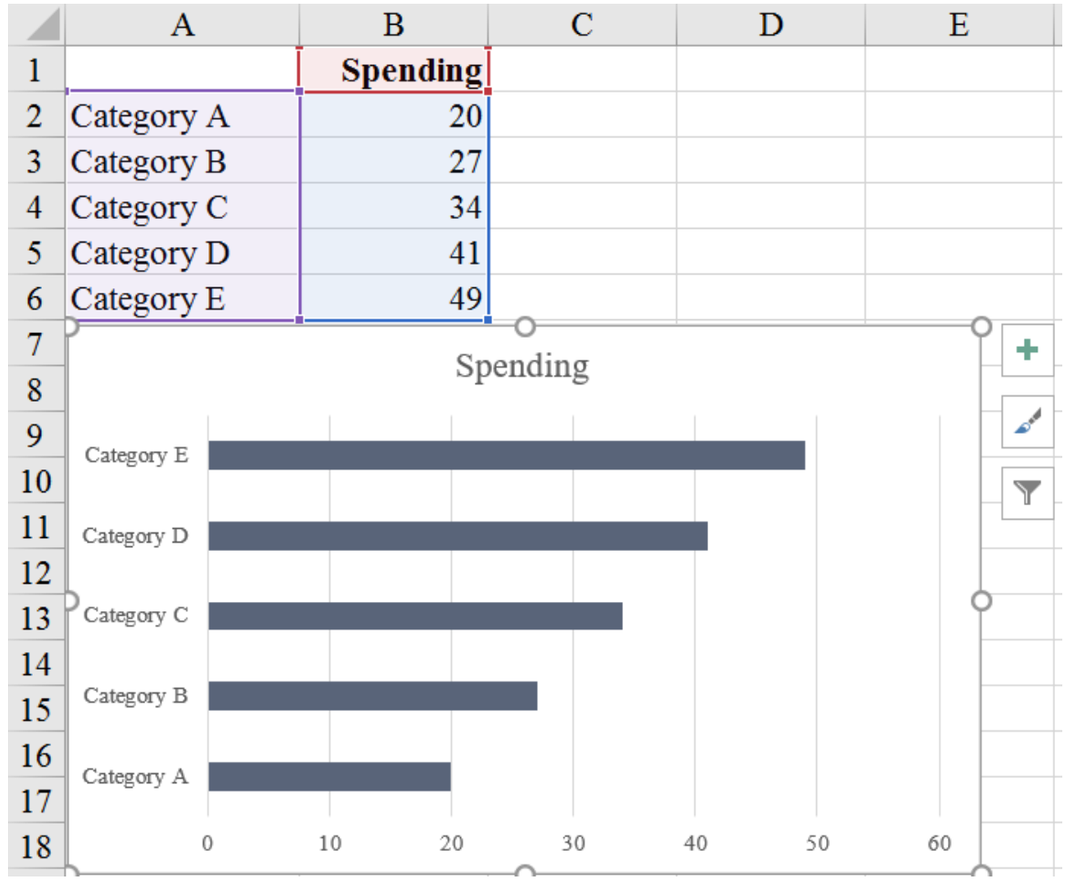


# Lollipop

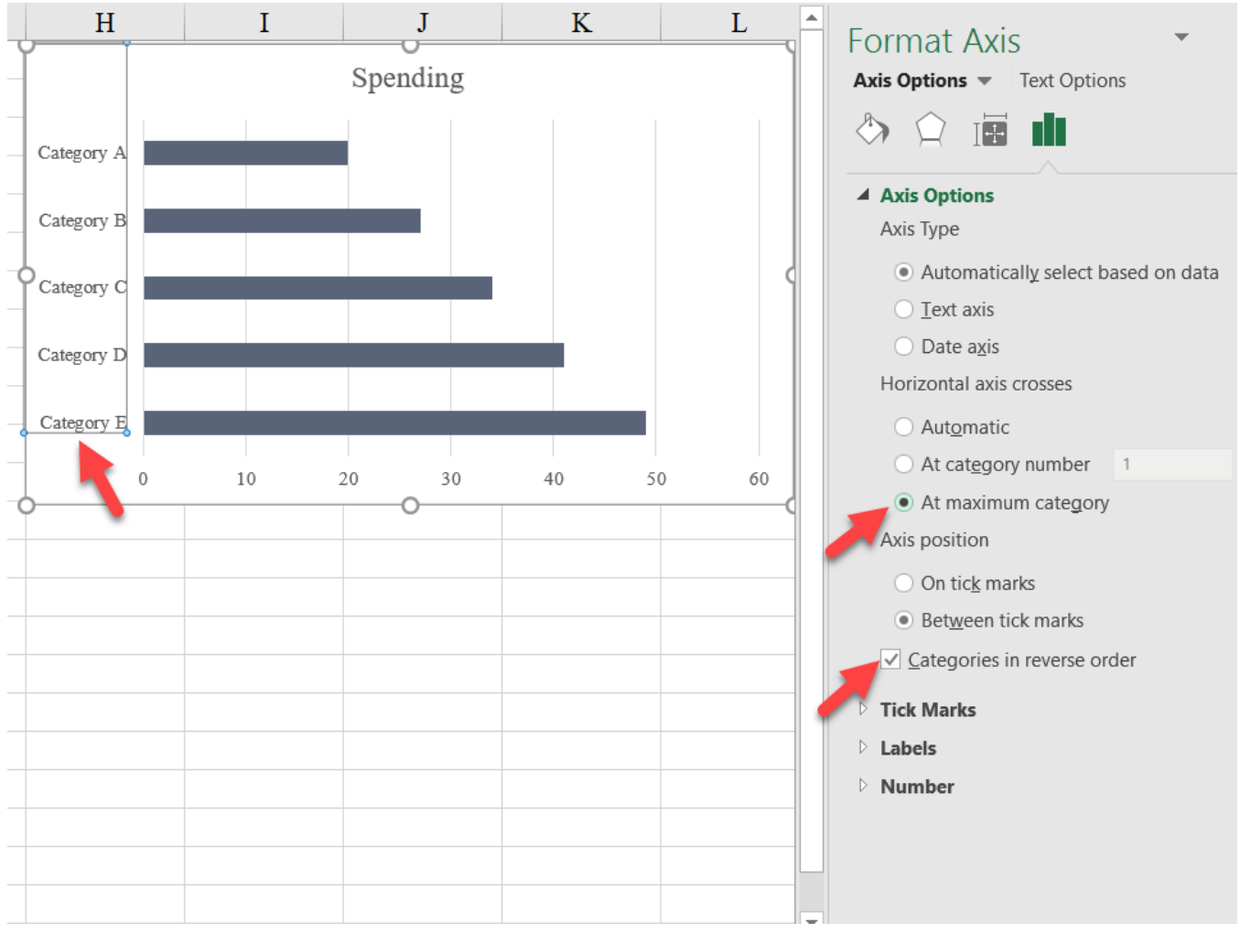
A lollipop chart is basically a bar chart except that the end of the bar is replaced with a dot (the candy) and the bar itself is replaced with a line (the stick, if you will). The lollipop graph reduces a lot of the ink on the page and I think helps the reader focus just on the end where the data are encoded. Use the *Lollipop tab* in the *Advanced Data Visualizations with Excel 2016 Hands-On.xlsx spreadsheet* to create the chart.



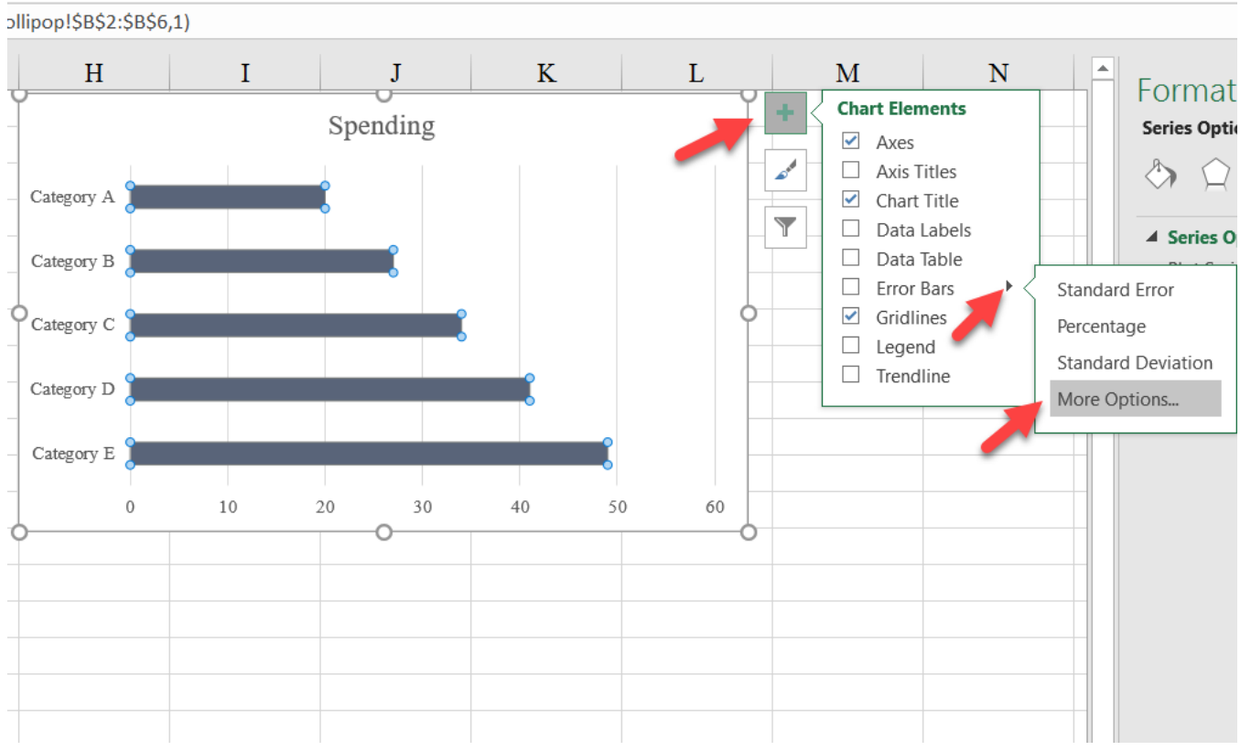
1. Create a bar chart with the Spending data using cells A1:B6. You'll notice that Excel sorts the data with Category E at the top of the chart. Personally, I want my data to be visualized in the same order as it appears in the spreadsheet. So, the first step is to re-sort the data so that Category A appears at the top of the chart.



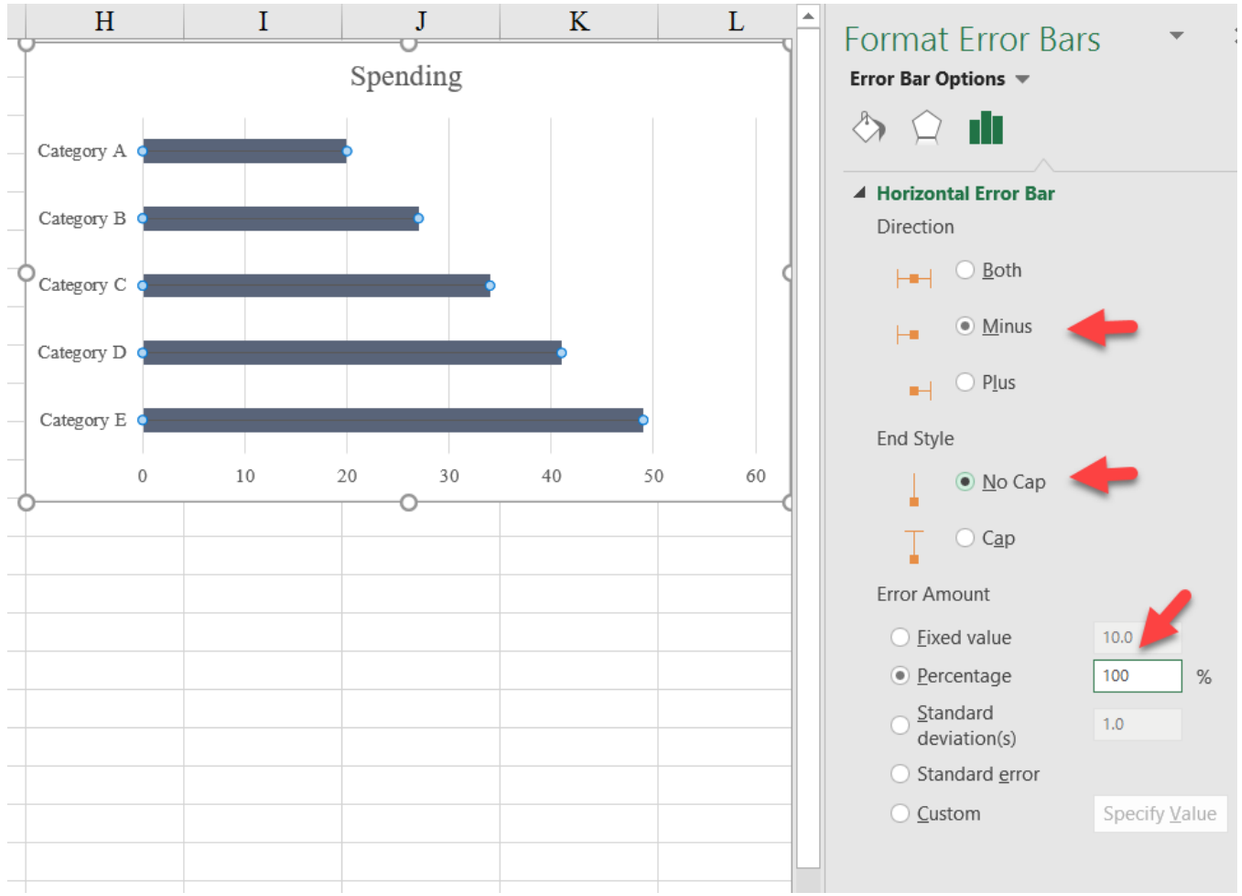
2. To do so, format the y-axis by selecting it and right-clicking or using the CTRL-1 shortcut. In the "Format Axis" menu, check the box next to "Categories in reverse order" *and* change the "Horizontal axis crosses:" option to "At maximum category". The first change flips the order of the data, but it also moves the x-axis to the top of the chart; that's why the second step is needed.



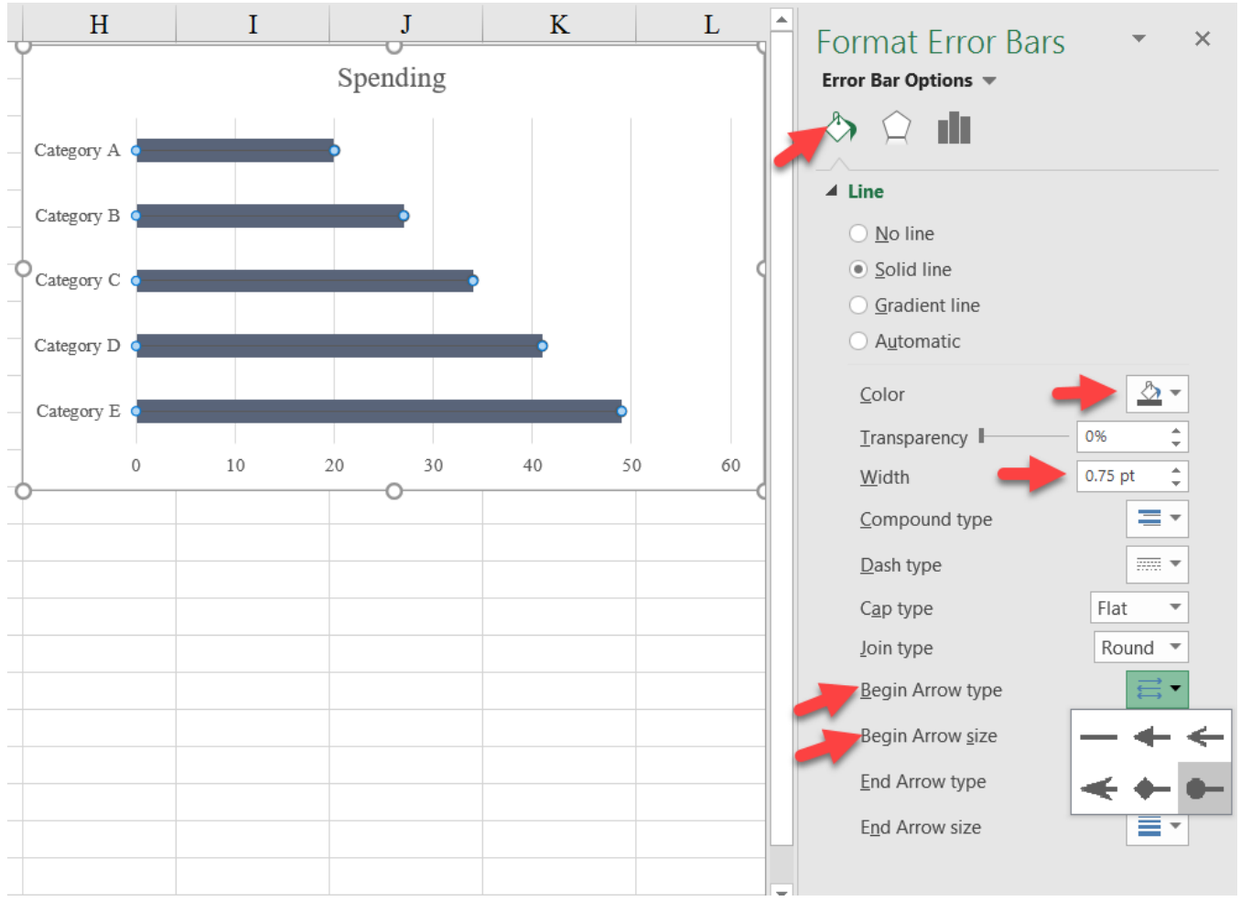
3. To change this to the lollipop, we'll use error bars. Select the bars in the chart, and select the "More Options" option in the "Error Bars" section of the "Chart Elements" menu available when you select the chart.



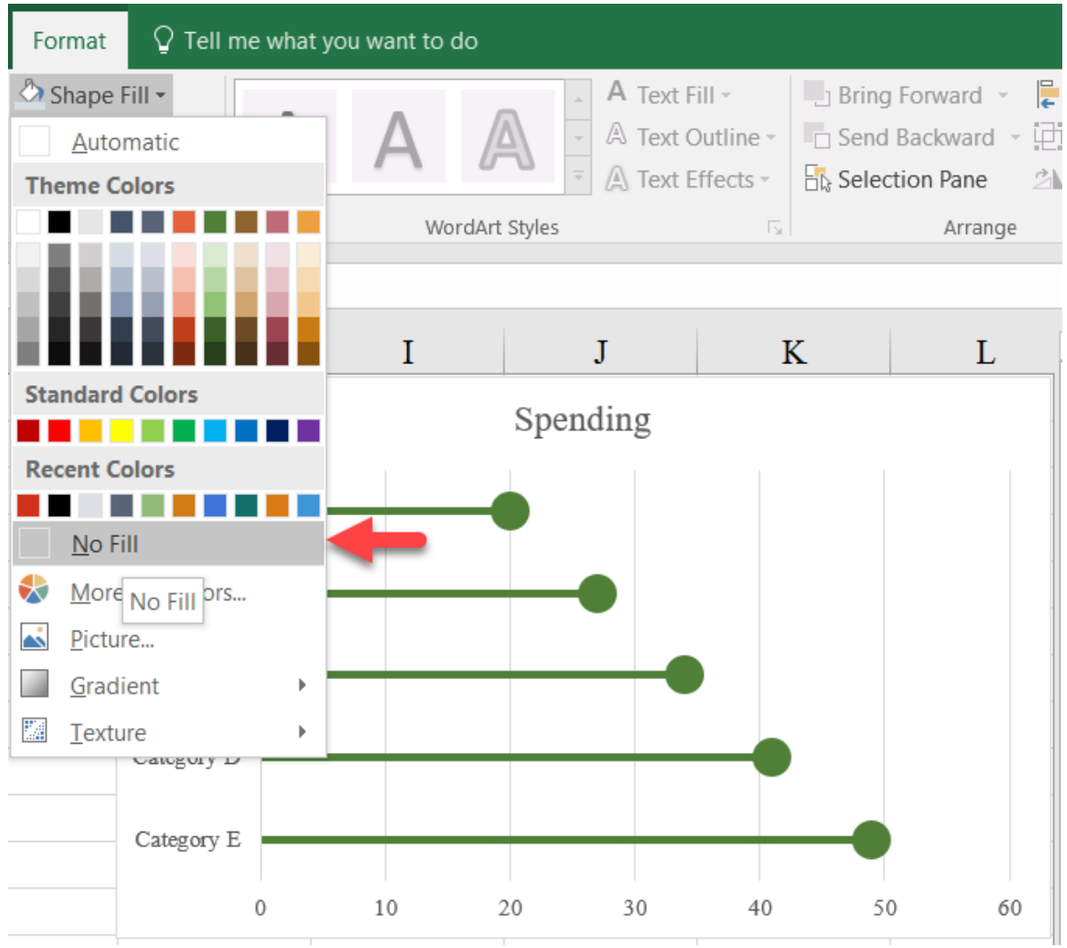
4. Excel will automatically add horizontal error bars to the chart. In the “Horizontal Error Bar” menu, change the “Direction” to “Minus”, and the “End Style” to “No Cap”. We also want to select the “Percentage” option in the “Error Amount” area of the menu, and place a 100 in the box. This will create a horizontal error bar that goes to the left all the way to the y-axis, regardless of the data.



5. In the “Line” menu (the first option in this menu) change the “Begin Arrow type” to the circle and increase its size (if you like) in the “Begin Arrow size” menu just below. (You can also change the color in the “Line Color” menu.) (Note: Excel 2016 reversed how ‘begin’ and ‘end’ were defined, so if you’ve made this graph in an earlier version of Excel and opened it in Excel 2016, you’ll notice that the circle is in the wrong position.)



6. Change the fill on the **blue** bars to “No Fill” by selecting the bars and selecting “No Fill” in the “Shape Fill” dropdown located in the “Format” menu on the ribbon.



# Final Version with Styling

# Sparklines

Sparklines are a simple chart type that show small versions (or "small multiples") of graphs. Beginning with Excel 2010, Sparklines became a default option, available in the "Insert" tab of the ribbon.

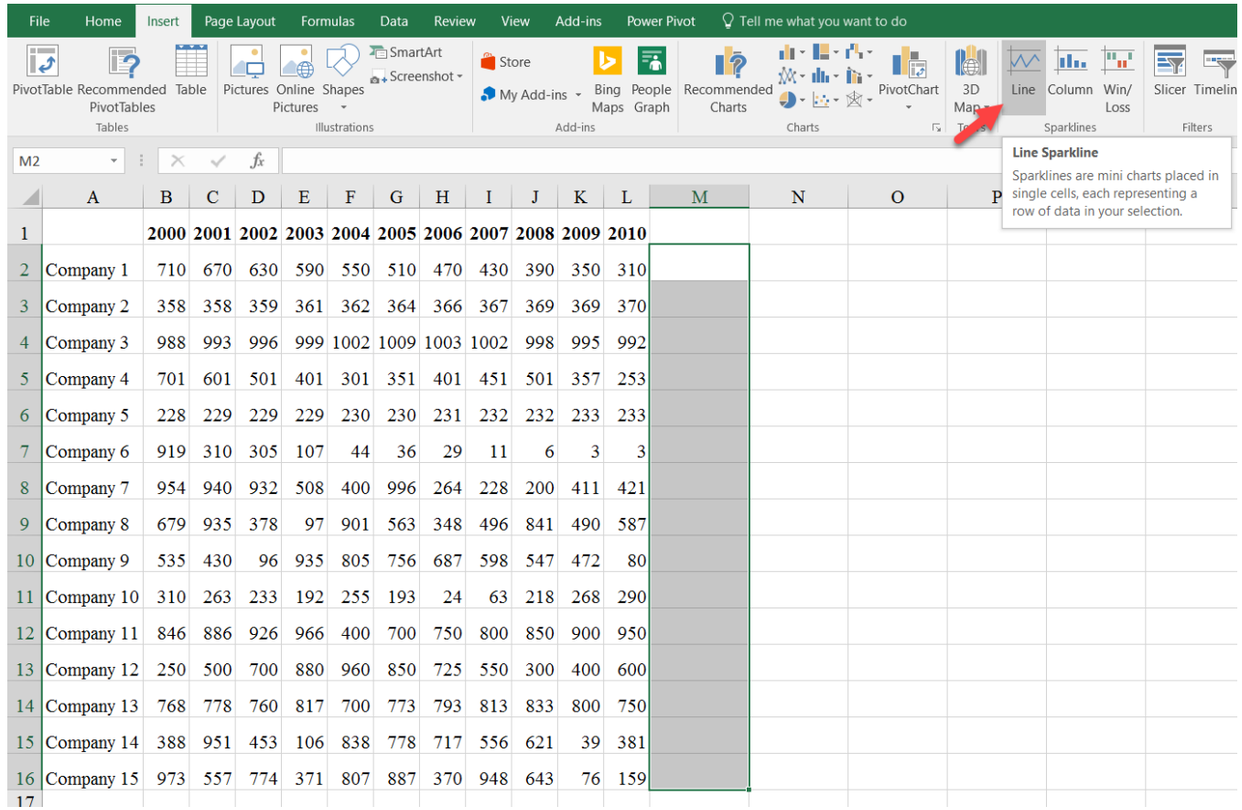
Use the *Sparklines tab* in the *Advanced Data Visualizations with Excel 2016 Hands-On.xlsx spreadsheet* to create the chart.

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Company 1** | 710 | 4 | 505 | 264 | 353 | 721 | 715 | 249 | 944 | 124 | 503 | | |
| **Company 2** | 358 | 978 | 415 | 300 | 446 | 305 | 910 | 126 | 769 | 841 | 106 | | |
| **Company 3** | 988 | 124 | 84 | 283 | 309 | 534 | 490 | 973 | 588 | 517 | 982 | | |
| **Company 4** | 701 | 329 | 733 | 981 | 641 | 94 | 416 | 937 | 526 | 357 | 253 | | |
| **Company 5** | 228 | 878 | 210 | 382 | 118 | 214 | 829 | 391 | 752 | 178 | 790 | | |
| **Company 6** | 919 | 712 | 143 | 455 | 709 | 185 | 291 | 315 | 775 | 917 | 153 | | |
| **Company 7** | 954 | 196 | 932 | 108 | 224 | 997 | 264 | 228 | 200 | 411 | 421 | | |
| **Company 8** | 679 | 935 | 378 | 97 | 901 | 563 | 348 | 496 | 841 | 490 | 587 | | |
| **Company 9** | 535 | 430 | 96 | 935 | 805 | 356 | 687 | 598 | 547 | 472 | 80 | | |
| **Company 10** | 310 | 747 | 268 | 611 | 421 | 112 | 768 | 695 | 505 | 279 | 969 | | |
| **Company 11** | 846 | 489 | 845 | 959 | 5 | 19 | 77 | 494 | 973 | 625 | 572 | | |
| **Company 12** | 677 | 369 | 626 | 628 | 226 | 305 | 863 | 157 | 389 | 289 | 802 | | |
| **Company 13** | 768 | 672 | 698 | 817 | 635 | 773 | 915 | 282 | 93 | 398 | 435 | | |
| **Company 14** | 388 | 951 | 453 | 106 | 838 | 778 | 717 | 556 | 621 | 39 | 381 | | |
| **Company 15** | 973 | 557 | 774 | 371 | 807 | 887 | 370 | 948 | 643 | 76 | 159 | | |

1. Select where you would like to place your Sparklines (though this could be done later too).

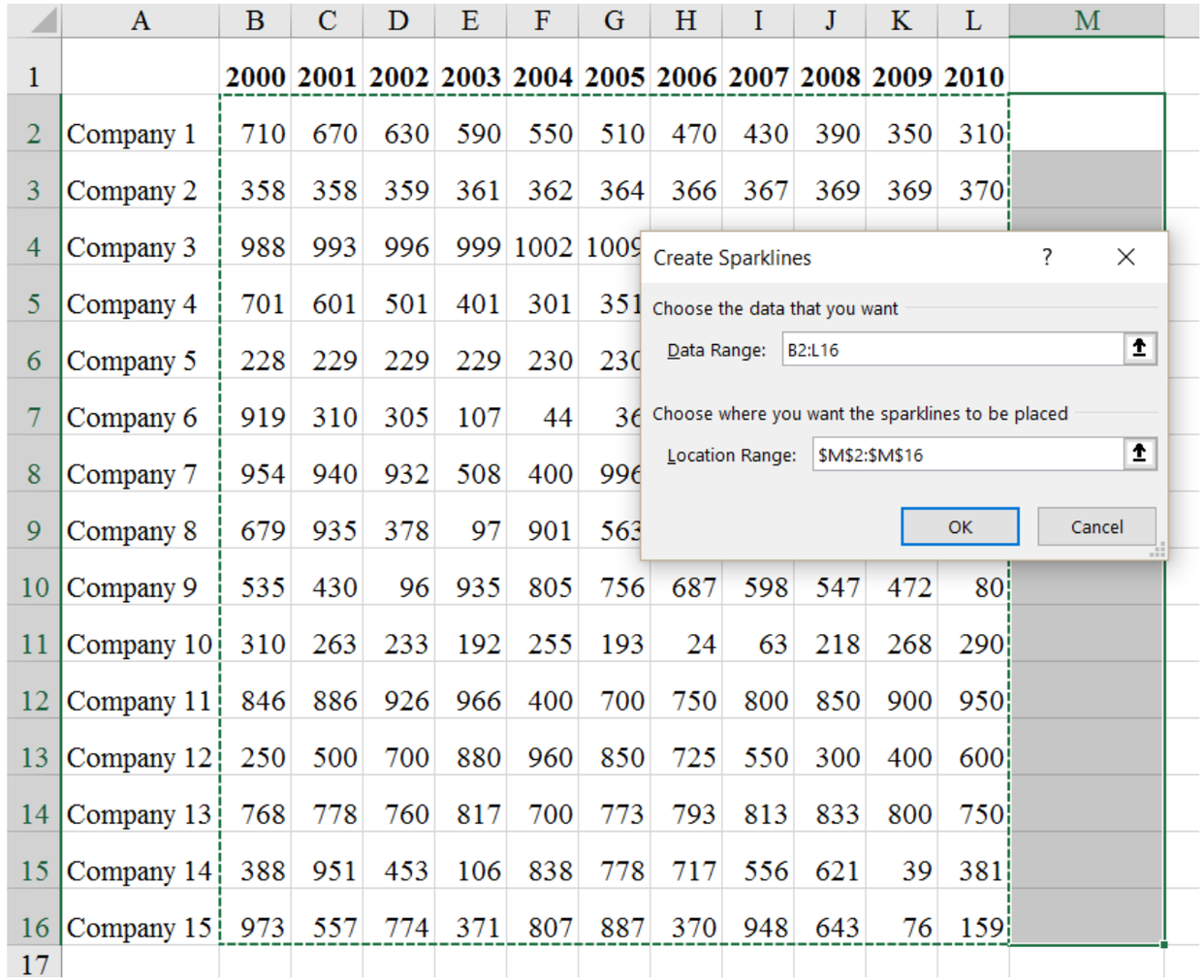
| | A | B | C | D | E | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | |
| 2 | Company 1 | 710 | 670 | 630 | 590 | 550 | 510 | 470 | 430 | 390 | 350 | 310 | |
| 3 | Company 2 | 358 | 358 | 359 | 361 | 362 | 364 | 366 | 367 | 369 | 369 | 370 | |
| 4 | Company 3 | 988 | 993 | 996 | 999 | 1002 | 1009 | 1003 | 1002 | 998 | 995 | 992 | |
| 5 | Company 4 | 701 | 601 | 501 | 401 | 301 | 351 | 401 | 451 | 501 | 357 | 253 | |
| 6 | Company 5 | 228 | 229 | 229 | 229 | 230 | 230 | 231 | 232 | 232 | 233 | 233 | |
| 7 | Company 6 | 919 | 310 | 305 | 107 | 44 | 36 | 29 | 11 | 6 | 3 | 3 | |
| 8 | Company 7 | 954 | 940 | 932 | 508 | 400 | 996 | 264 | 228 | 200 | 411 | 421 | |
| 9 | Company 8 | 679 | 935 | 378 | 97 | 901 | 563 | 348 | 496 | 841 | 490 | 587 | |
| 10 | Company 9 | 535 | 430 | 96 | 935 | 805 | 756 | 687 | 598 | 547 | 472 | 80 | |
| 11 | Company 10 | 310 | 263 | 233 | 192 | 255 | 193 | 24 | 63 | 218 | 268 | 290 | |
| 12 | Company 11 | 846 | 886 | 926 | 966 | 400 | 700 | 750 | 800 | 850 | 900 | 950 | |
| 13 | Company 12 | 250 | 500 | 700 | 880 | 960 | 850 | 725 | 550 | 300 | 400 | 600 | |
| 14 | Company 13 | 768 | 778 | 760 | 817 | 700 | 773 | 793 | 813 | 833 | 800 | 750 | |
| 15 | Company 14 | 388 | 951 | 453 | 106 | 838 | 778 | 717 | 556 | 621 | 39 | 381 | |
| 16 | Company 15 | 973 | 557 | 774 | 371 | 807 | 887 | 370 | 948 | 643 | 76 | 159 | |
| 17 | | | | | | | | | | | | | |

2. Select the “Line” option in the “Sparklines” menu in the “Insert” tab on the ribbon.




| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | | | | |
| 2 | Company 1 | 710 | 670 | 630 | 590 | 550 | 510 | 470 | 430 | 390 | 350 | 310 | | | | |
| 3 | Company 2 | 358 | 358 | 359 | 361 | 362 | 364 | 366 | 367 | 369 | 369 | 370 | | | | |
| 4 | Company 3 | 988 | 993 | 996 | 999 | 1002 | 1009 | 1003 | 1002 | 998 | 995 | 992 | | | | |
| 5 | Company 4 | 701 | 601 | 501 | 401 | 301 | 351 | 401 | 451 | 501 | 357 | 253 | | | | |
| 6 | Company 5 | 228 | 229 | 229 | 229 | 230 | 230 | 231 | 232 | 232 | 233 | 233 | | | | |
| 7 | Company 6 | 919 | 310 | 305 | 107 | 44 | 36 | 29 | 11 | 6 | 3 | 3 | | | | |
| 8 | Company 7 | 954 | 940 | 932 | 508 | 400 | 996 | 264 | 228 | 200 | 411 | 421 | | | | |
| 9 | Company 8 | 679 | 935 | 378 | 97 | 901 | 563 | 348 | 496 | 841 | 490 | 587 | | | | |
| 10 | Company 9 | 535 | 430 | 96 | 935 | 805 | 756 | 687 | 598 | 547 | 472 | 80 | | | | |
| 11 | Company 10 | 310 | 263 | 233 | 192 | 255 | 193 | 24 | 63 | 218 | 268 | 290 | | | | |
| 12 | Company 11 | 846 | 886 | 926 | 966 | 400 | 700 | 750 | 800 | 850 | 900 | 950 | | | | |
| 13 | Company 12 | 250 | 500 | 700 | 880 | 960 | 850 | 725 | 550 | 300 | 400 | 600 | | | | |
| 14 | Company 13 | 768 | 778 | 760 | 817 | 700 | 773 | 793 | 813 | 833 | 800 | 750 | | | | |
| 15 | Company 14 | 388 | 951 | 453 | 106 | 838 | 778 | 717 | 556 | 621 | 39 | 381 | | | | |
| 16 | Company 15 | 973 | 557 | 774 | 371 | 807 | 887 | 370 | 948 | 643 | 76 | 159 | | | | |
| 17 | | | | | | | | | | | | | | | | |

3. Select your data for the “Data Range:”.

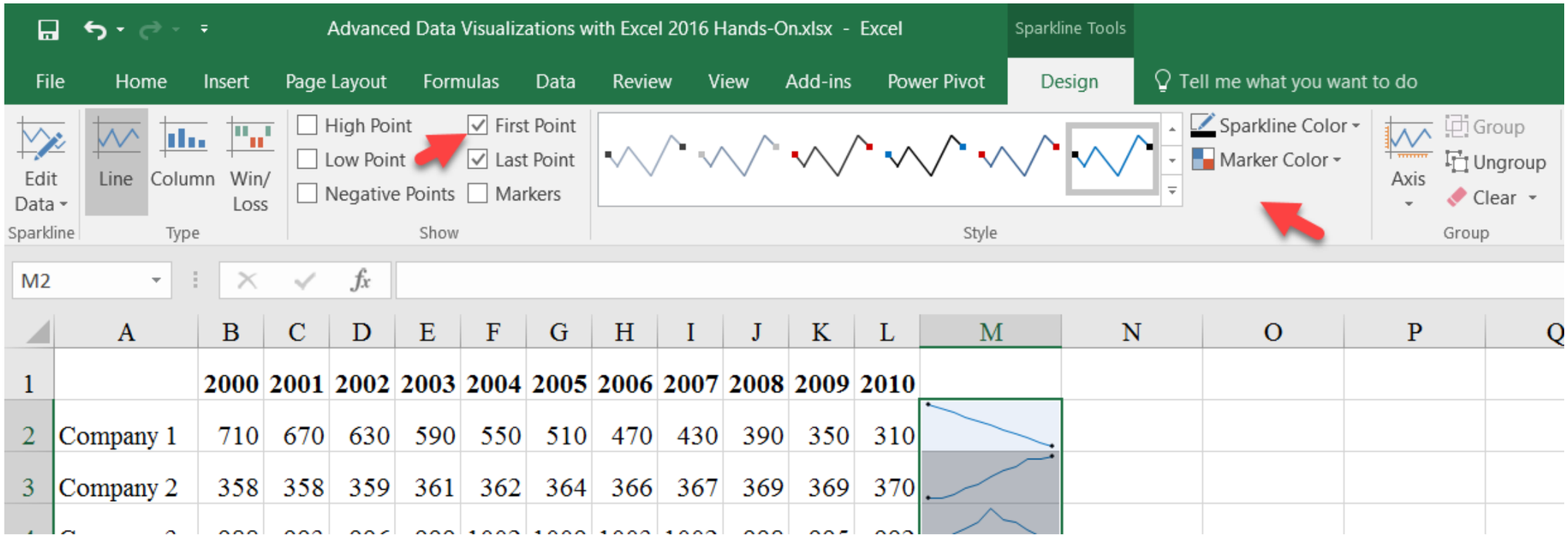


| | A | B | C | D | E | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | |
| 2 | Company 1 | 710 | 670 | 630 | 590 | 550 | 510 | 470 | 430 | 390 | 350 | 310 | |
| 3 | Company 2 | 358 | 358 | 359 | 361 | 362 | 364 | 366 | 367 | 369 | 369 | 370 | |
| 4 | Company 3 | 988 | 993 | 996 | 999 | 1002 | 1009 | | | | | | |
| 5 | Company 4 | 701 | 601 | 501 | 401 | 301 | 351 | | | | | | |
| 6 | Company 5 | 228 | 229 | 229 | 229 | 230 | 230 | | | | | | |
| 7 | Company 6 | 919 | 310 | 305 | 107 | 44 | 36 | | | | | | |
| 8 | Company 7 | 954 | 940 | 932 | 508 | 400 | 996 | | | | | | |
| 9 | Company 8 | 679 | 935 | 378 | 97 | 901 | 563 | | | | | | |
| 10 | Company 9 | 535 | 430 | 96 | 935 | 805 | 756 | 687 | 598 | 547 | 472 | 80 | |
| 11 | Company 10 | 310 | 263 | 233 | 192 | 255 | 193 | 24 | 63 | 218 | 268 | 290 | |
| 12 | Company 11 | 846 | 886 | 926 | 966 | 400 | 700 | 750 | 800 | 850 | 900 | 950 | |
| 13 | Company 12 | 250 | 500 | 700 | 880 | 960 | 850 | 725 | 550 | 300 | 400 | 600 | |
| 14 | Company 13 | 768 | 778 | 760 | 817 | 700 | 773 | 793 | 813 | 833 | 800 | 750 | |
| 15 | Company 14 | 388 | 951 | 453 | 106 | 838 | 778 | 717 | 556 | 621 | 39 | 381 | |
| 16 | Company 15 | 973 | 557 | 774 | 371 | 807 | 887 | 370 | 948 | 643 | 76 | 159 | |
| 17 | | | | | | | | | | | | | |

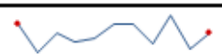
4. Hit OK and the Sparklines fill in.

| | A | B | C | D | E | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | |
| 2 | Company 1 | 710 | 670 | 630 | 590 | 550 | 510 | 470 | 430 | 390 | 350 | 310 | |
| 3 | Company 2 | 358 | 358 | 359 | 361 | 362 | 364 | 366 | 367 | 369 | 369 | 370 | |
| 4 | Company 3 | 988 | 993 | 996 | 999 | 1002 | 1009 | 1003 | 1002 | 998 | 995 | 992 | |
| 5 | Company 4 | 701 | 601 | 501 | 401 | 301 | 351 | 401 | 451 | 501 | 357 | 253 | |
| 6 | Company 5 | 228 | 229 | 229 | 229 | 230 | 230 | 231 | 232 | 232 | 233 | 233 | |
| 7 | Company 6 | 919 | 310 | 305 | 107 | 44 | 36 | 29 | 11 | 6 | 3 | 3 | |
| 8 | Company 7 | 954 | 940 | 932 | 508 | 400 | 996 | 264 | 228 | 200 | 411 | 421 | |
| 9 | Company 8 | 679 | 935 | 378 | 97 | 901 | 563 | 348 | 496 | 841 | 490 | 587 | |
| 10 | Company 9 | 535 | 430 | 96 | 935 | 805 | 756 | 687 | 598 | 547 | 472 | 80 | |
| 11 | Company 10 | 310 | 263 | 233 | 192 | 255 | 193 | 24 | 63 | 218 | 268 | 290 | |
| 12 | Company 11 | 846 | 886 | 926 | 966 | 400 | 700 | 750 | 800 | 850 | 900 | 950 | |
| 13 | Company 12 | 250 | 500 | 700 | 880 | 960 | 850 | 725 | 550 | 300 | 400 | 600 | |
| 14 | Company 13 | 768 | 778 | 760 | 817 | 700 | 773 | 793 | 813 | 833 | 800 | 750 | |
| 15 | Company 14 | 388 | 951 | 453 | 106 | 838 | 778 | 717 | 556 | 621 | 39 | 381 | |
| 16 | Company 15 | 973 | 557 | 774 | 371 | 807 | 887 | 370 | 948 | 643 | 76 | 159 | |

5. Using the Sparkline Tools, you can format the color of the Sparklines (in the “Sparkline Color” drop down), add markers (in the “Show” tab), or even change the chart type to columns (in the “Type” tab).



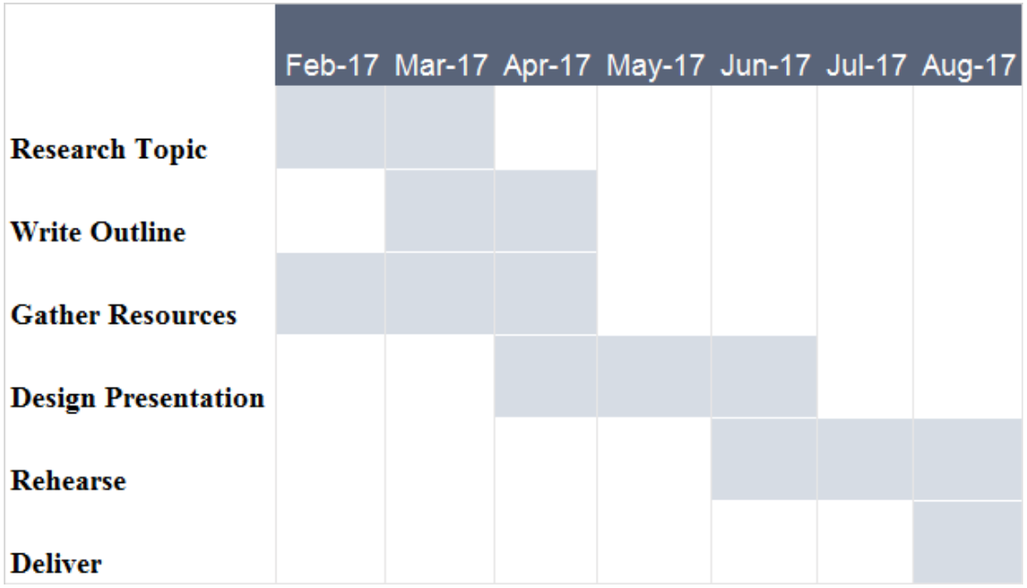
# Final Version with Styling

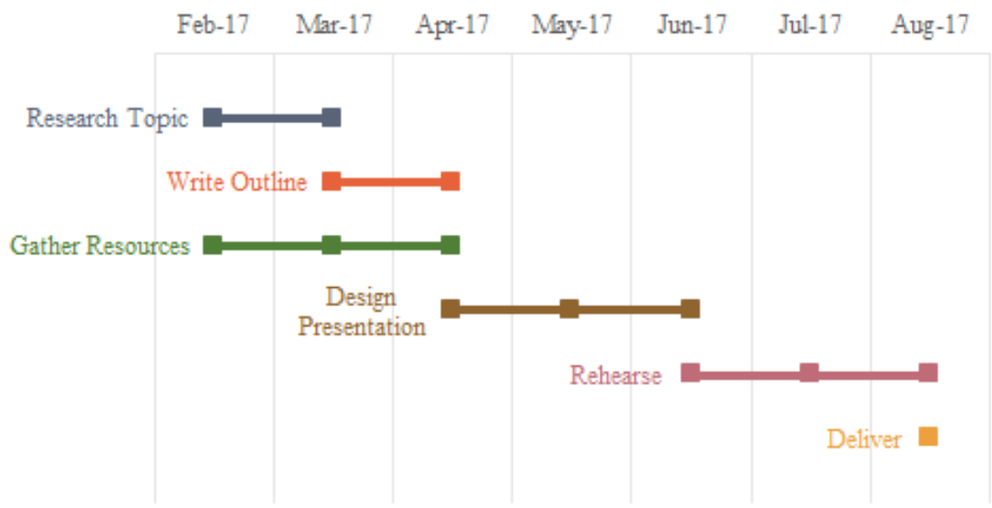
| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Company 1** | 710 | 4 | 505 | 264 | 353 | 721 | 715 | 249 | 944 | 124 | 503 |  |  |
| **Company 2** | 358 | 978 | 415 | 300 | 446 | 305 | 910 | 126 | 769 | 841 | 106 |  |  |
| **Company 3** | 988 | 124 | 84 | 283 | 309 | 534 | 490 | 973 | 588 | 517 | 982 |  |  |
| **Company 4** | 701 | 329 | 733 | 981 | 641 | 94 | 416 | 937 | 526 | 357 | 253 |  |  |
| **Company 5** | 228 | 878 | 210 | 382 | 118 | 214 | 829 | 391 | 752 | 178 | 790 |  |  |
| **Company 6** | 919 | 712 | 143 | 455 | 709 | 185 | 291 | 315 | 775 | 917 | 153 |  |  |
| **Company 7** | 954 | 196 | 932 | 108 | 224 | 997 | 264 | 228 | 200 | 411 | 421 |  |  |
| **Company 8** | 679 | 935 | 378 | 97 | 901 | 563 | 348 | 496 | 841 | 490 | 587 |  |  |
| **Company 9** | 535 | 430 | 96 | 935 | 805 | 356 | 687 | 598 | 547 | 472 | 80 |  |  |
| **Company 10** | 310 | 747 | 268 | 611 | 421 | 112 | 768 | 695 | 505 | 279 | 969 |  |  |
| **Company 11** | 846 | 489 | 845 | 959 | 5 | 19 | 77 | 494 | 973 | 625 | 572 |  |  |
| **Company 12** | 677 | 369 | 626 | 628 | 226 | 305 | 863 | 157 | 389 | 289 | 802 |  |  |
| **Company 13** | 768 | 672 | 698 | 817 | 635 | 773 | 915 | 282 | 93 | 398 | 435 |  |  |
| **Company 14** | 388 | 951 | 453 | 106 | 838 | 778 | 717 | 556 | 621 | 39 | 381 |  |  |
| **Company 15** | 973 | 557 | 774 | 371 | 807 | 887 | 370 | 948 | 643 | 76 | 159 |  |  |

# Gantt

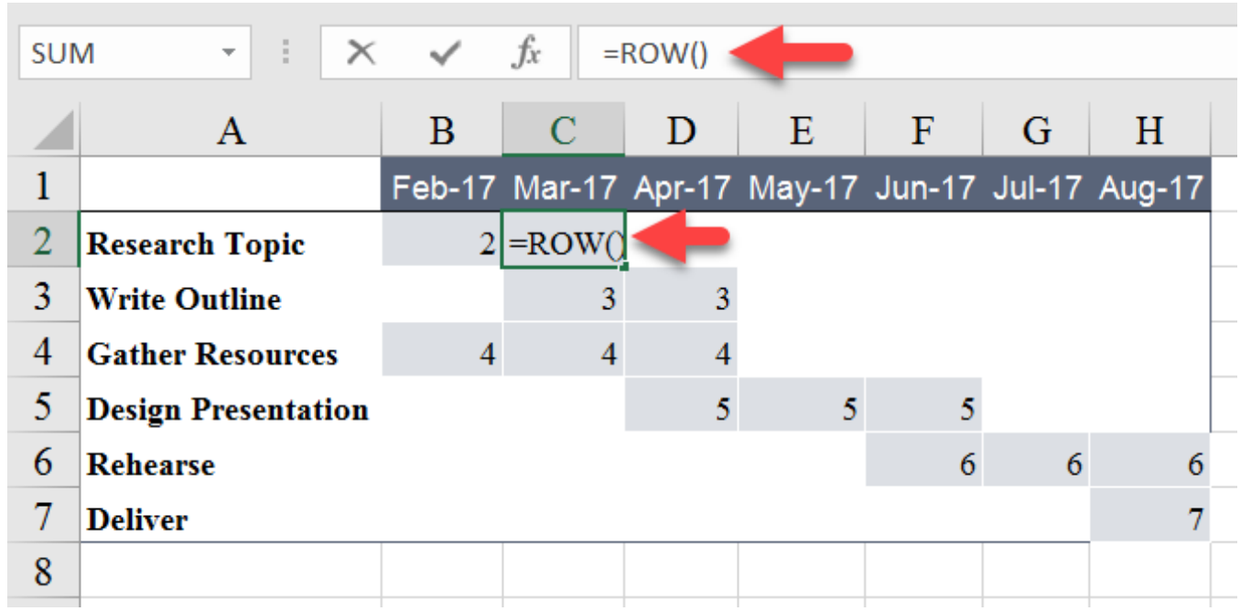
The Gantt chart consists of horizontal lines or bars and is typically used as a schedule-tracking device to show the duration of different values or actions. It's easy to create a Gantt chart in Excel by simply highlighting cells in the spreadsheet, but Glenna Shaw shared a way to create a different style of Gantt chart using a line chart with markers.

This Gantt chart has a slightly different look than the typical approach. Use the *Gantt* tab in the *Advanced Data Visualizations with Excel 2016 Hands-On.xlsx* spreadsheet to create the chart.

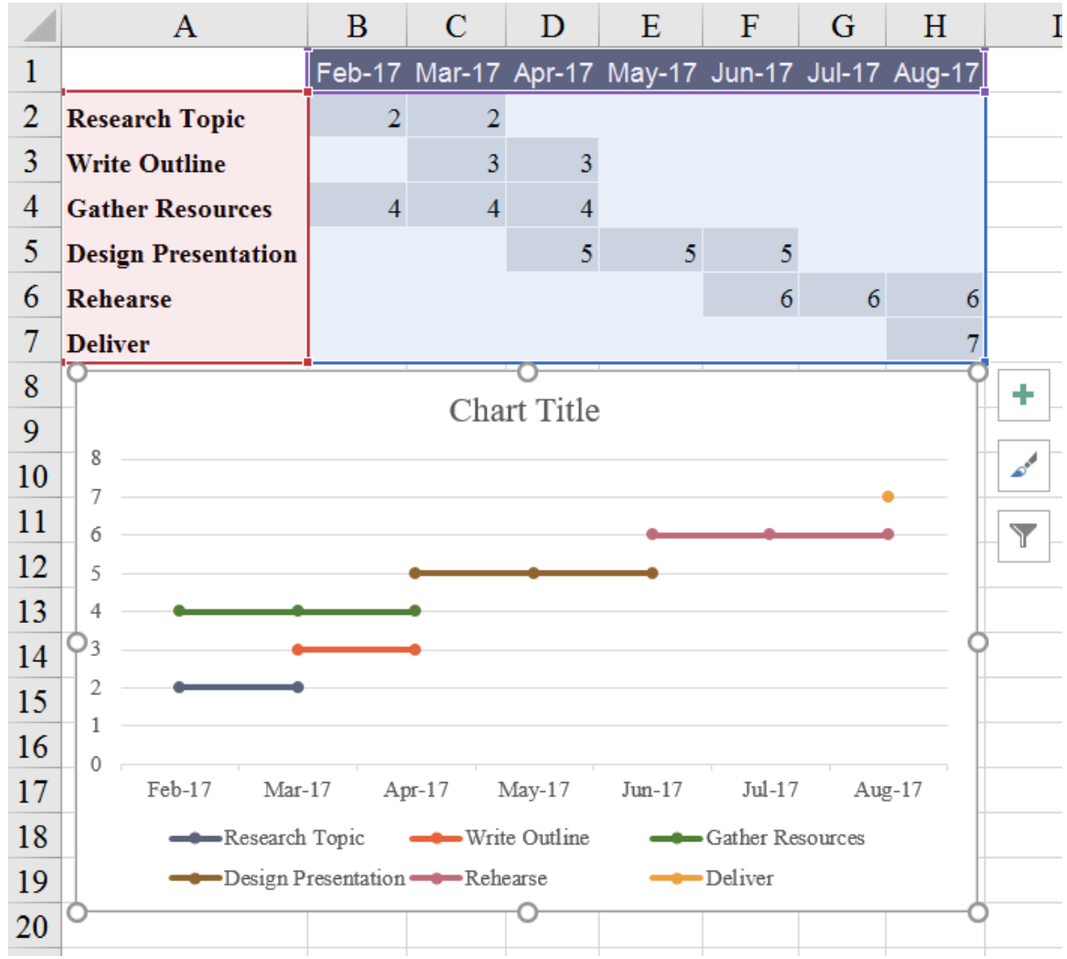


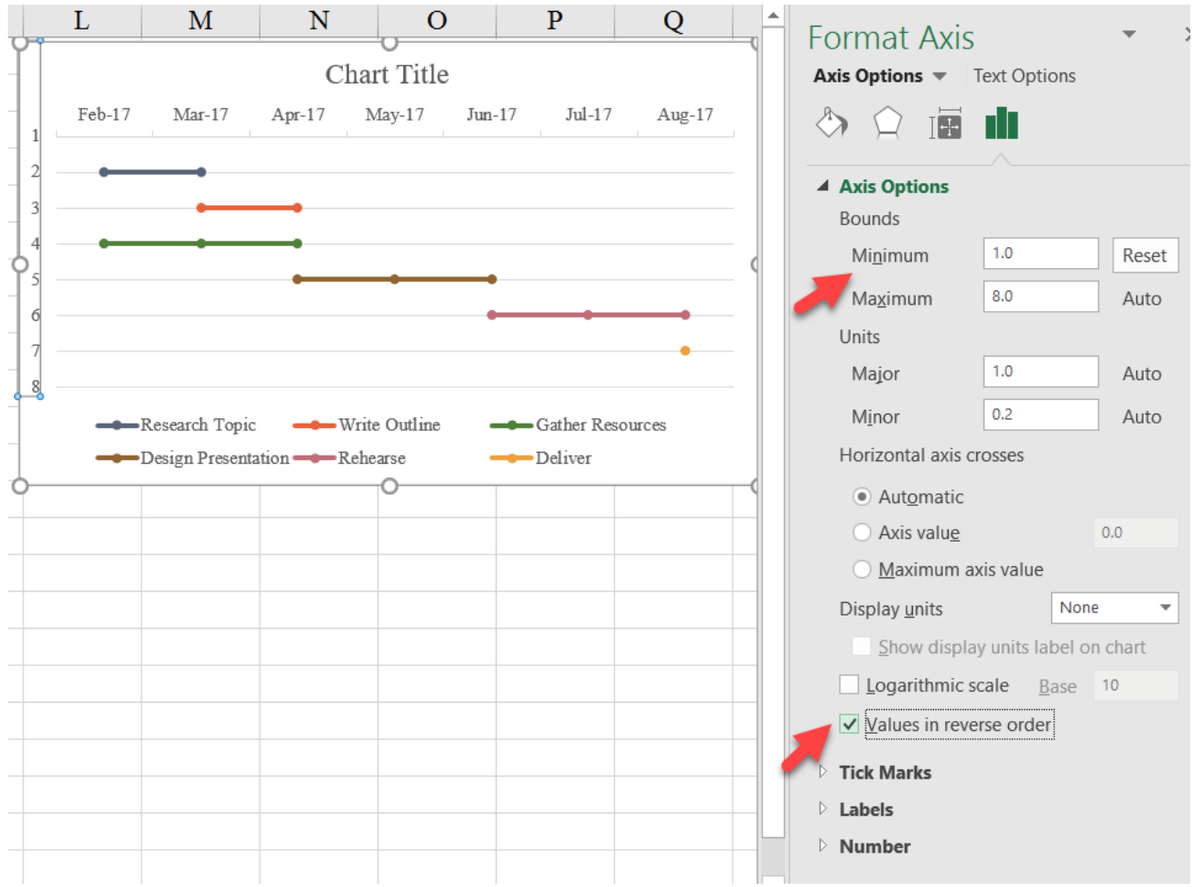
1. The basic Gantt chart using filled-in spreadsheet cells is shown here. We are going to add data to those cells to plot them in a graph. Use the =ROW() formula to place the value of each row in the highlighted cell. You could also manually type in some values, but the ROW formula is a bit faster and easier to update.



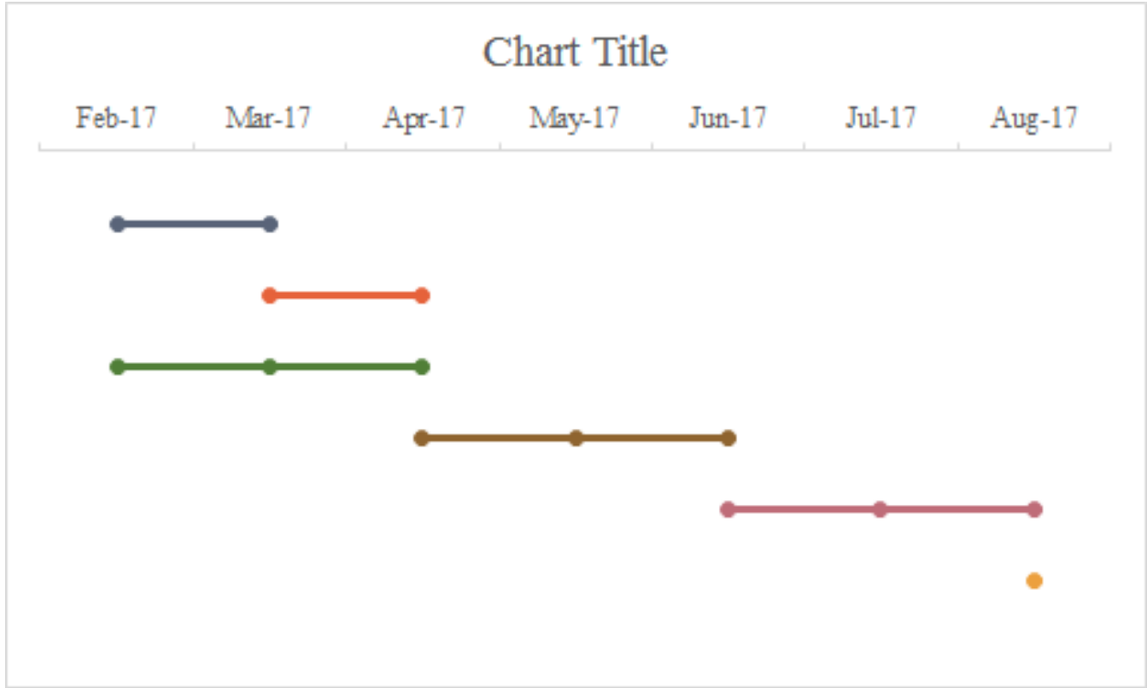
2. Insert a Line with Markers chart using the data in cells A2:H8.



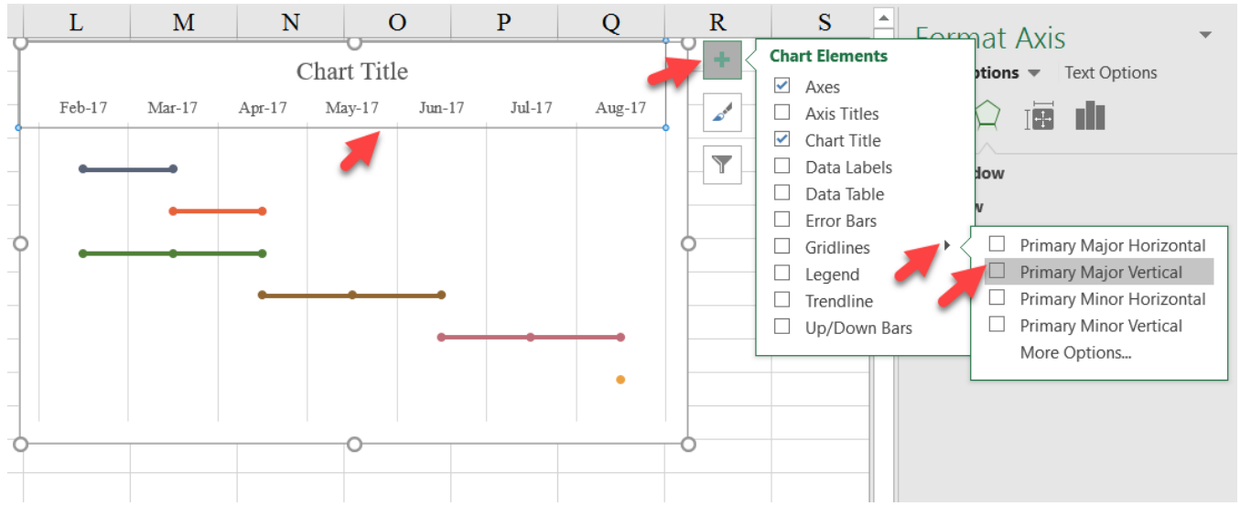
3. You'll notice that the order of the lines in the graph don't match the order of the data in the spreadsheet. As we've done before, format the y-axis so the order of the chart matches the order of the data by right-clicking the axis (or using the CTRL+1 keyboard shortcut) and check the box next to "Values in reverse order". Adjust the axis minimum to the lowest row number - 1 and maximum to the highest row number + 1 to use the full plot area of the chart.



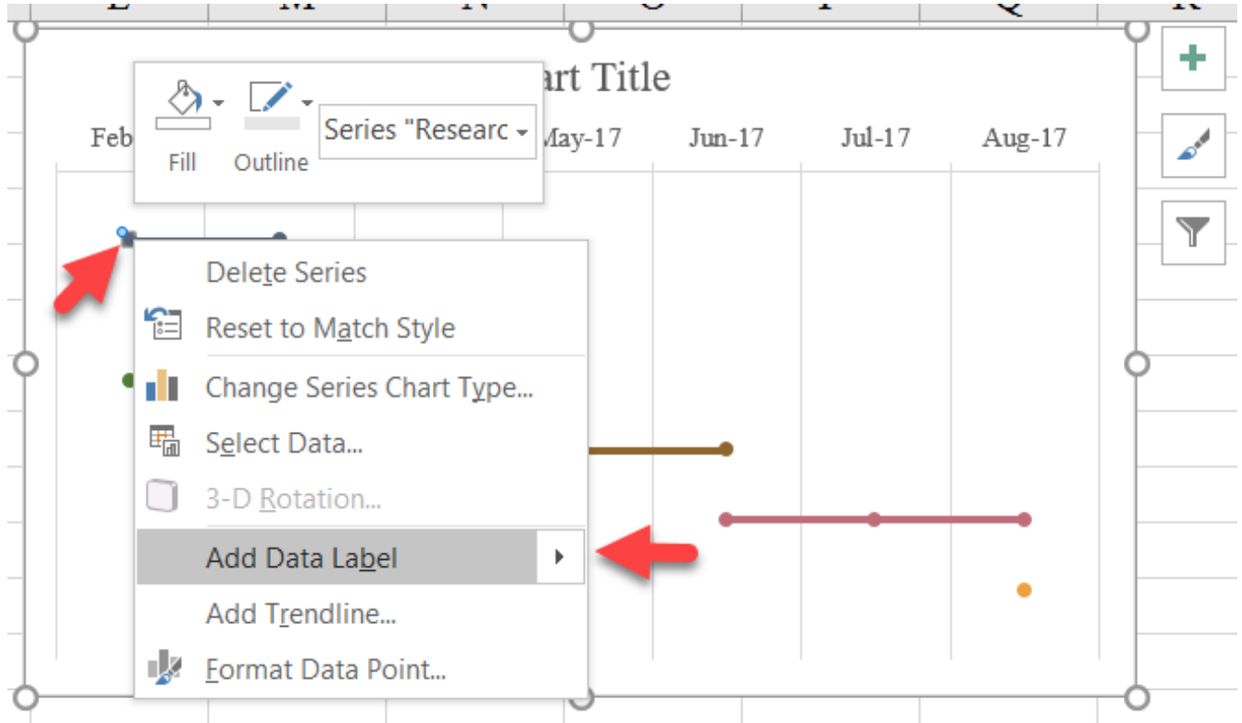
4. We can delete some of the unnecessary chart elements such as the y-axis, horizontal gridlines, and legend.



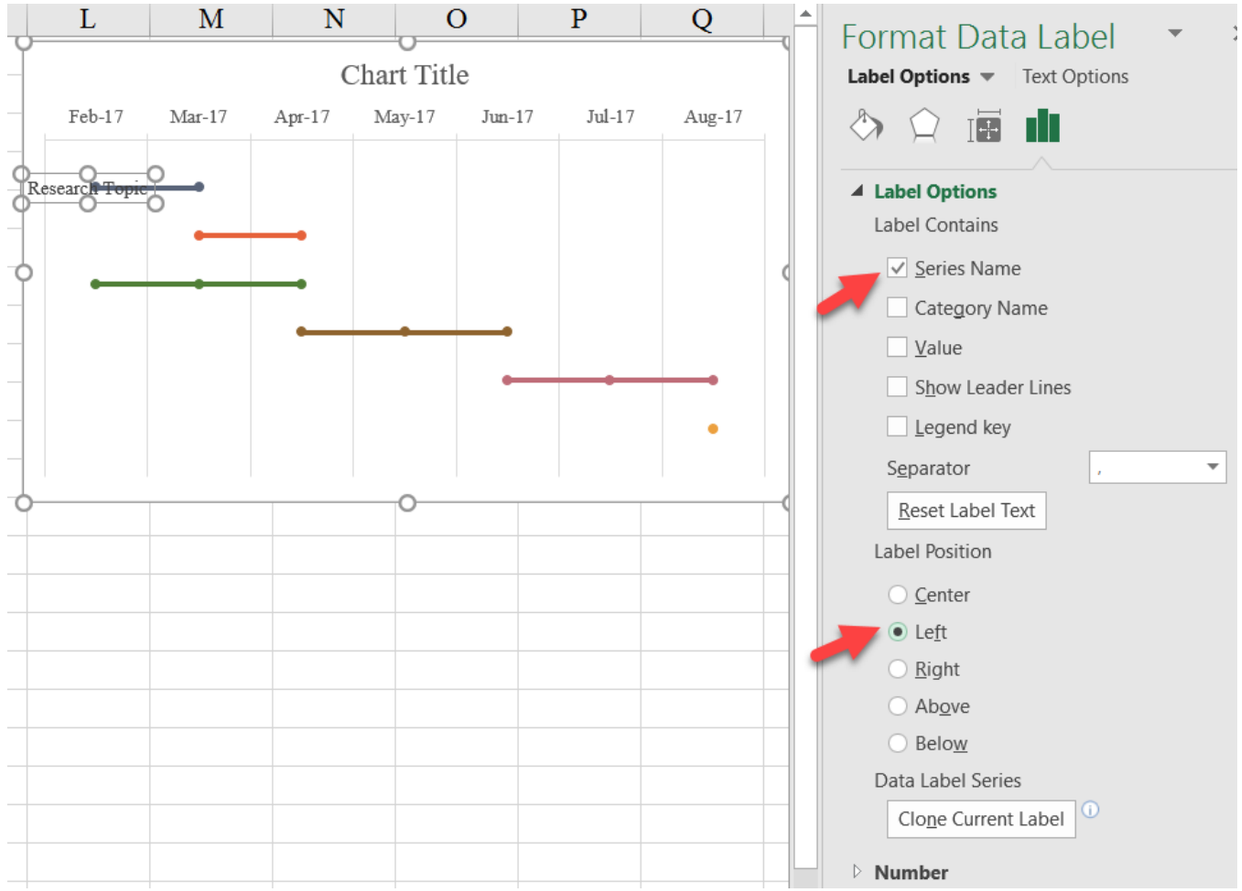
5. We can add vertical gridlines by selecting the x-axis (now at the top of the chart), and selecting the Gridlines option in the Chart Elements menu that appears when you select the plus button to the right of the chart.



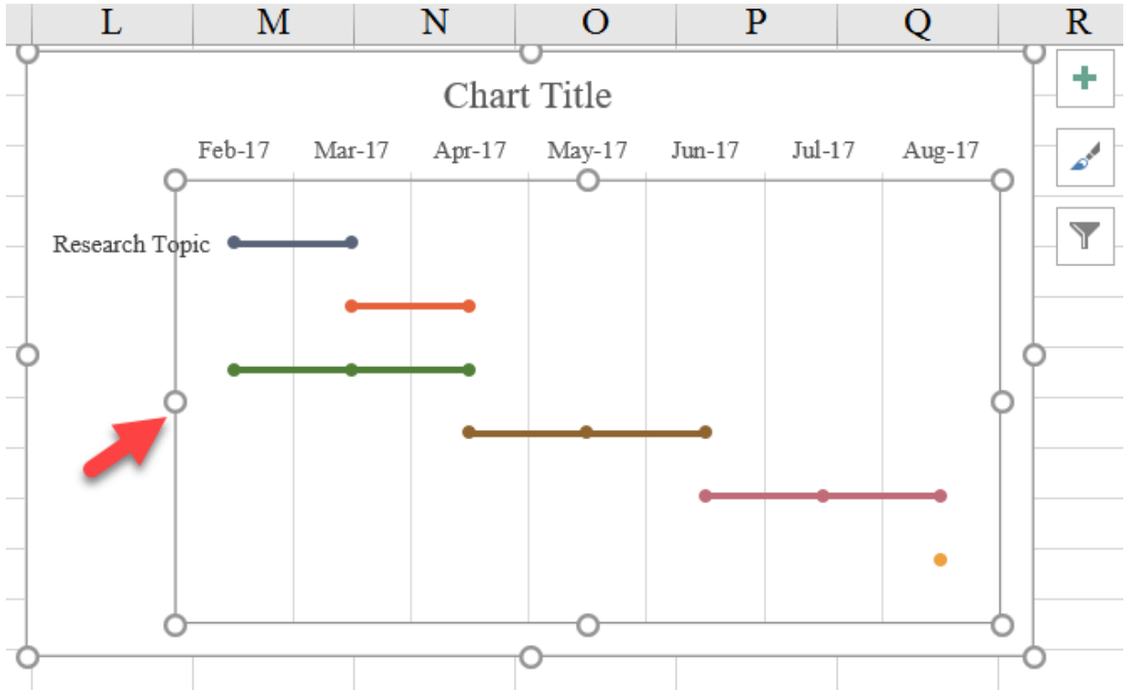
6. We are now going to add the labels to the chart. If you select the first (top) series, you'll notice that both points are selected. If you click again, only the first (left) point is highlighted; right-click and select Add Data Label.



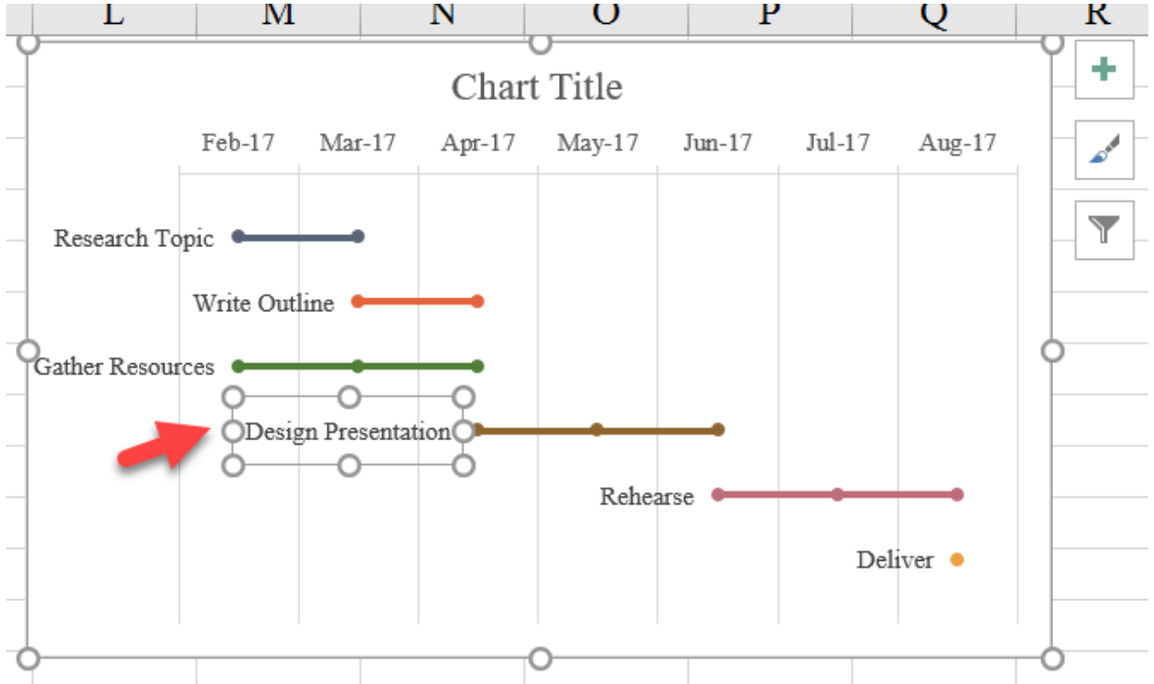
7. Click on the data label twice and right-click (or CTRL+1) and make two changes: select only the "Series Name" option under Label Options, and select the "Left" option in the bottom Label Position menu.



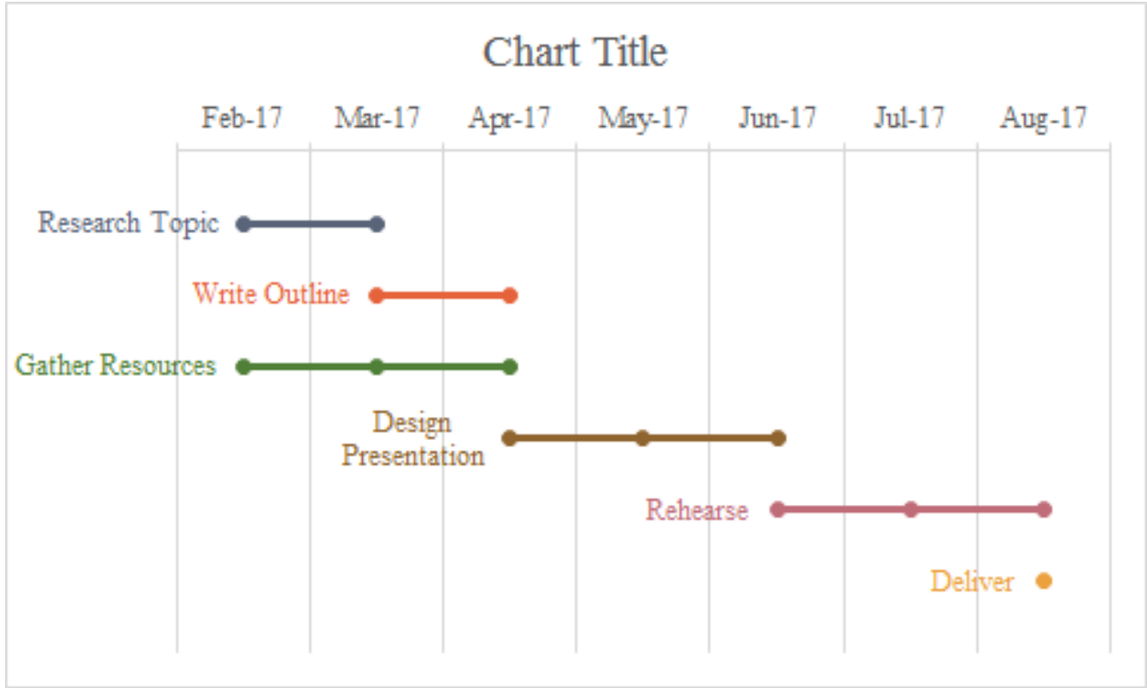
8. This first label doesn't look like it moved over to the left, but if you select the plot space (not the whole chart, just the space inside) you can shift it to the right and the label is now lined up to the left of the point. Now repeat the process for the other series.



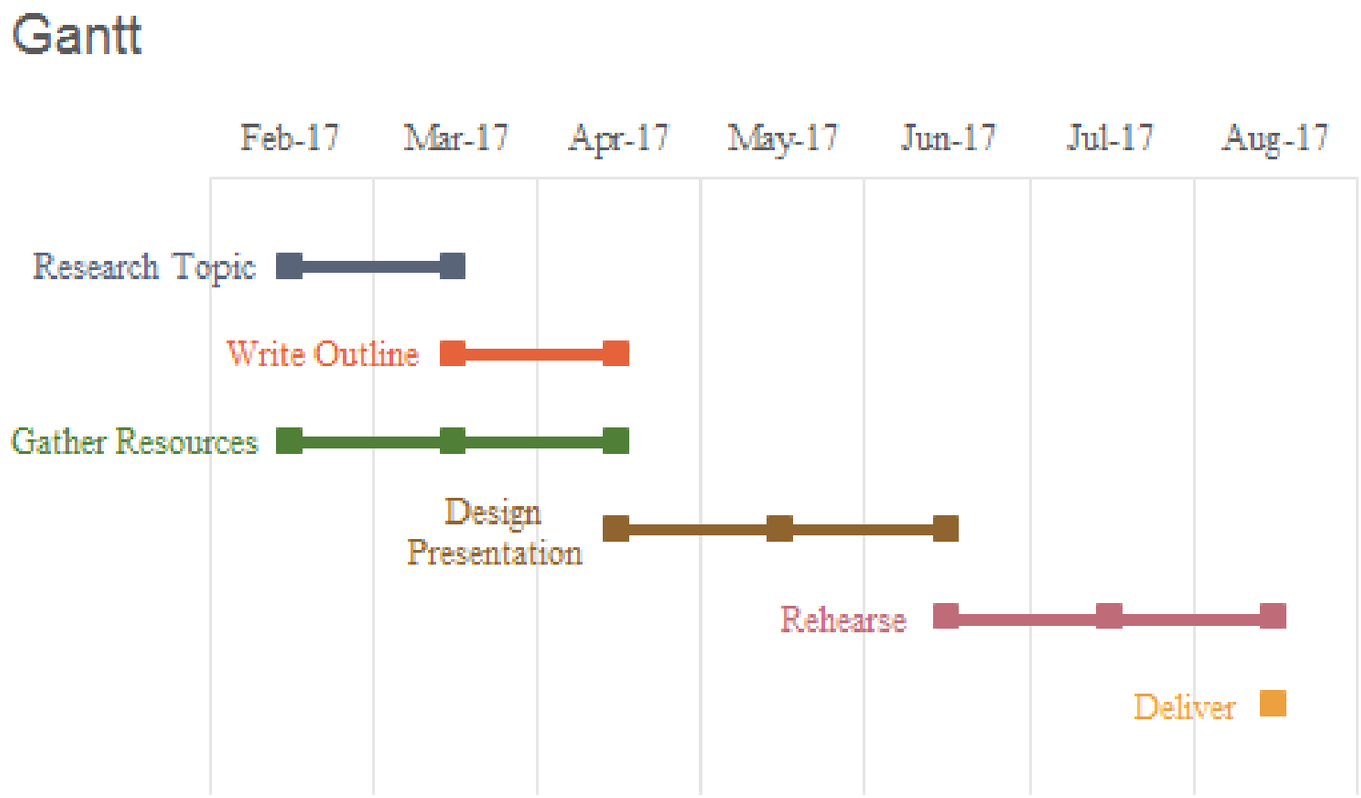
9. One advantage of Excel 2016 is that you can adjust the size of the data label boxes. You may find, for example, that the "Design Presentation" label is wrapped on two lines. If you want this label to be on just one line, you can select the box and select it again—this will bring up empty circles around the box; selecting those will enable you to adjust the size of the text box.



10. You can also change the color of the labels to match the colors of your lines.

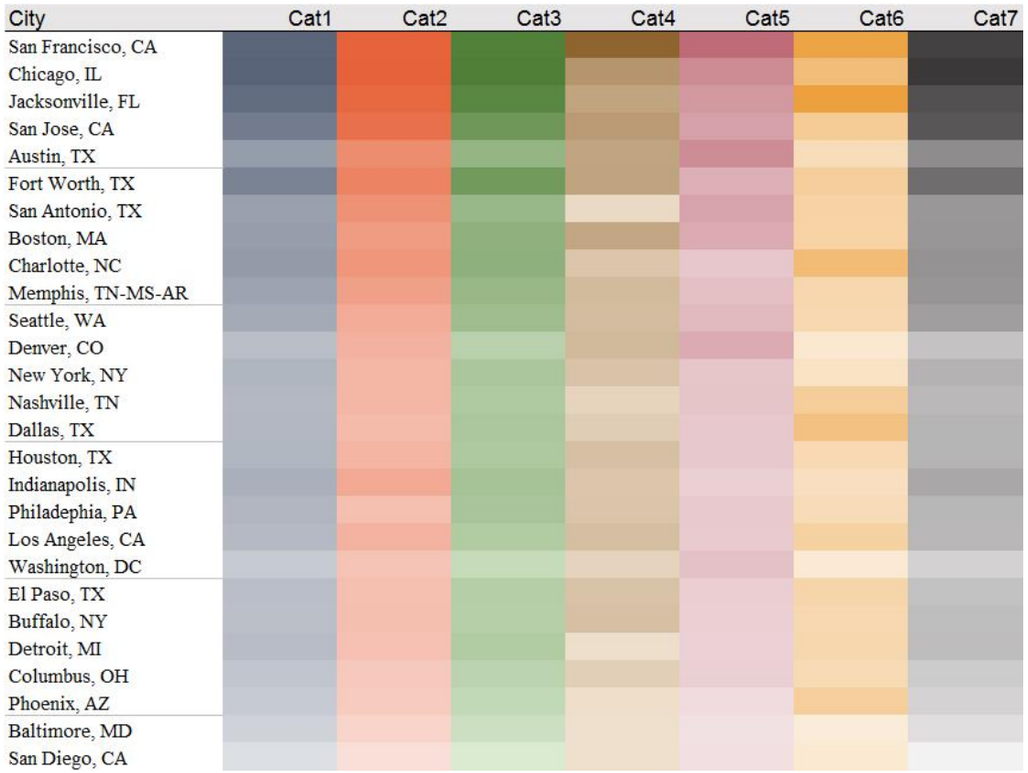


# Final Version with Styling



# Heatmap

Heatmaps are typically used to show high-frequency data in a compact format. You might think of them as a table, but instead of showing the actual numbers, the heatmap shows colors.



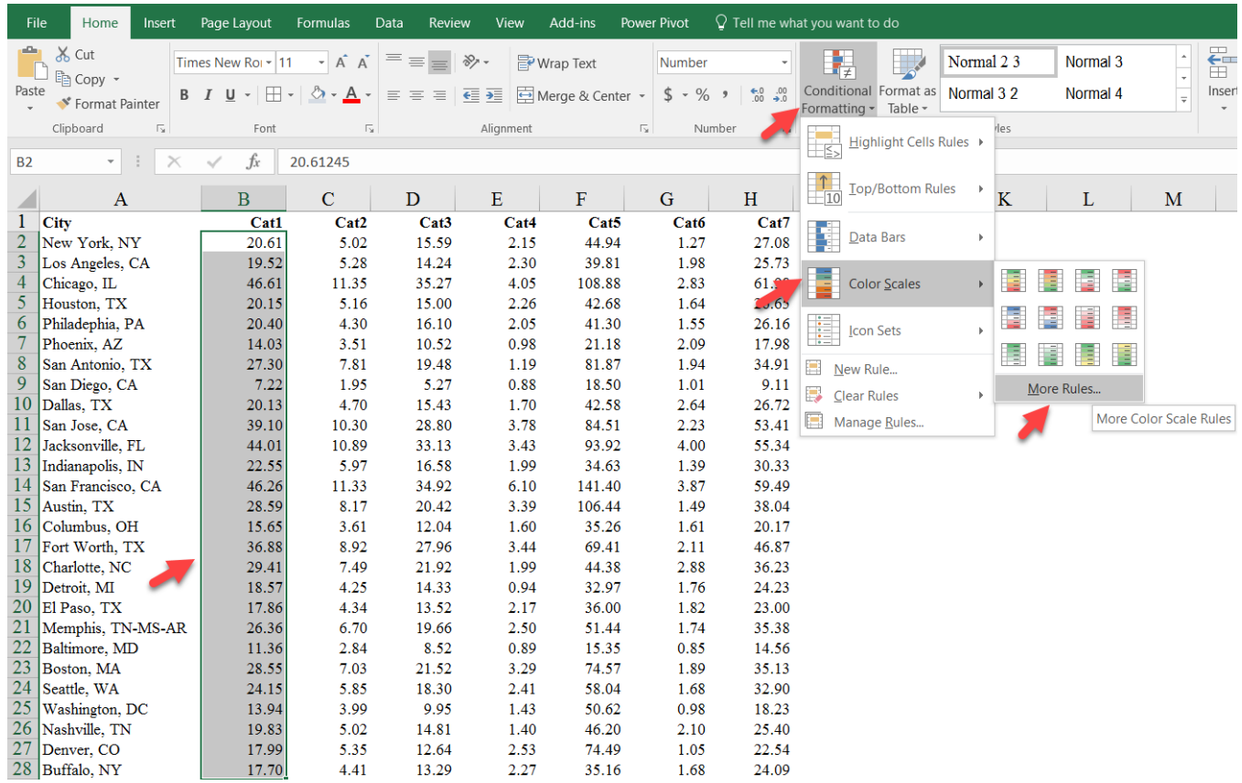

This visualization is relatively easy to create using Excel's Conditional Formatting menu and then a little trick to hide the numbers. Use the *Heatmap tab* in the *Advanced Data Visualizations with Excel 2016 Hands-On.xlsx spreadsheet* to create the chart.

1. The basic data for this example consists of 7 variables for 28 cities, laid out in a simple grid. We want to show frequency for each category.

Gridlines are turned off for this worksheet.

| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 1 | **City** | **Cat1** | **Cat2** | **Cat3** | **Cat4** | **Cat5** | **Cat6** | **Cat7** |
| 2 | New York, NY | 20.61 | 5.02 | 15.59 | 2.15 | 44.94 | 1.27 | 27.08 |
| 3 | Los Angeles, CA | 19.52 | 5.28 | 14.24 | 2.30 | 39.81 | 1.98 | 25.73 |
| 4 | Chicago, IL | 46.61 | 11.35 | 35.27 | 4.05 | 108.88 | 2.83 | 61.98 |
| 5 | Houston, TX | 20.15 | 5.16 | 15.00 | 2.26 | 42.68 | 1.64 | 26.65 |
| 6 | Philadephia, PA | 20.40 | 4.30 | 16.10 | 2.05 | 41.30 | 1.55 | 26.16 |
| 7 | Phoenix, AZ | 14.03 | 3.51 | 10.52 | 0.98 | 21.18 | 2.09 | 17.98 |
| 8 | San Antonio, TX | 27.30 | 7.81 | 19.48 | 1.19 | 81.87 | 1.94 | 34.91 |
| 9 | San Diego, CA | 7.22 | 1.95 | 5.27 | 0.88 | 18.50 | 1.01 | 9.11 |
| 10 | Dallas, TX | 20.13 | 4.70 | 15.43 | 1.70 | 42.58 | 2.64 | 26.72 |
| 11 | San Jose, CA | 39.10 | 10.30 | 28.80 | 3.78 | 84.51 | 2.23 | 53.41 |
| 12 | Jacksonville, FL | 44.01 | 10.89 | 33.13 | 3.43 | 93.92 | 4.00 | 55.34 |
| 13 | Indianapolis, IN | 22.55 | 5.97 | 16.58 | 1.99 | 34.63 | 1.39 | 30.33 |
| 14 | San Francisco, CA | 46.26 | 11.33 | 34.92 | 6.10 | 141.40 | 3.87 | 59.49 |
| 15 | Austin, TX | 28.59 | 8.17 | 20.42 | 3.39 | 106.44 | 1.49 | 38.04 |
| 16 | Columbus, OH | 15.65 | 3.61 | 12.04 | 1.60 | 35.26 | 1.61 | 20.17 |
| 17 | Fort Worth, TX | 36.88 | 8.92 | 27.96 | 3.44 | 69.41 | 2.11 | 46.87 |
| 18 | Charlotte, NC | 29.41 | 7.49 | 21.92 | 1.99 | 44.38 | 2.88 | 36.23 |
| 19 | Detroit, MI | 18.57 | 4.25 | 14.33 | 0.94 | 32.97 | 1.76 | 24.23 |
| 20 | El Paso, TX | 17.86 | 4.34 | 13.52 | 2.17 | 36.00 | 1.82 | 23.00 |
| 21 | Memphis, TN-MS-AR | 26.36 | 6.70 | 19.66 | 2.50 | 51.44 | 1.74 | 35.38 |
| 22 | Baltimore, MD | 11.36 | 2.84 | 8.52 | 0.89 | 15.35 | 0.85 | 14.56 |
| 23 | Boston, MA | 28.55 | 7.03 | 21.52 | 3.29 | 74.57 | 1.89 | 35.13 |
| 24 | Seattle, WA | 24.15 | 5.85 | 18.30 | 2.41 | 58.04 | 1.68 | 32.90 |
| 25 | Washington, DC | 13.94 | 3.99 | 9.95 | 1.43 | 50.62 | 0.98 | 18.23 |
| 26 | Nashville, TN | 19.83 | 5.02 | 14.81 | 1.40 | 46.20 | 2.10 | 25.40 |
| 27 | Denver, CO | 17.99 | 5.35 | 12.64 | 2.53 | 74.49 | 1.05 | 22.54 |
| 28 | Buffalo, NY | 17.70 | 4.41 | 13.29 | 2.27 | 35.16 | 1.68 | 24.09 |
| 29 | | | | | | | | |

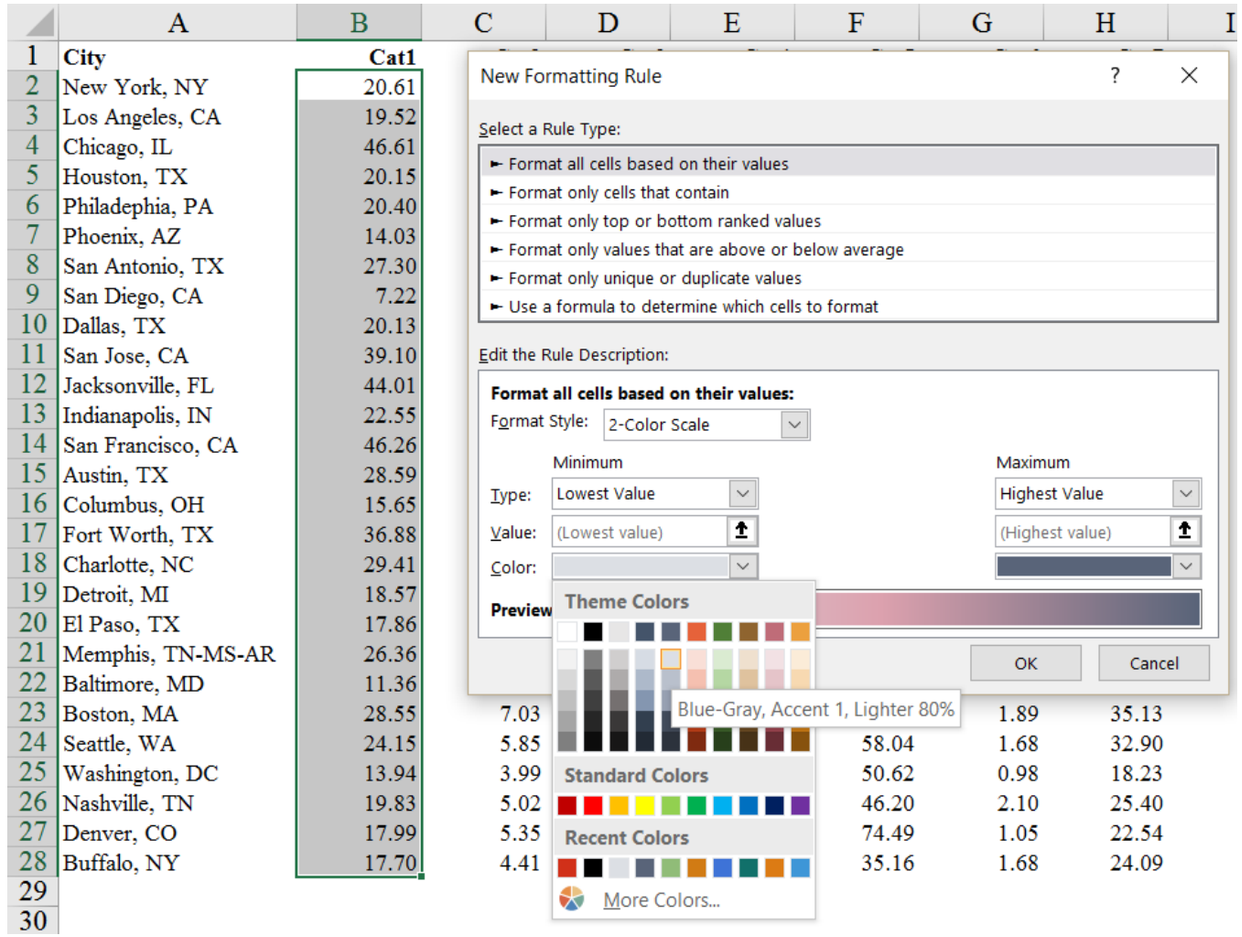
2. To add color to the cells using Conditional Formatting, select the first category (cells B2:B28) and open the “Color Scales” option in the Conditional Formatting dropdown found in the “Home” tab. Select the “More Rules…” option.




| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 1 | City | Cat1 | Cat2 | Cat3 | Cat4 | Cat5 | Cat6 | Cat7 |
| 2 | New York, NY | 20.61 | 5.02 | 15.59 | 2.15 | 44.94 | 1.27 | 27.08 |
| 3 | Los Angeles, CA | 19.52 | 5.28 | 14.24 | 2.30 | 39.81 | 1.98 | 25.73 |
| 4 | Chicago, IL | 46.61 | 11.35 | 35.27 | 4.05 | 108.88 | 2.83 | 61.88 |
| 5 | Houston, TX | 20.15 | 5.16 | 15.00 | 2.26 | 42.68 | 1.64 | 26.65 |
| 6 | Philadephia, PA | 20.40 | 4.30 | 16.10 | 2.05 | 41.30 | 1.55 | 26.16 |
| 7 | Phoenix, AZ | 14.03 | 3.51 | 10.52 | 0.98 | 21.18 | 2.09 | 17.98 |
| 8 | San Antonio, TX | 27.30 | 7.81 | 19.48 | 1.19 | 81.87 | 1.94 | 34.91 |
| 9 | San Diego, CA | 7.22 | 1.95 | 5.27 | 0.88 | 18.50 | 1.01 | 9.11 |
| 10 | Dallas, TX | 20.13 | 4.70 | 15.43 | 1.70 | 42.58 | 2.64 | 26.72 |
| 11 | San Jose, CA | 39.10 | 10.30 | 28.80 | 3.78 | 84.51 | 2.23 | 53.41 |
| 12 | Jacksonville, FL | 44.01 | 10.89 | 33.13 | 3.43 | 93.92 | 4.00 | 55.34 |
| 13 | Indianapolis, IN | 22.55 | 5.97 | 16.58 | 1.99 | 34.63 | 1.39 | 30.33 |
| 14 | San Francisco, CA | 46.26 | 11.33 | 34.92 | 6.10 | 141.40 | 3.87 | 59.49 |
| 15 | Austin, TX | 28.59 | 8.17 | 20.42 | 3.39 | 106.44 | 1.49 | 38.04 |
| 16 | Columbus, OH | 15.65 | 3.61 | 12.04 | 1.60 | 35.26 | 1.61 | 20.17 |
| 17 | Fort Worth, TX | 36.88 | 8.92 | 27.96 | 3.44 | 69.41 | 2.11 | 46.87 |
| 18 | Charlotte, NC | 29.41 | 7.49 | 21.92 | 1.99 | 44.38 | 2.88 | 36.23 |
| 19 | Detroit, MI | 18.57 | 4.25 | 14.33 | 0.94 | 32.97 | 1.76 | 24.23 |
| 20 | El Paso, TX | 17.86 | 4.34 | 13.52 | 2.17 | 36.00 | 1.82 | 23.00 |
| 21 | Memphis, TN-MS-AR | 26.36 | 6.70 | 19.66 | 2.50 | 51.44 | 1.74 | 35.38 |
| 22 | Baltimore, MD | 11.36 | 2.84 | 8.52 | 0.89 | 15.35 | 0.85 | 14.56 |
| 23 | Boston, MA | 28.55 | 7.03 | 21.52 | 3.29 | 74.57 | 1.89 | 35.13 |
| 24 | Seattle, WA | 24.15 | 5.85 | 18.30 | 2.41 | 58.04 | 1.68 | 32.90 |
| 25 | Washington, DC | 13.94 | 3.99 | 9.95 | 1.43 | 50.62 | 0.98 | 18.23 |
| 26 | Nashville, TN | 19.83 | 5.02 | 14.81 | 1.40 | 46.20 | 2.10 | 25.40 |
| 27 | Denver, CO | 17.99 | 5.35 | 12.64 | 2.53 | 74.49 | 1.05 | 22.54 |
| 28 | Buffalo, NY | 17.70 | 4.41 | 13.29 | 2.27 | 35.16 | 1.68 | 24.09 |

If you wanted to show frequency for the entire table instead of by category, you could select your data and choose one of Excel’s predefined color scale options.

3. In the resulting menu, you can select the colors you would like to use. It is customary to use lighter colors for smaller values, and darker colors for larger values. Select the colors in the “Color:” dropdown menu. Click OK.



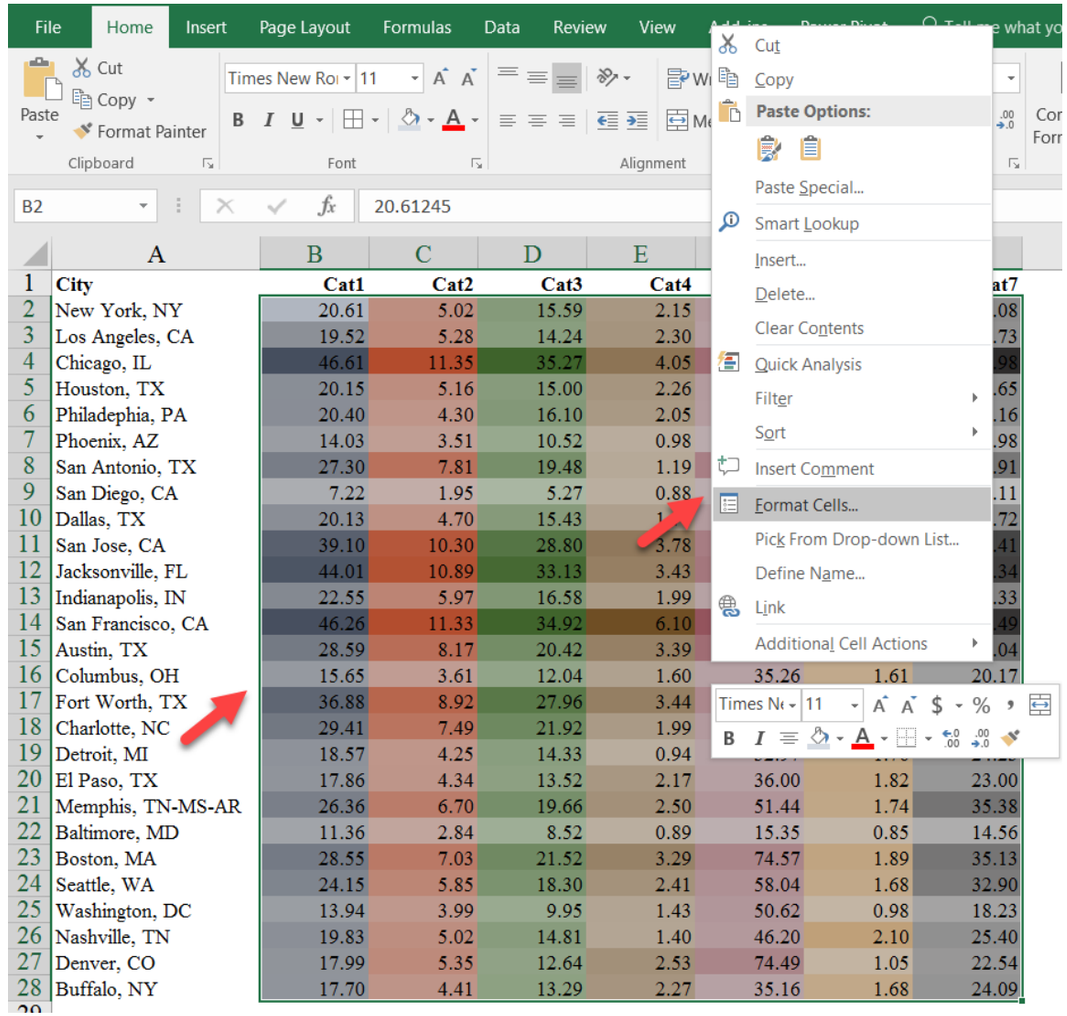
| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 1 | **City** | **Cat1** | **Cat2** | **Cat3** | **Cat4** | **Cat5** | **Cat6** | **Cat7** |
| 2 | New York, NY | 20.61 | 5.02 | 15.59 | 2.15 | 44.94 | 1.27 | 27.08 |
| 3 | Los Angeles, CA | 19.52 | 5.28 | 14.24 | 2.30 | 39.81 | 1.98 | 25.73 |
| 4 | Chicago, IL | 46.61 | 11.35 | 35.27 | 4.05 | 108.88 | 2.83 | 61.98 |
| 5 | Houston, TX | 20.15 | 5.16 | 15.00 | 2.26 | 42.68 | 1.64 | 26.65 |
| 6 | Philadephia, PA | 20.40 | 4.30 | 16.10 | 2.05 | 41.30 | 1.55 | 26.16 |
| 7 | Phoenix, AZ | 14.03 | 3.51 | 10.52 | 0.98 | 21.18 | 2.09 | 17.98 |
| 8 | San Antonio, TX | 27.30 | 7.81 | 19.48 | 1.19 | 81.87 | 1.94 | 34.91 |
| 9 | San Diego, CA | 7.22 | 1.95 | 5.27 | 0.88 | 18.50 | 1.01 | 9.11 |
| 10 | Dallas, TX | 20.13 | 4.70 | 15.43 | 1.70 | 42.58 | 2.64 | 26.72 |
| 11 | San Jose, CA | 39.10 | 10.30 | 28.80 | 3.78 | 84.51 | 2.23 | 53.41 |
| 12 | Jacksonville, FL | 44.01 | 10.89 | 33.13 | 3.43 | 93.92 | 4.00 | 55.34 |
| 13 | Indianapolis, IN | 22.55 | 5.97 | 16.58 | 1.99 | 34.63 | 1.39 | 30.33 |
| 14 | San Francisco, CA | 46.26 | 11.33 | 34.92 | 6.10 | 141.40 | 3.87 | 59.49 |
| 15 | Austin, TX | 28.59 | 8.17 | 20.42 | 3.39 | 106.44 | 1.49 | 38.04 |
| 16 | Columbus, OH | 15.65 | 3.61 | 12.04 | 1.60 | 35.26 | 1.61 | 20.17 |
| 17 | Fort Worth, TX | 36.88 | 8.92 | 27.96 | 3.44 | 69.41 | 2.11 | 46.87 |
| 18 | Charlotte, NC | 29.41 | 7.49 | 21.92 | 1.99 | 44.38 | 2.88 | 36.23 |
| 19 | Detroit, MI | 18.57 | 4.25 | 14.33 | 0.94 | 32.97 | 1.76 | 24.23 |
| 20 | El Paso, TX | 17.86 | 4.34 | 13.52 | 2.17 | 36.00 | 1.82 | 23.00 |
| 21 | Memphis, TN-MS-AR | 26.36 | 6.70 | 19.66 | 2.50 | 51.44 | 1.74 | 35.38 |
| 22 | Baltimore, MD | 11.36 | 2.84 | 8.52 | 0.89 | 15.35 | 0.85 | 14.56 |
| 23 | Boston, MA | 28.55 | 7.03 | 21.52 | 3.29 | 74.57 | 1.89 | 35.13 |
| 24 | Seattle, WA | 24.15 | 5.85 | 18.30 | 2.41 | 58.04 | 1.68 | 32.90 |
| 25 | Washington, DC | 13.94 | 3.99 | 9.95 | 1.43 | 50.62 | 0.98 | 18.23 |
| 26 | Nashville, TN | 19.83 | 5.02 | 14.81 | 1.40 | 46.20 | 2.10 | 25.40 |
| 27 | Denver, CO | 17.99 | 5.35 | 12.64 | 2.53 | 74.49 | 1.05 | 22.54 |
| 28 | Buffalo, NY | 17.70 | 4.41 | 13.29 | 2.27 | 35.16 | 1.68 | 24.09 |

The column will now be shaded with the colors selected.

4. Repeat the process separately for the remaining columns.

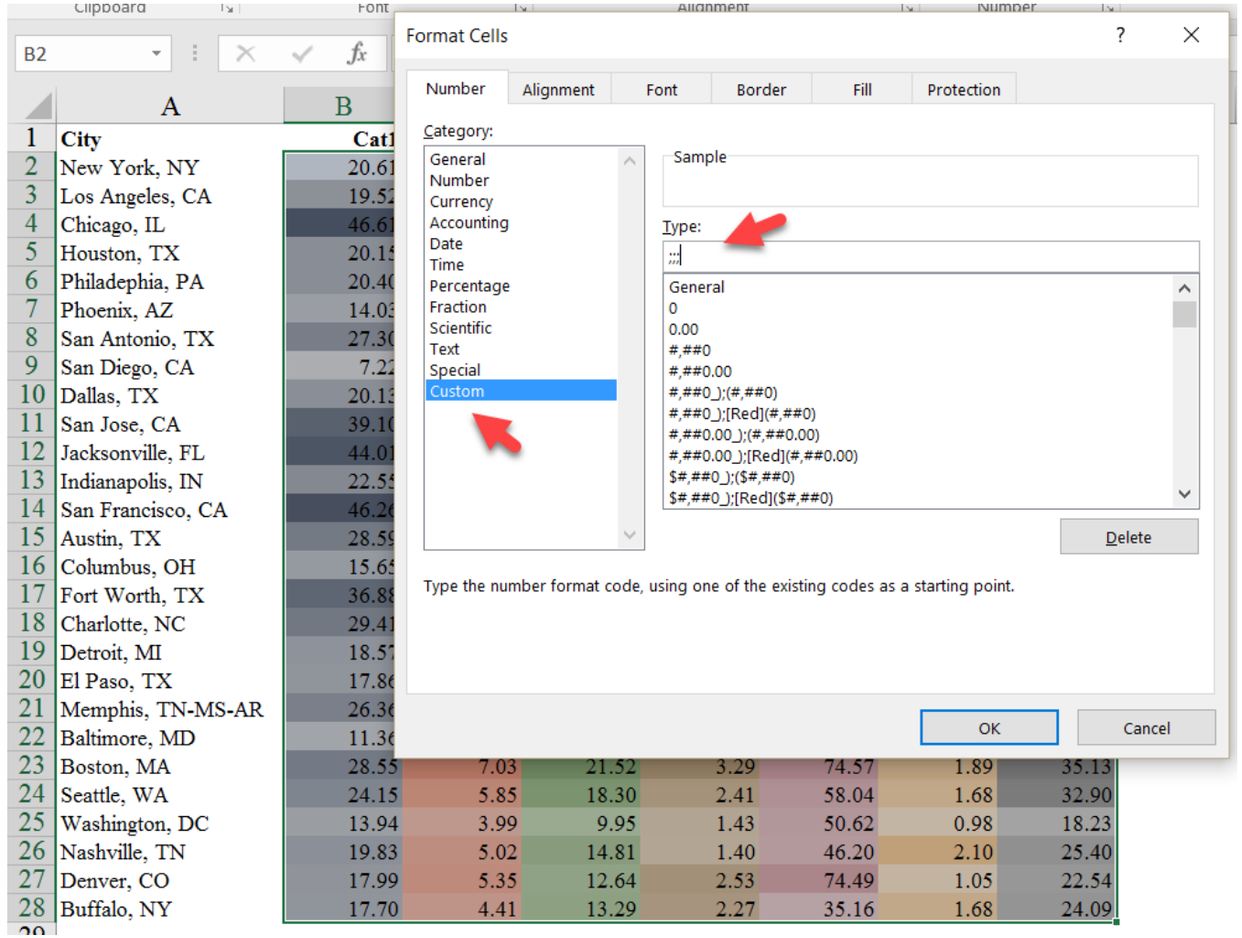
| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 1 | **City** | **Cat1** | **Cat2** | **Cat3** | **Cat4** | **Cat5** | **Cat6** | **Cat7** |
| 2 | New York, NY | 20.61 | 5.02 | 15.59 | 2.15 | 44.94 | 1.27 | 27.08 |
| 3 | Los Angeles, CA | 19.52 | 5.28 | 14.24 | 2.30 | 39.81 | 1.98 | 25.73 |
| 4 | Chicago, IL | 46.61 | 11.35 | 35.27 | 4.05 | 108.88 | 2.83 | 61.98 |
| 5 | Houston, TX | 20.15 | 5.16 | 15.00 | 2.26 | 42.68 | 1.64 | 26.65 |
| 6 | Philadephia, PA | 20.40 | 4.30 | 16.10 | 2.05 | 41.30 | 1.55 | 26.16 |
| 7 | Phoenix, AZ | 14.03 | 3.51 | 10.52 | 0.98 | 21.18 | 2.09 | 17.98 |
| 8 | San Antonio, TX | 27.30 | 7.81 | 19.48 | 1.19 | 81.87 | 1.94 | 34.91 |
| 9 | San Diego, CA | 7.22 | 1.95 | 5.27 | 0.88 | 18.50 | 1.01 | 9.11 |
| 10 | Dallas, TX | 20.13 | 4.70 | 15.43 | 1.70 | 42.58 | 2.64 | 26.72 |
| 11 | San Jose, CA | 39.10 | 10.30 | 28.80 | 3.78 | 84.51 | 2.23 | 53.41 |
| 12 | Jacksonville, FL | 44.01 | 10.89 | 33.13 | 3.43 | 93.92 | 4.00 | 55.34 |
| 13 | Indianapolis, IN | 22.55 | 5.97 | 16.58 | 1.99 | 34.63 | 1.39 | 30.33 |
| 14 | San Francisco, CA | 46.26 | 11.33 | 34.92 | 6.10 | 141.40 | 3.87 | 59.49 |
| 15 | Austin, TX | 28.59 | 8.17 | 20.42 | 3.39 | 106.44 | 1.49 | 38.04 |
| 16 | Columbus, OH | 15.65 | 3.61 | 12.04 | 1.60 | 35.26 | 1.61 | 20.17 |
| 17 | Fort Worth, TX | 36.88 | 8.92 | 27.96 | 3.44 | 69.41 | 2.11 | 46.87 |
| 18 | Charlotte, NC | 29.41 | 7.49 | 21.92 | 1.99 | 44.38 | 2.88 | 36.23 |
| 19 | Detroit, MI | 18.57 | 4.25 | 14.33 | 0.94 | 32.97 | 1.76 | 24.23 |
| 20 | El Paso, TX | 17.86 | 4.34 | 13.52 | 2.17 | 36.00 | 1.82 | 23.00 |
| 21 | Memphis, TN-MS-AR | 26.36 | 6.70 | 19.66 | 2.50 | 51.44 | 1.74 | 35.38 |
| 22 | Baltimore, MD | 11.36 | 2.84 | 8.52 | 0.89 | 15.35 | 0.85 | 14.56 |
| 23 | Boston, MA | 28.55 | 7.03 | 21.52 | 3.29 | 74.57 | 1.89 | 35.13 |
| 24 | Seattle, WA | 24.15 | 5.85 | 18.30 | 2.41 | 58.04 | 1.68 | 32.90 |
| 25 | Washington, DC | 13.94 | 3.99 | 9.95 | 1.43 | 50.62 | 0.98 | 18.23 |
| 26 | Nashville, TN | 19.83 | 5.02 | 14.81 | 1.40 | 46.20 | 2.10 | 25.40 |
| 27 | Denver, CO | 17.99 | 5.35 | 12.64 | 2.53 | 74.49 | 1.05 | 22.54 |
| 28 | Buffalo, NY | 17.70 | 4.41 | 13.29 | 2.27 | 35.16 | 1.68 | 24.09 |
| 29 | | | | | | | | |

5. The last task is to hide the numbers. You can't delete them because the shading would then disappear, and you can't turn them to white (to match the background) because they would then show through the colors. Instead, it's a small formatting trick. Highlight the 7 columns of data and right-click (or use the CTRL-1 keyboard shortcut) to select "Format Cells".




| | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| 1 | City | Cat1 | Cat2 | Cat3 | Cat4 | | |
| 2 | New York, NY | 20.61 | 5.02 | 15.59 | 2.15 | | |
| 3 | Los Angeles, CA | 19.52 | 5.28 | 14.24 | 2.30 | | |
| 4 | Chicago, IL | 46.61 | 11.35 | 35.27 | 4.05 | | |
| 5 | Houston, TX | 20.15 | 5.16 | 15.00 | 2.26 | | |
| 6 | Philadephia, PA | 20.40 | 4.30 | 16.10 | 2.05 | | |
| 7 | Phoenix, AZ | 14.03 | 3.51 | 10.52 | 0.98 | | |
| 8 | San Antonio, TX | 27.30 | 7.81 | 19.48 | 1.19 | | |
| 9 | San Diego, CA | 7.22 | 1.95 | 5.27 | 0.88 | | |
| 10 | Dallas, TX | 20.13 | 4.70 | 15.43 | | | |
| 11 | San Jose, CA | 39.10 | 10.30 | 28.80 | 3.78 | | |
| 12 | Jacksonville, FL | 44.01 | 10.89 | 33.13 | 3.43 | | |
| 13 | Indianapolis, IN | 22.55 | 5.97 | 16.58 | 1.99 | | |
| 14 | San Francisco, CA | 46.26 | 11.33 | 34.92 | 6.10 | | |
| 15 | Austin, TX | 28.59 | 8.17 | 20.42 | 3.39 | | |
| 16 | Columbus, OH | 15.65 | 3.61 | 12.04 | 1.60 | 35.26 | 1.61 |
| 17 | Fort Worth, TX | 36.88 | 8.92 | 27.96 | 3.44 | | |
| 18 | Charlotte, NC | 29.41 | 7.49 | 21.92 | 1.99 | | |
| 19 | Detroit, MI | 18.57 | 4.25 | 14.33 | 0.94 | | |
| 20 | El Paso, TX | 17.86 | 4.34 | 13.52 | 2.17 | 36.00 | 1.82 |
| 21 | Memphis, TN-MS-AR | 26.36 | 6.70 | 19.66 | 2.50 | 51.44 | 1.74 |
| 22 | Baltimore, MD | 11.36 | 2.84 | 8.52 | 0.89 | 15.35 | 0.85 |
| 23 | Boston, MA | 28.55 | 7.03 | 21.52 | 3.29 | 74.57 | 1.89 |
| 24 | Seattle, WA | 24.15 | 5.85 | 18.30 | 2.41 | 58.04 | 1.68 |
| 25 | Washington, DC | 13.94 | 3.99 | 9.95 | 1.43 | 50.62 | 0.98 |
| 26 | Nashville, TN | 19.83 | 5.02 | 14.81 | 1.40 | 46.20 | 2.10 |
| 27 | Denver, CO | 17.99 | 5.35 | 12.64 | 2.53 | 74.49 | 1.05 |
| 28 | Buffalo, NY | 17.70 | 4.41 | 13.29 | 2.27 | 35.16 | 1.68 |

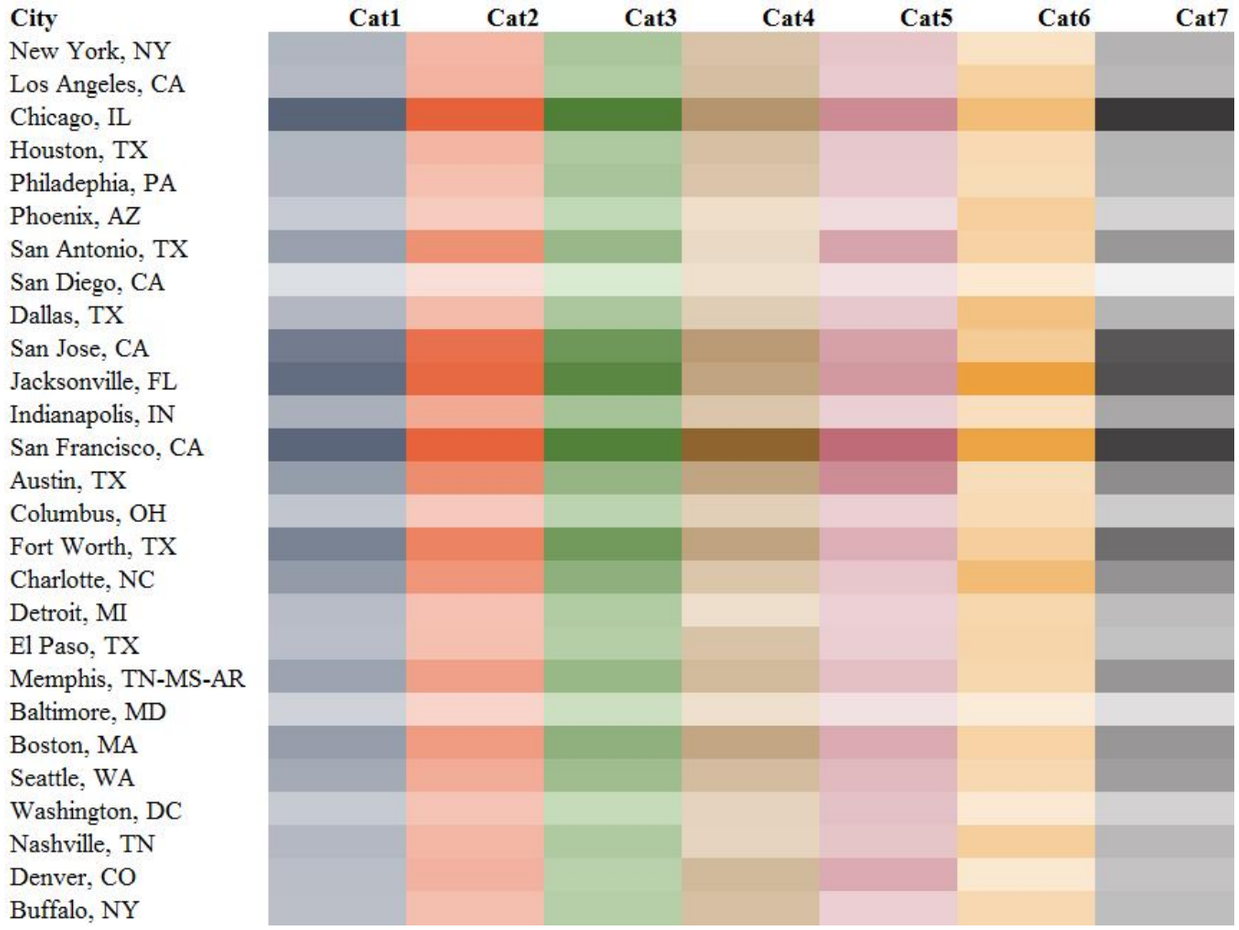
6. Select the “Custom” option at the bottom of the “Category:” menu. Type 3 semicolons (;;;) in the “Type:” box.



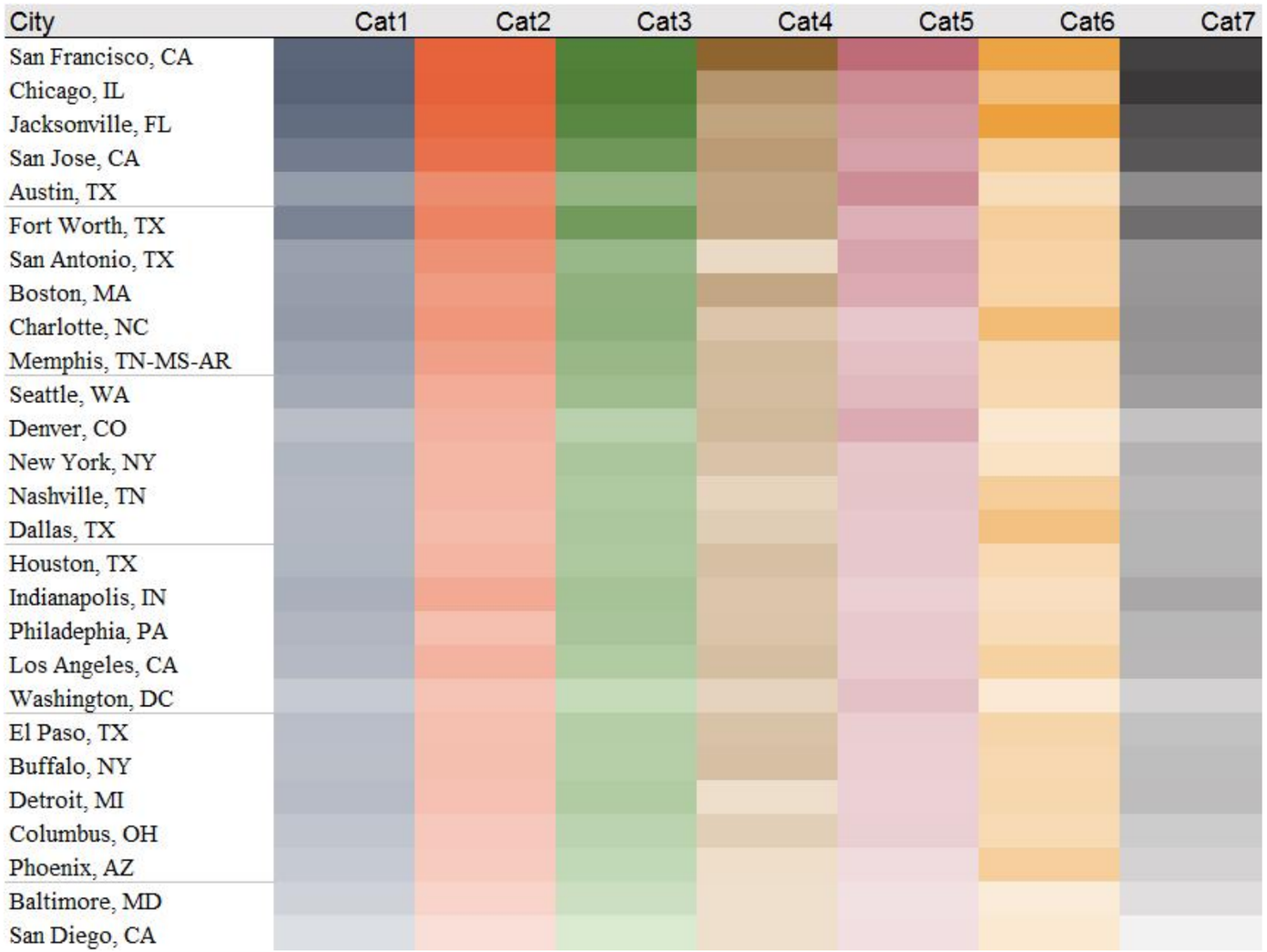
7. Press OK. This number format hides the numbers; they are still in the cells and can be used and manipulated, and the colors remain.

To make your heat map even easier to understand,

- Average the category numbers by city and sort largest to smallest, or
- Sort by city name, or
- Sort by state.

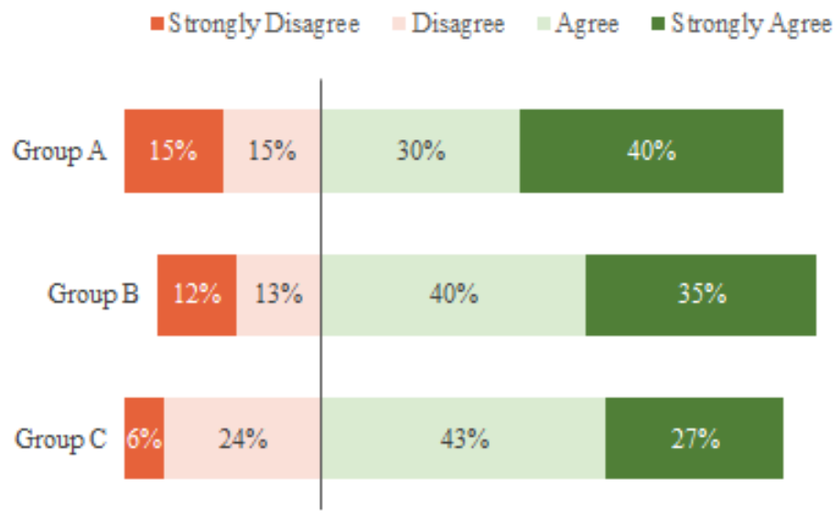


# Final Version with Styling

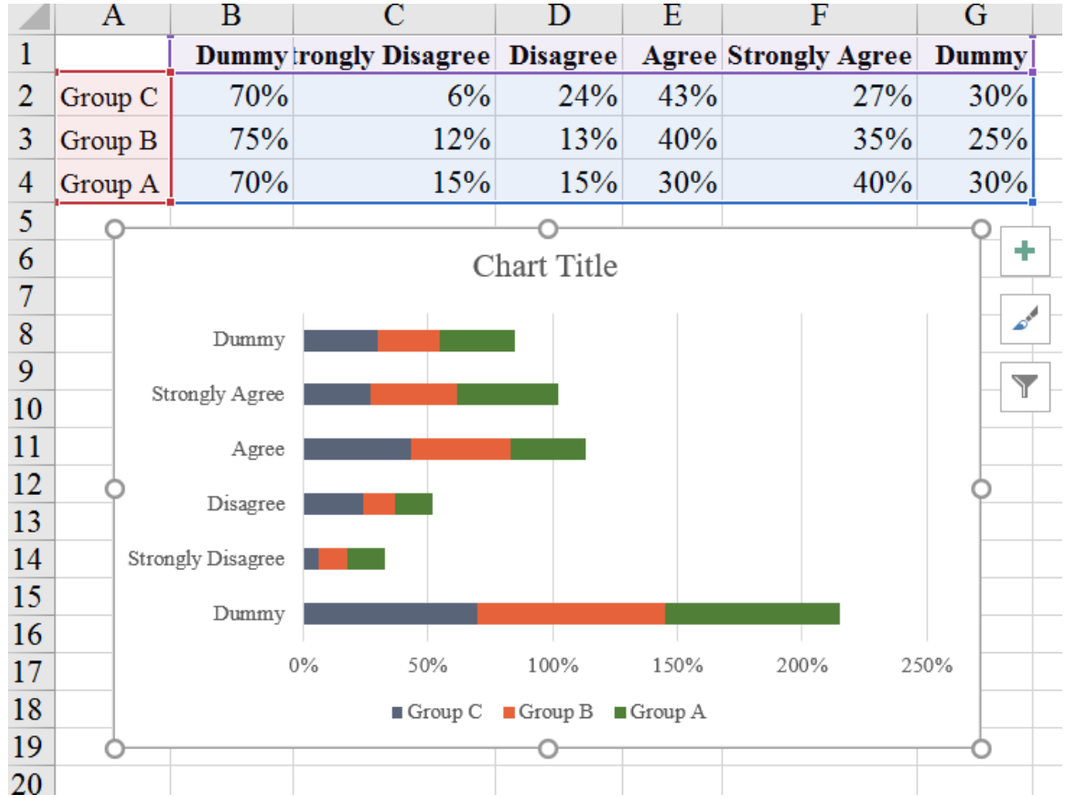


# Diverging Bars

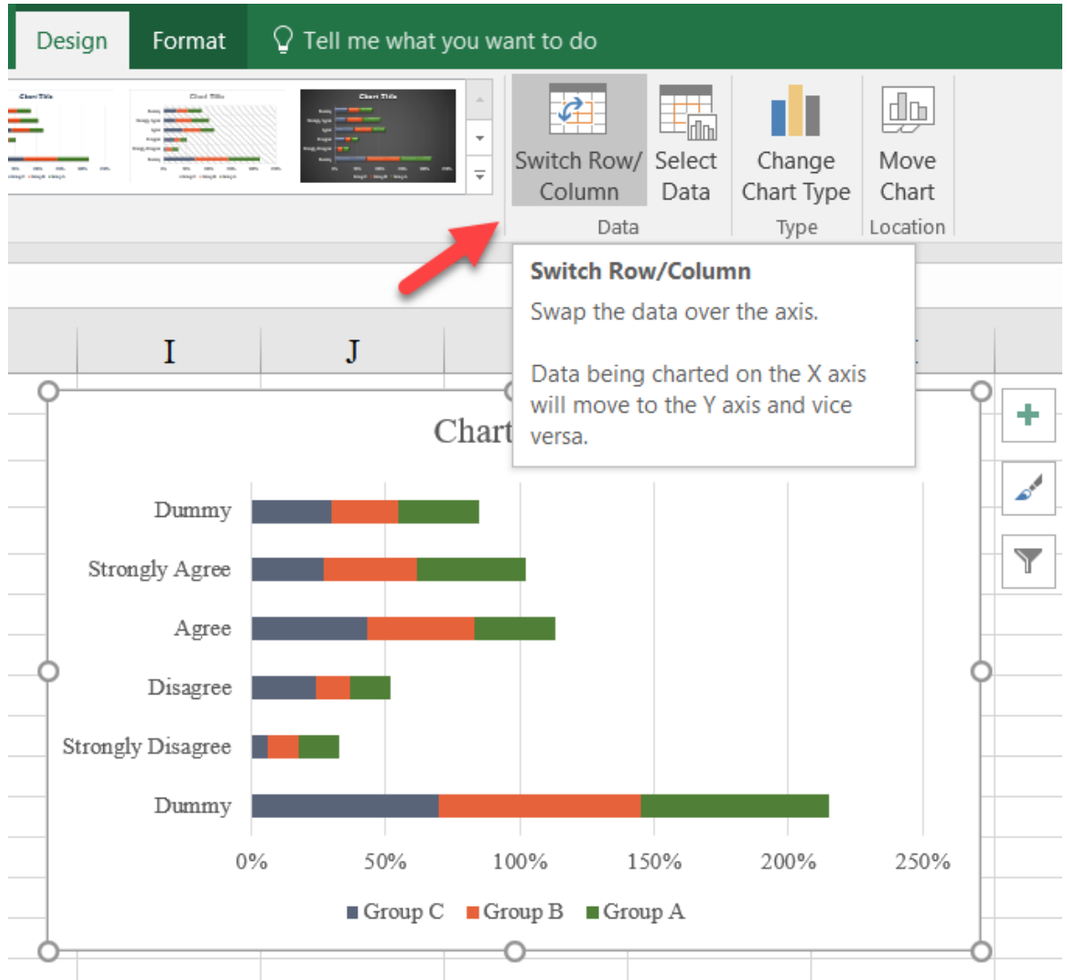
Diverging bar charts are great for showing the differences of negative and positive values, such as Strongly Agree to Strongly Disagree. Because they align around a central (neutral) value, it can be clearer to show these categories diverging from a single midpoint. Use the *DivergingBars tab* in the *Advanced Data Visualizations with Excel 2016 Hands-On.xlsx spreadsheet* to create the chart.



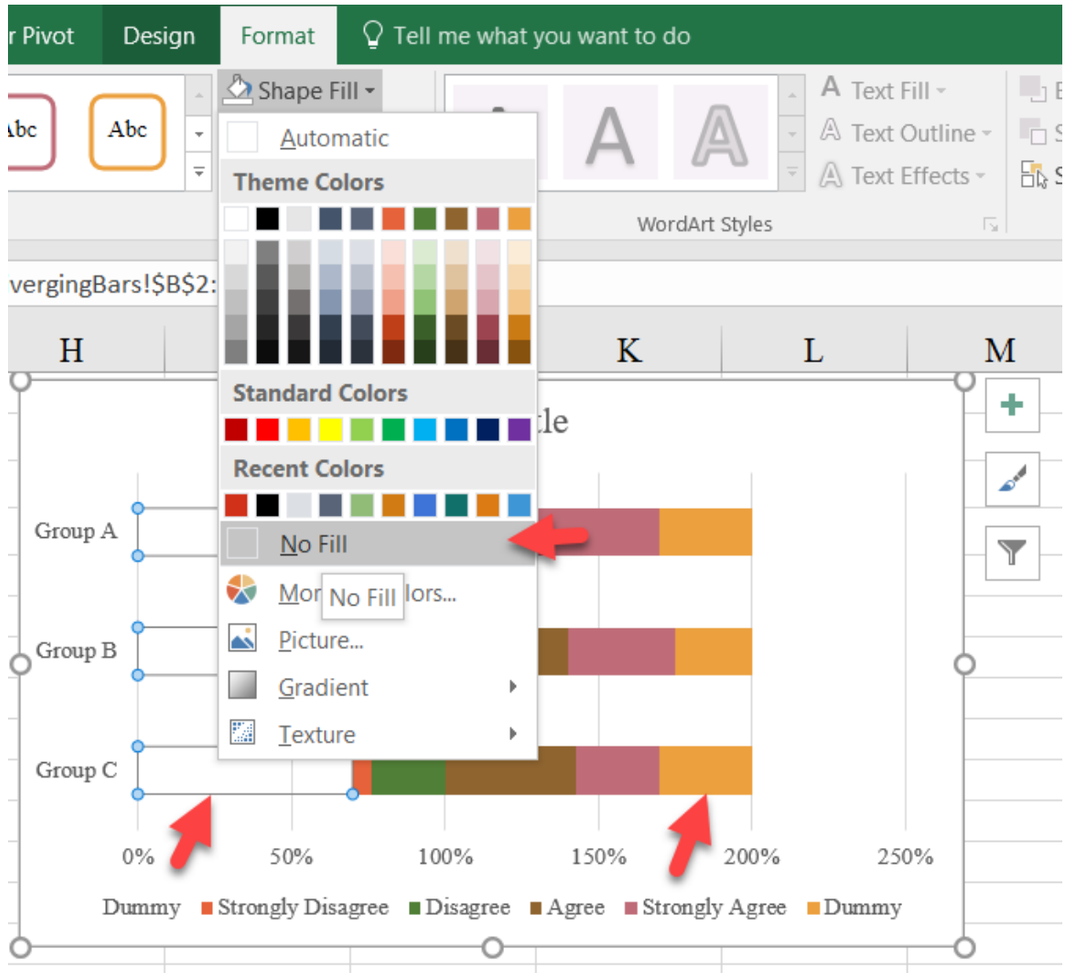
1. Create a stacked bar chart using cells A1:G4. You'll notice that Excel creates the chart along the columns, but we want to plot the data along the rows. (You can also select the second option on the right when you initially insert the chart.)



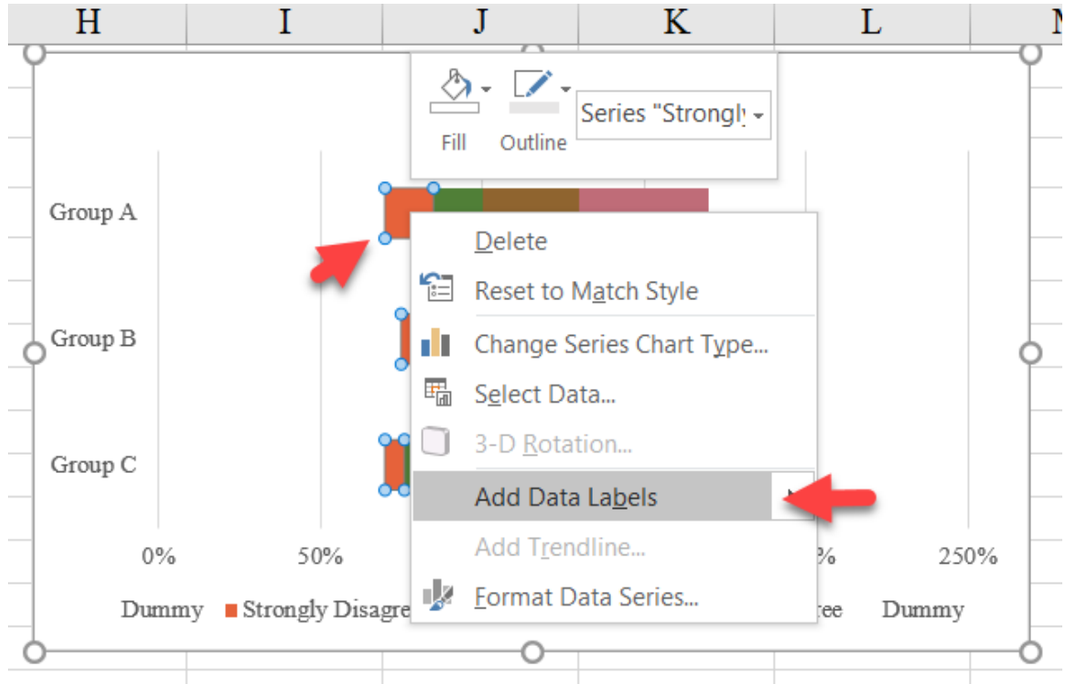
2. To switch this, select the “Switch Row/Column” button in the “Design” tab of the ribbon.



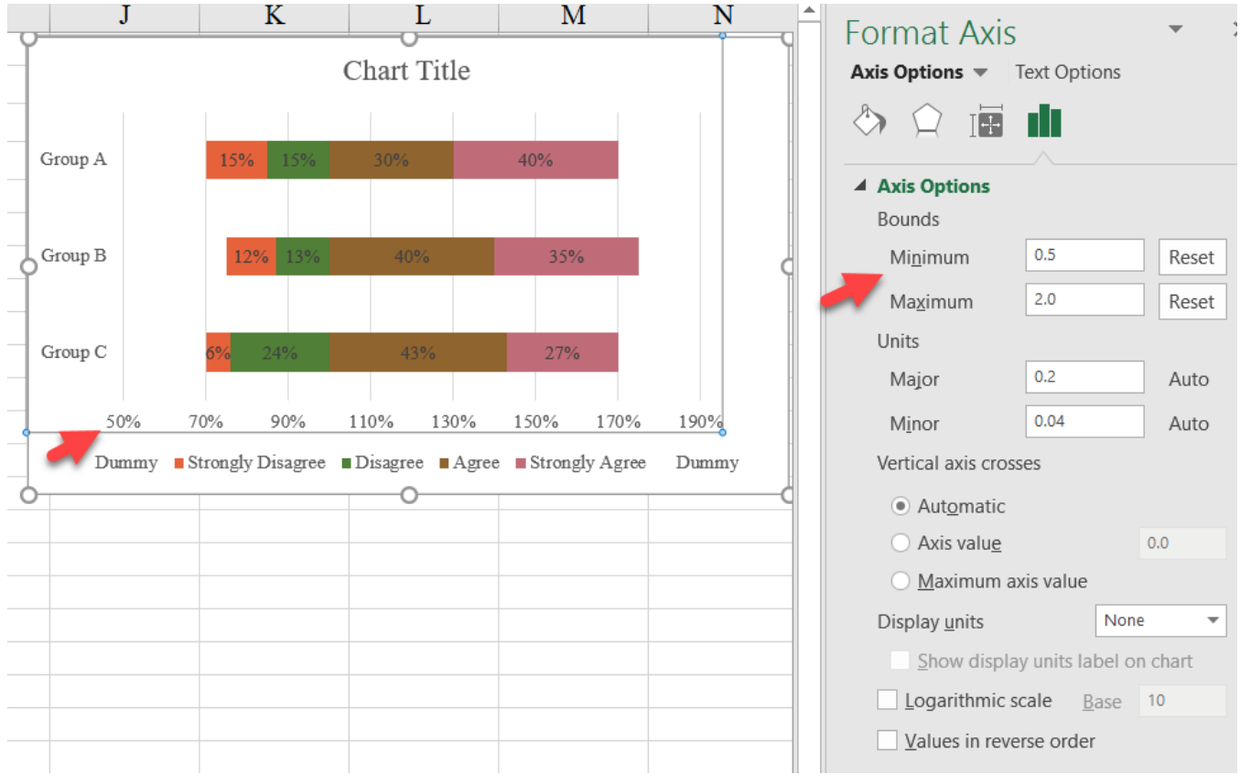
3. The “Dummy” series are just used as fillers, so set the “Fill” on those series to “No Fill” using the “Shape Fill” menu in the “Format” tab of the ribbon.



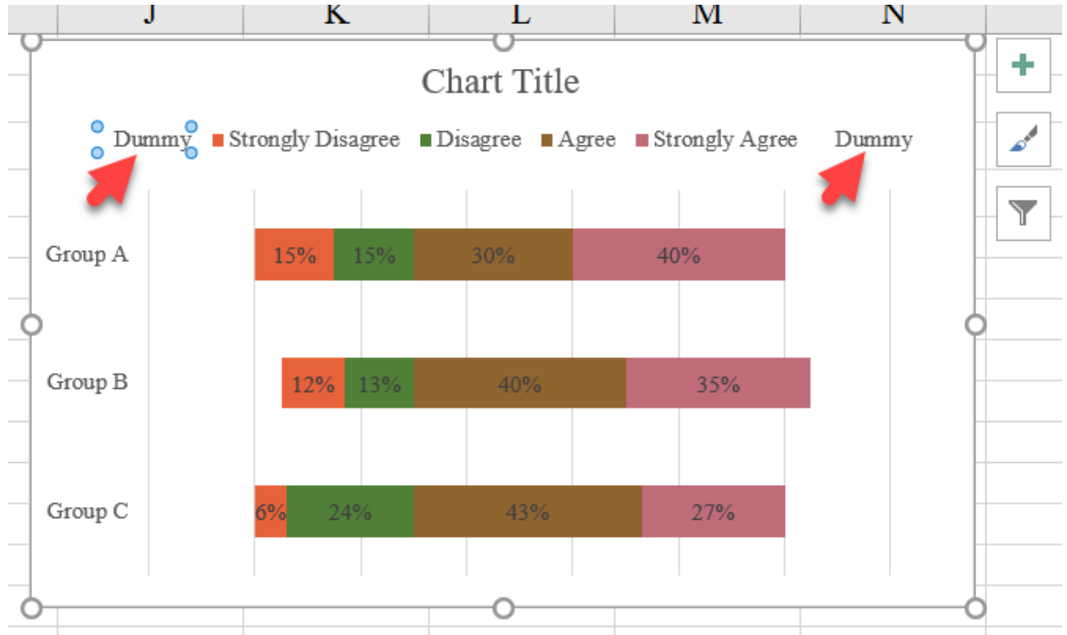
4. Add data labels to each series by right-clicking and selecting the “Add Data Labels…” option from the menu.



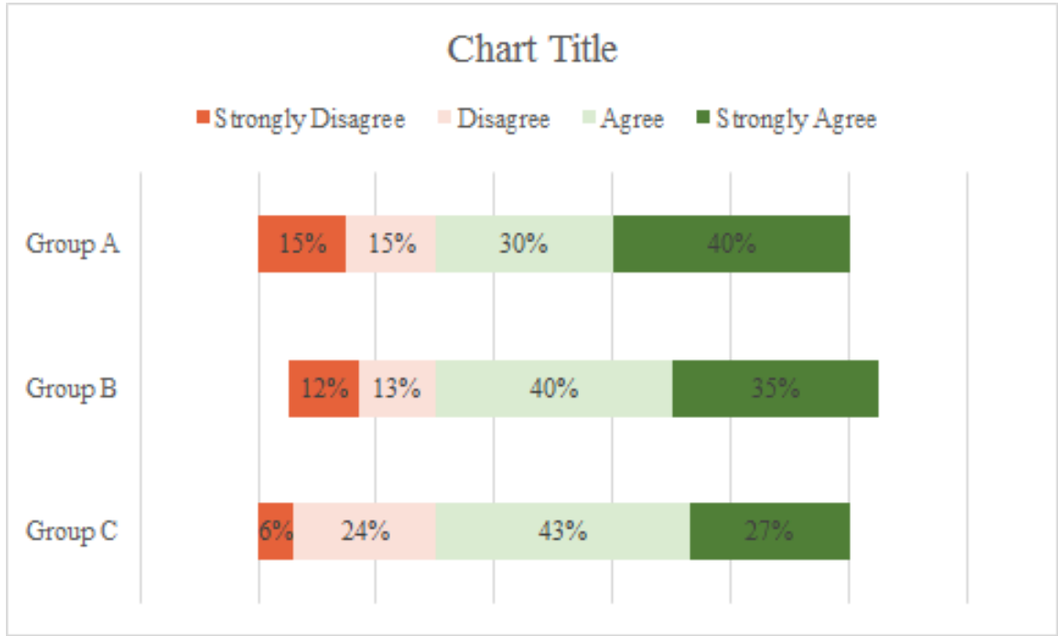
5. Change the range of the x-axis (again, by right-clicking or CTRL-1) to .5 for minimum and 2 for maximum to use more of the space. You can also delete the x-axis because the x-axis labels are essentially meaningless.



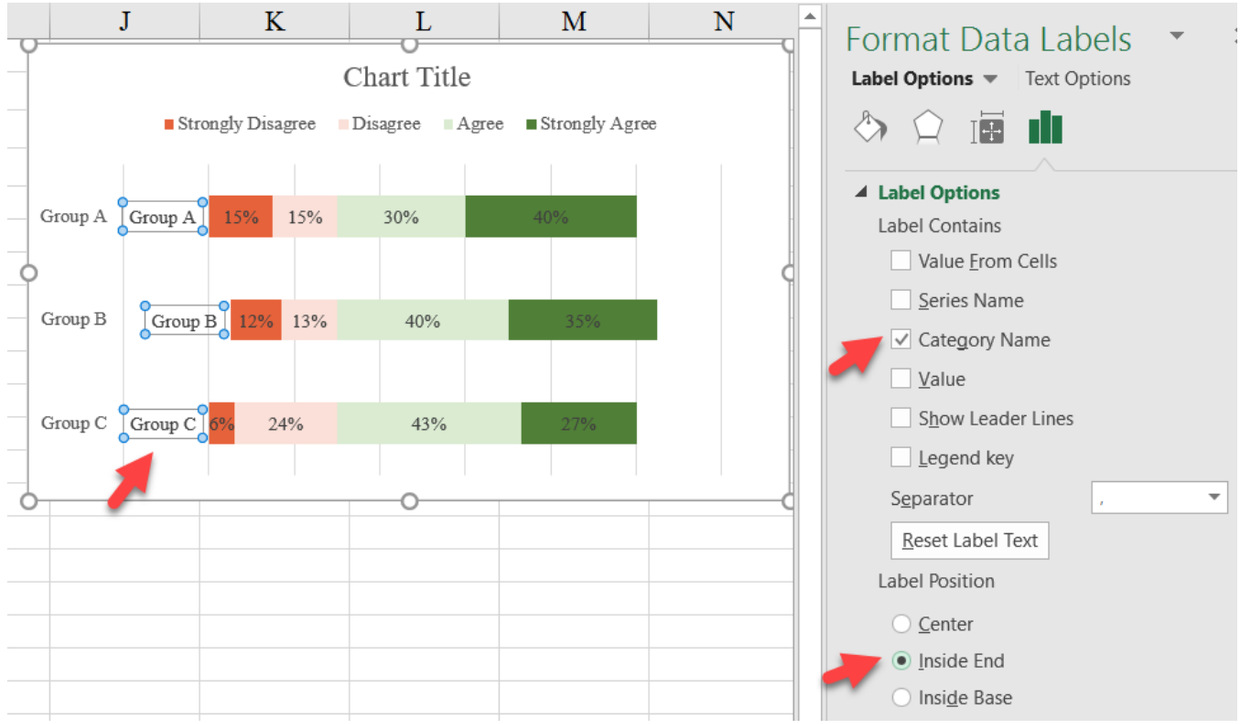
6. Move the Legend to the top of the chart. Remove the "Dummy" series labels by individually selecting and deleting them.



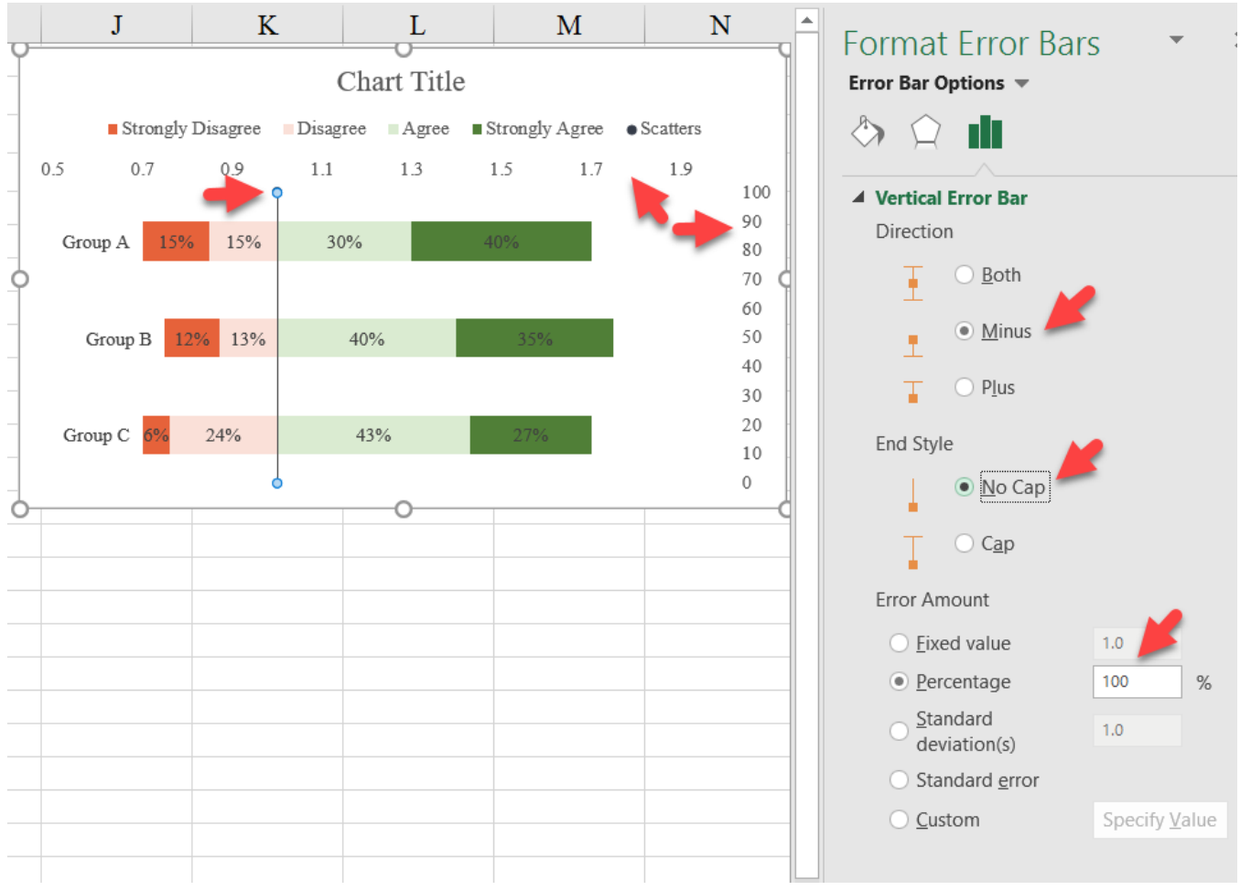
7. Finally, recolor the series as you wish, with different color palettes for either side.



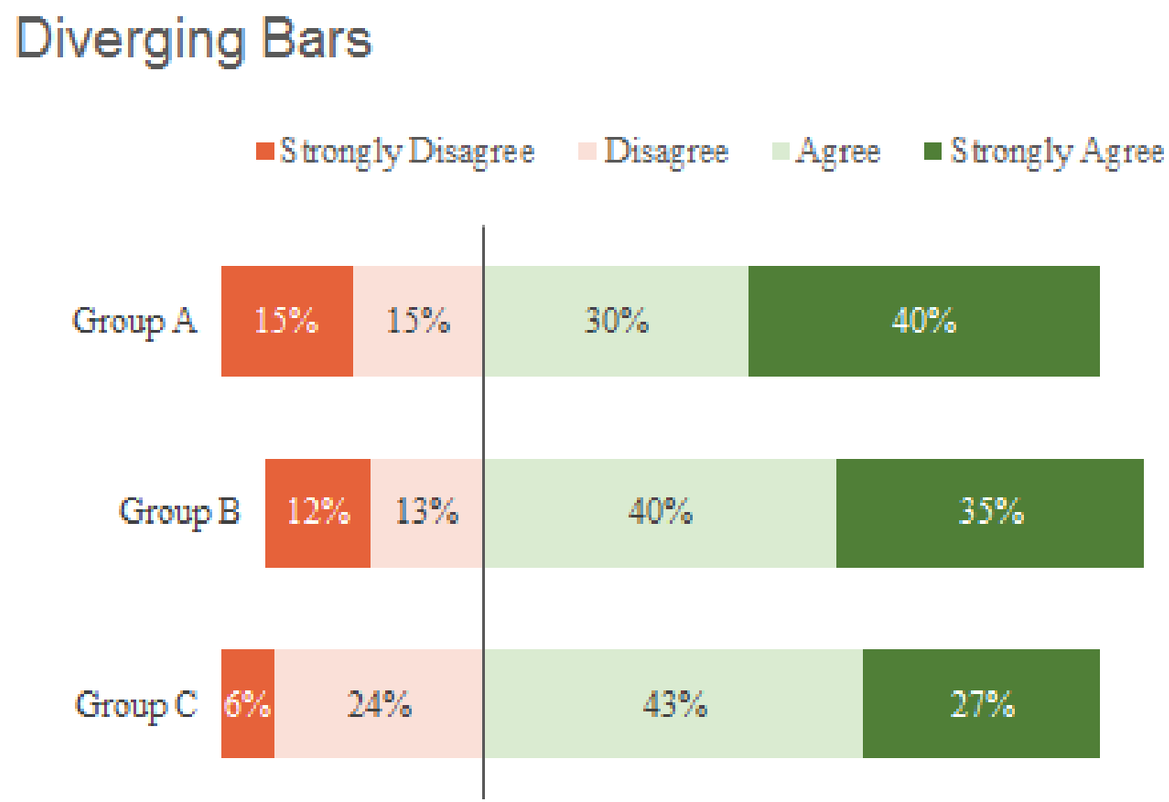
If you wish to place the “Group” labels closer to the chart, you can label the first “Dummy” series; right-click (or CTRL-1) on that series, and change the “Label Contains” option to “Category Name” and place the “Label Position” at the “Inside End”. Then delete the vertical axis.



You can also add a vertical bar at the midpoint by adding a scatterplot to the chart. Right-click on the chart and choose “Select Data” from the menu. Add the new series (“Vertical” in row 23) and change to a scatterplot (see some of the other tutorials on how to do so). This new scatterplot will be pegged to the “Secondary Axis”, so you just need to modify the secondary horizontal and vertical axes to place the point in the correct position. Once positioned, add a vertical error bar (see some of the other tutorials on how to do so).

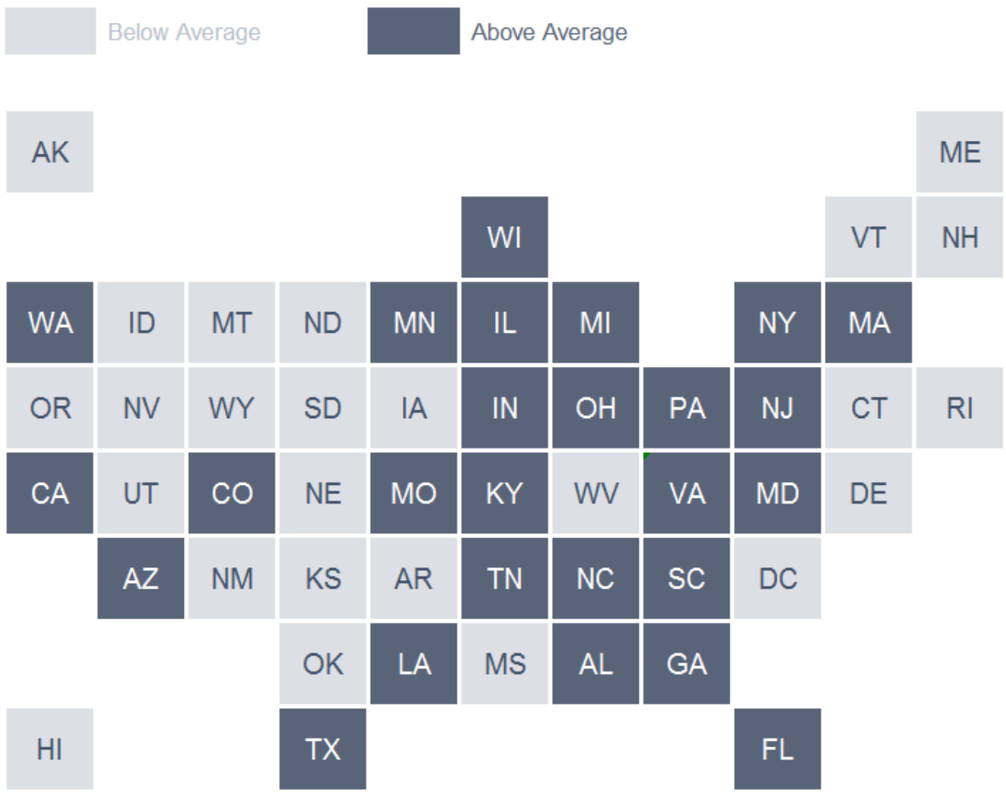


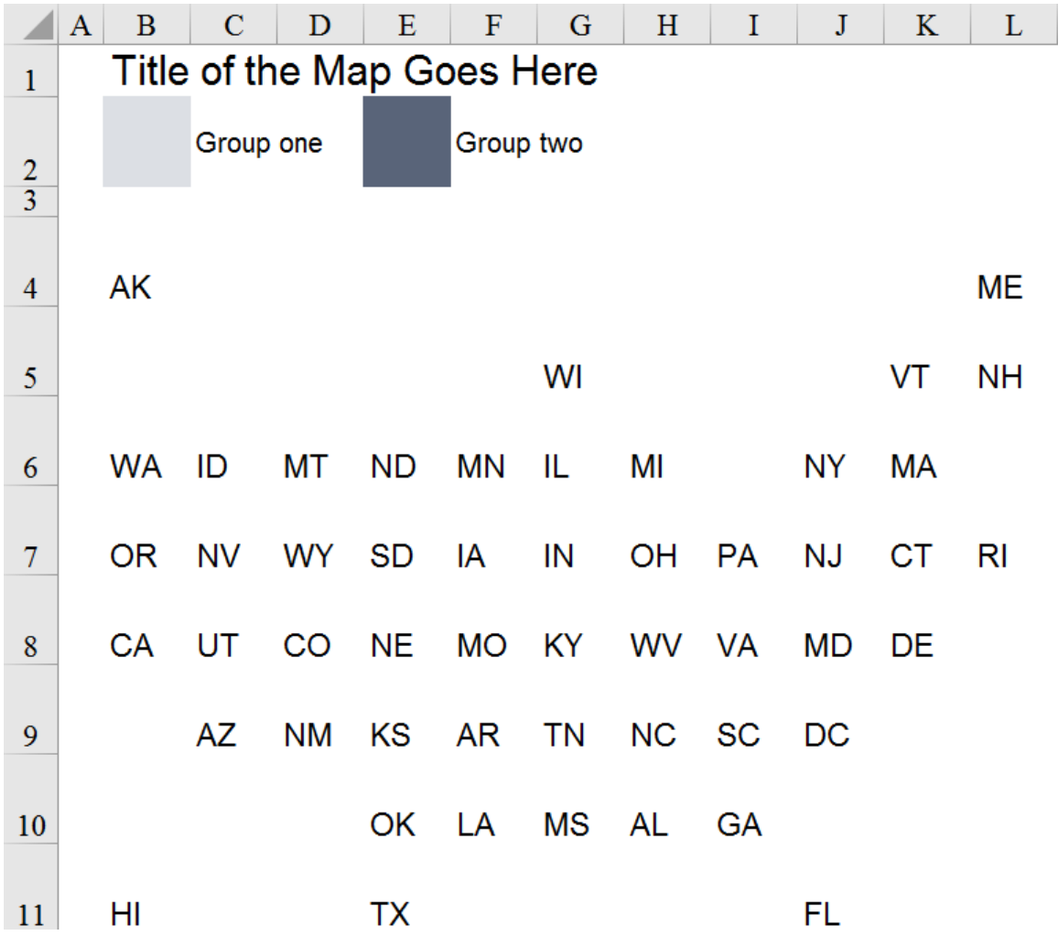
# Final Version with Styling



# Tile Grid Map

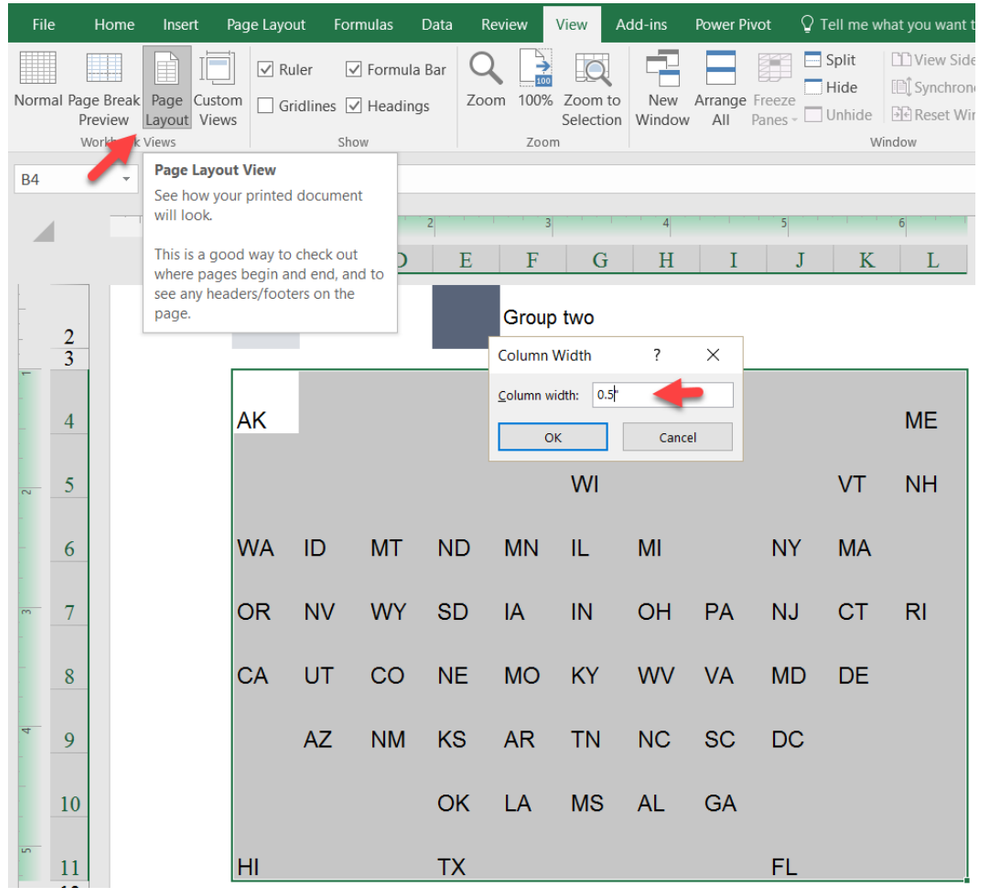
In a Tile Grid Map, the map areas are given a uniform size and shape—usually a square—and are arranged to approximate their real-world position. They can be constructed fairly easily in Excel after some upfront time with cell formatting and formula building. Use the *TileGrid tab* in the *Advanced Data Visualizations with Excel 2016 Hands-On.xlsx spreadsheet* to create the chart. I have included a final, formatted version of the Tile Grid Map in the *FinalTileGrid tab* of the file so that you don't need to do some of the tedious retyping.





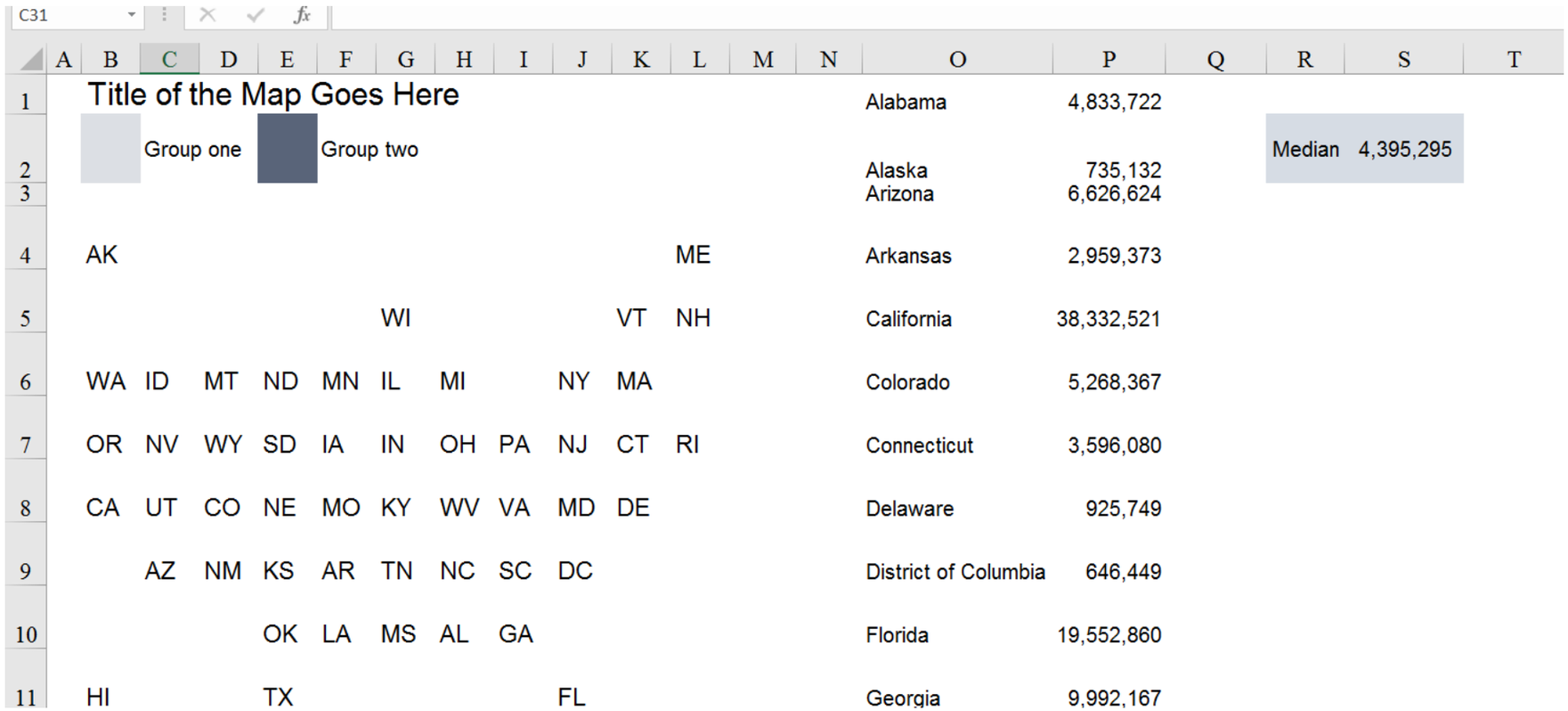

The map is set up by typing the abbreviation of each state name in the appropriate cell. I've already done this part for you.

1. Change to the Page Layout by selecting the “Page Layout” button in the “View” tab of the ribbon. This sets the row and column measurements to inches. Size the cells into squares (I set the row and column widths to 0.5 inches). Either grab the columns (and then rows) and change the width with your mouse, or right-click on the columns (and then rows) and select the “Column Width…” (or “Row Height…”) option. Change back to Normal view or continue to work in Page Layout if preferred.

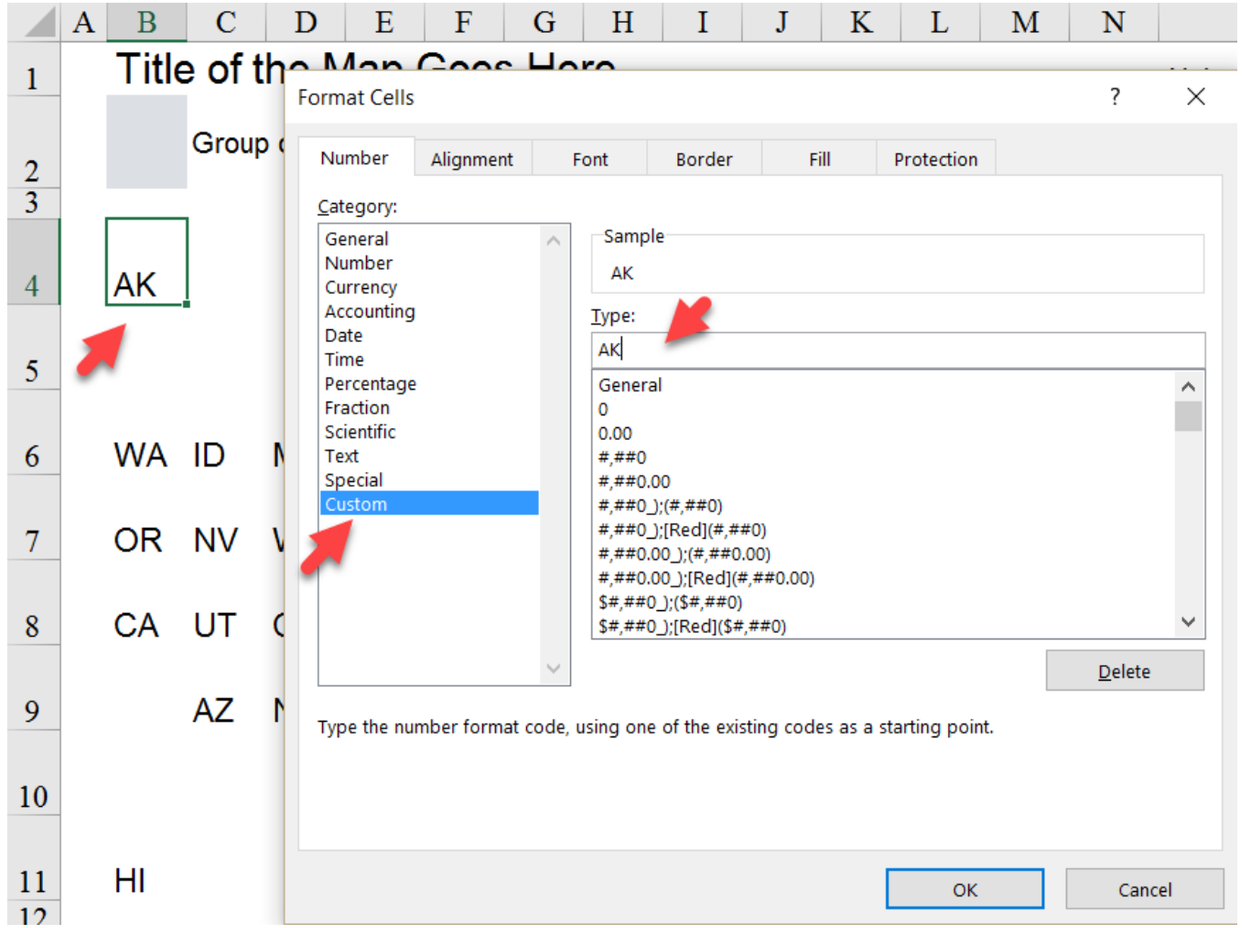


In the Excel file, the map is located in the left side of the worksheet and the data table is located to the right in columns O and P. To the right of the data table is another cell that calculates the median value of the series (using the MEDIAN formula); this measure splits the data into the two groups.

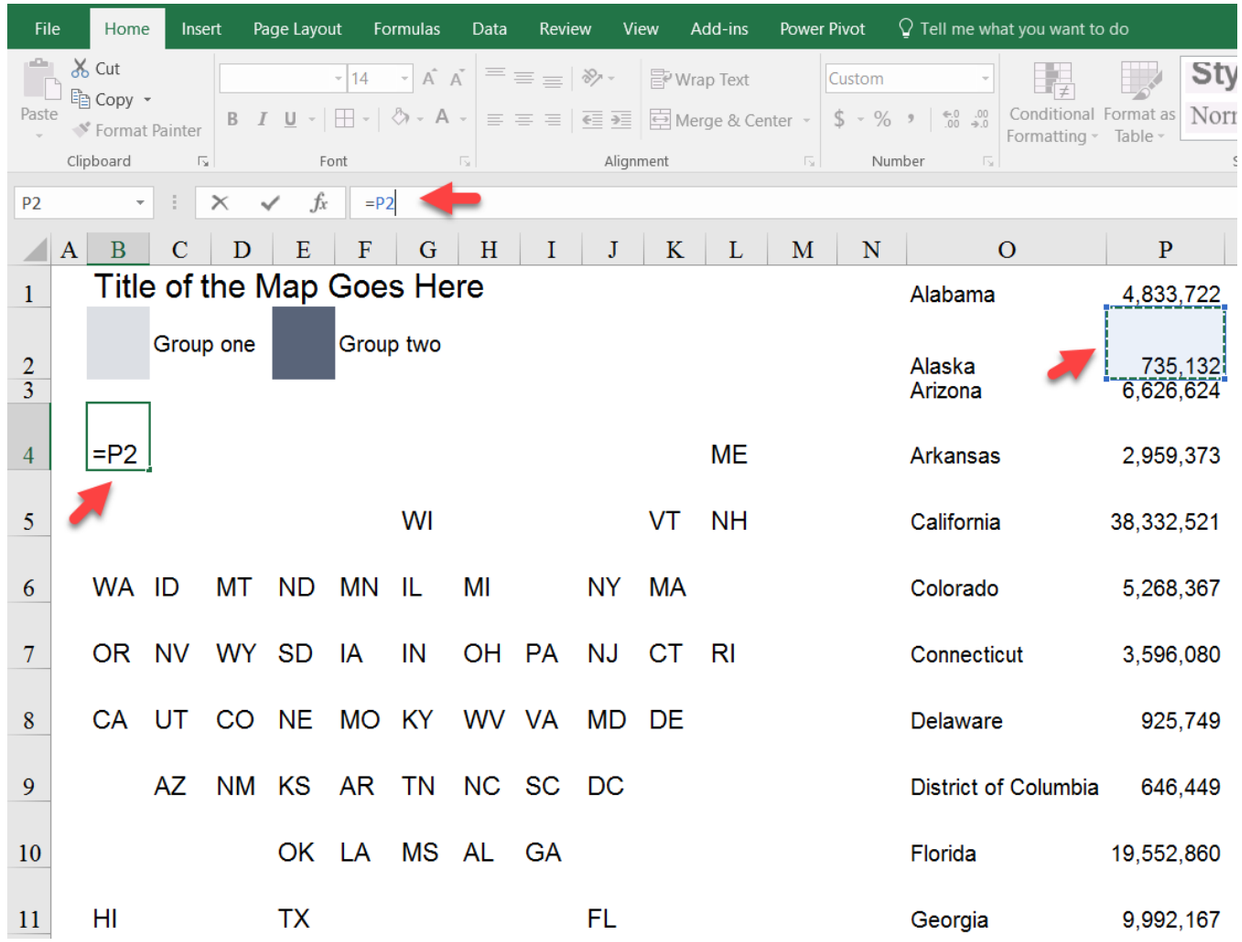
One group is greater than the median and the other group is less than or equal to the median. For each state in the map, the cell needs to point to the appropriate point in the data column. For example, the state cell for Alaska in the map (cell B4) will need to point to cell P2 (e.g., '=P2').



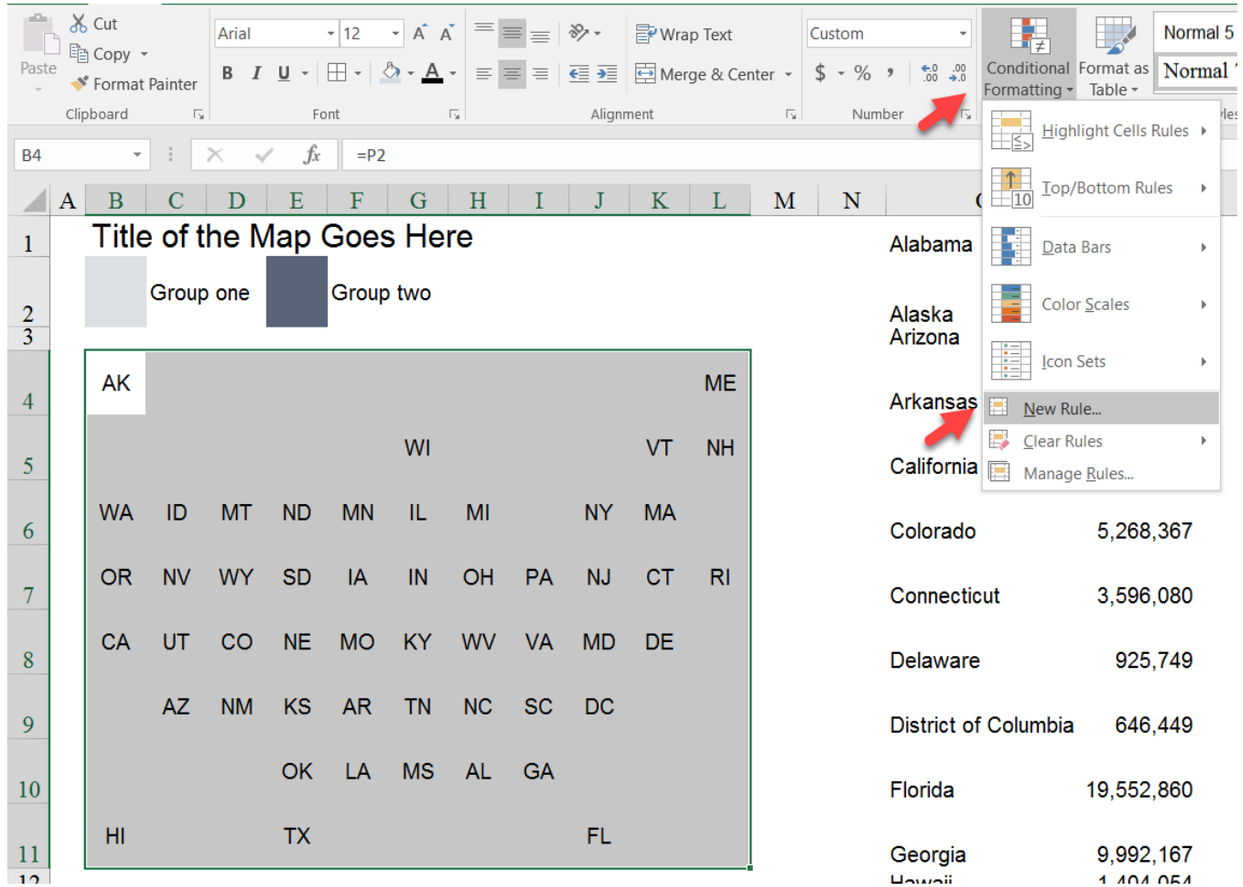
2. To get the state abbreviations in the cell and not the data value from the formula, apply a Custom Number Format for each state. You need to do this one state at a time. For example, select Alaska, and right-click (or CTRL-1). In the "Format Cells" menu, go to the "Custom" option and type in "AK". This custom label hides the number and replaces it with the "AK" abbreviation. Repeat for every state.



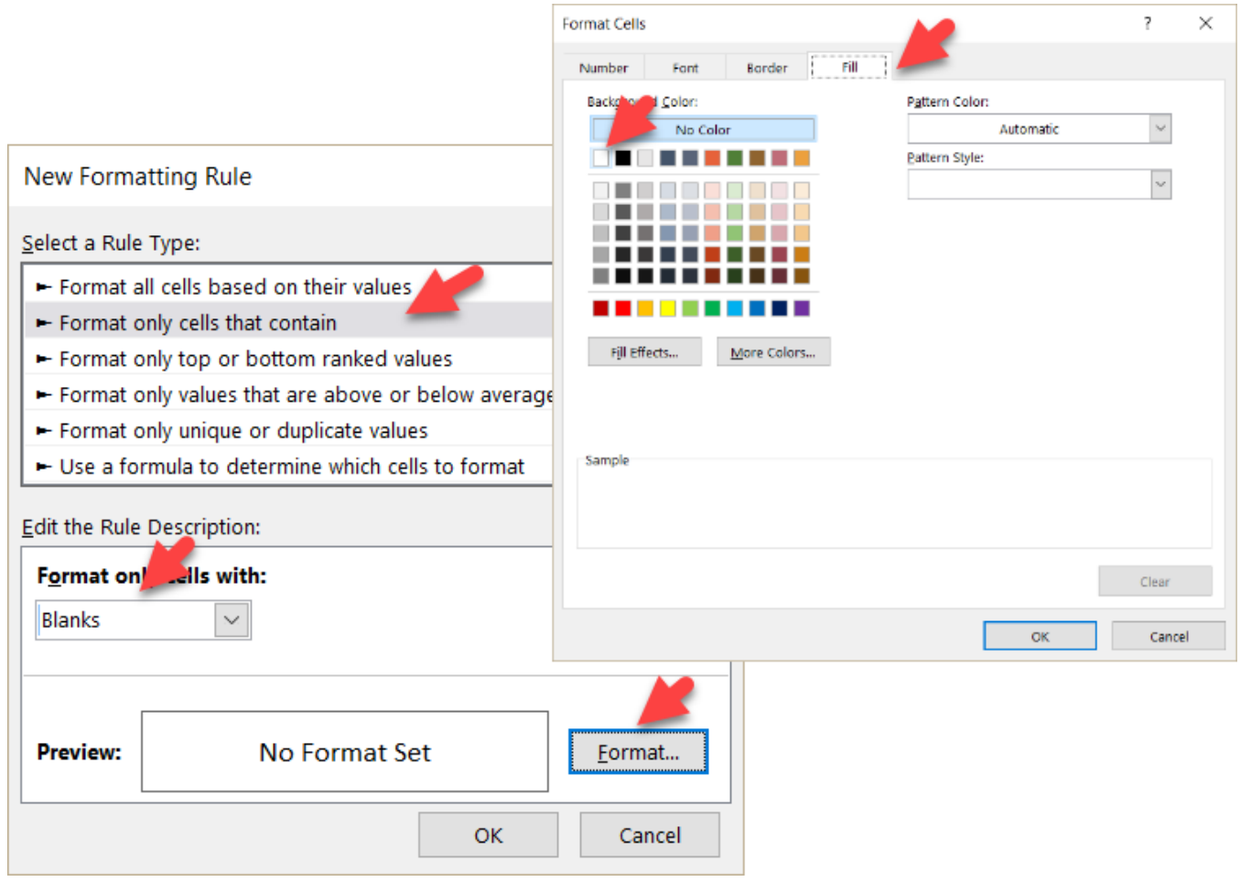
3. For each state in the map, the cell needs to point to the appropriate cell in the data column on the right. Select the state cell for Alaska, in the formula bar type = and then click on cell P2 in the data table to map it to Alaska's value. Hit enter. Map all the states to their respective values in the data column.



4. Excel's Conditional Formatting menu is used to set the colors in the map based on the number of groups you want to show (above the median, fill the cell with a **dark blue**; below the median, fill it with **light blue**). To apply it here, select the entire map and select the "New Rule" option in the Conditional Formatting menu.

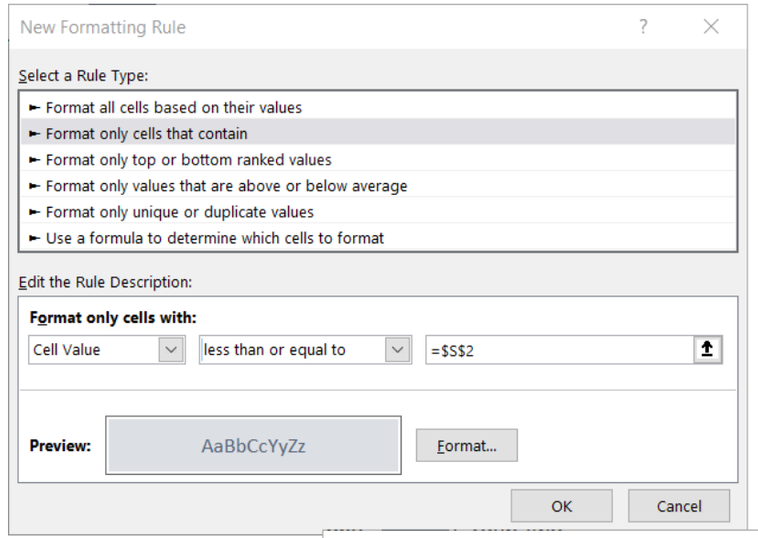


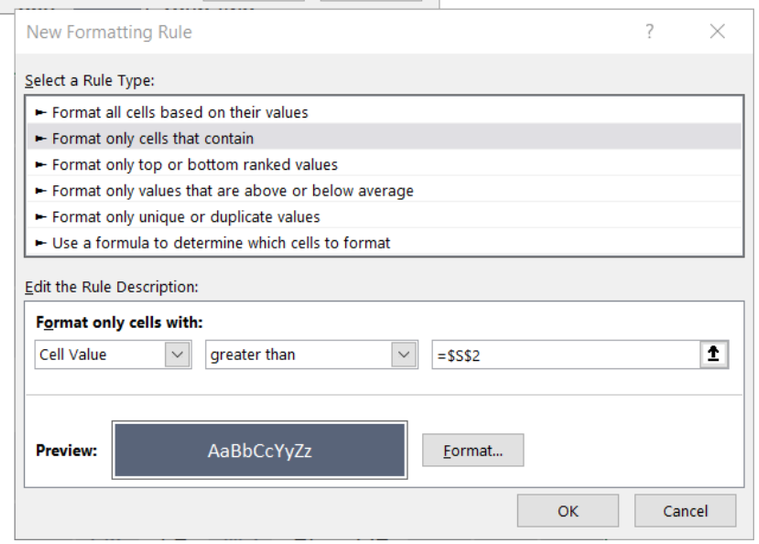
5. We first add the formula for the blank cells. Select the second option in the "New Formatting Rule" menu, choose Blanks in the Format only cells with: drop down, and format those cells (using the "Format" button) to fill with a white color.



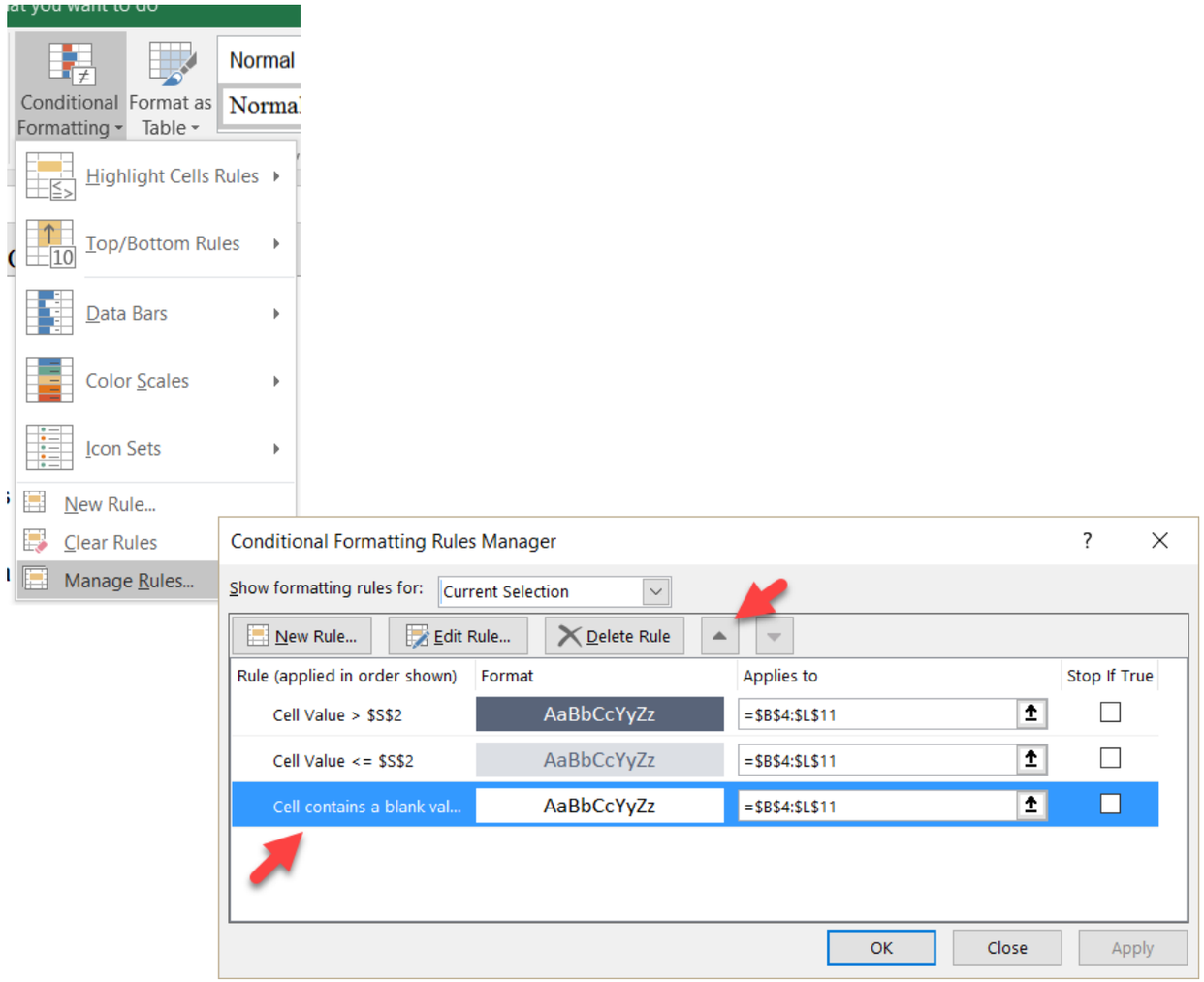
6. We next add the formatting for the data values. Add two more conditional formatting rules as follows:
    a. Format only cells that contain cell values less than or equal to $S$2 with orange fill and black text
    b. Format only cells that contain cell values greater than $S$2 with blue fill and white text

You can choose different fill and text colors. I've used shades of blue as my example colors.

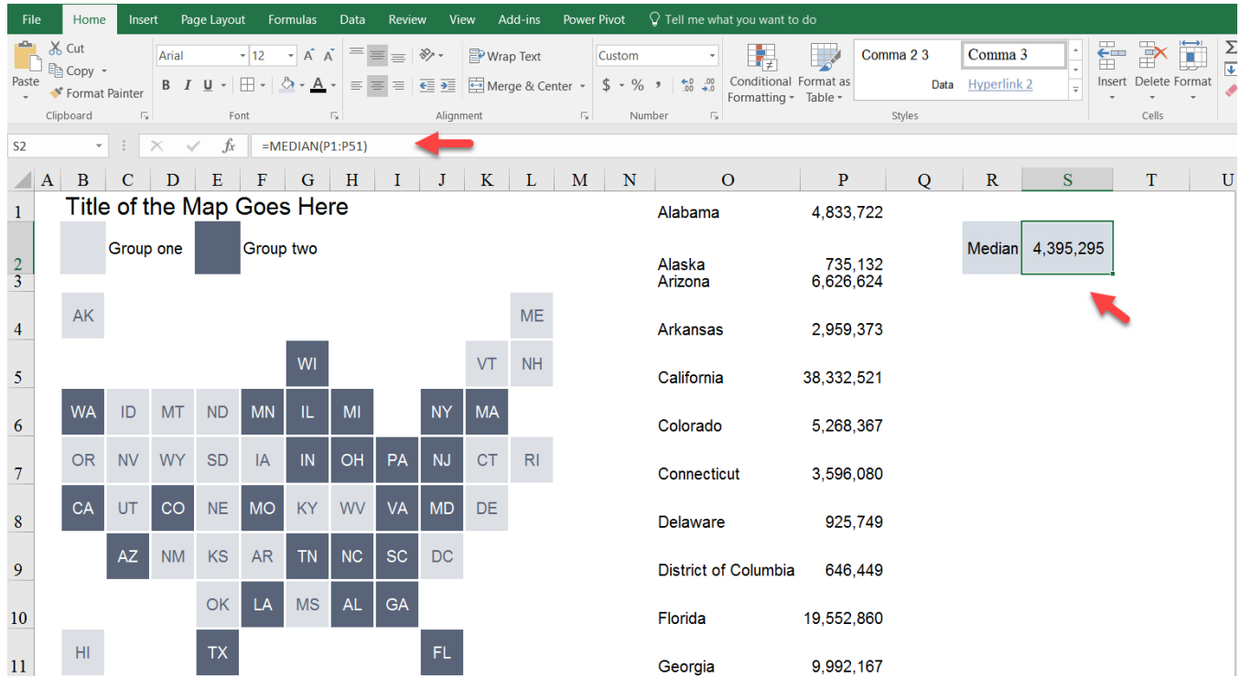


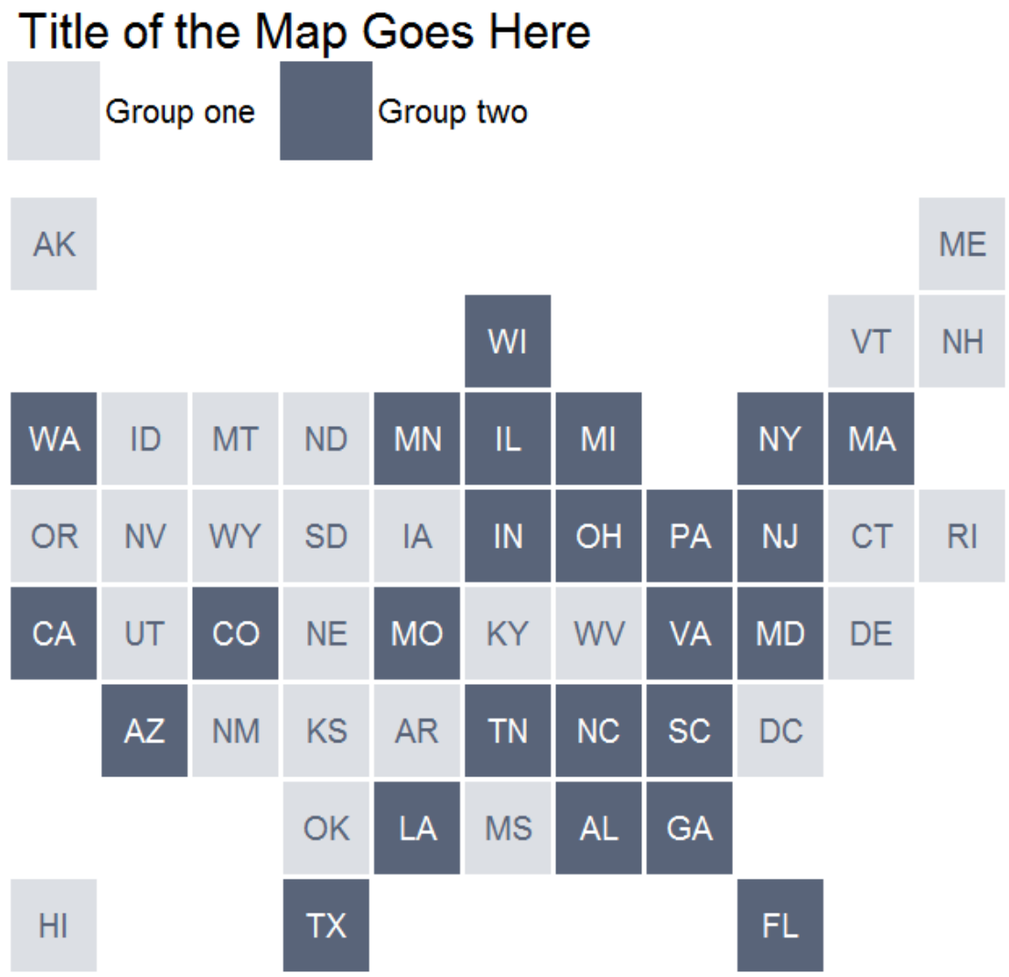
7. The order of these formulas *does* matter. You want the white (blank) formula to appear first; you can do so by selecting the map cells, selecting Manage Rules from the Conditional Formatting menu, selecting that rule and using the up arrow in the formula bar.



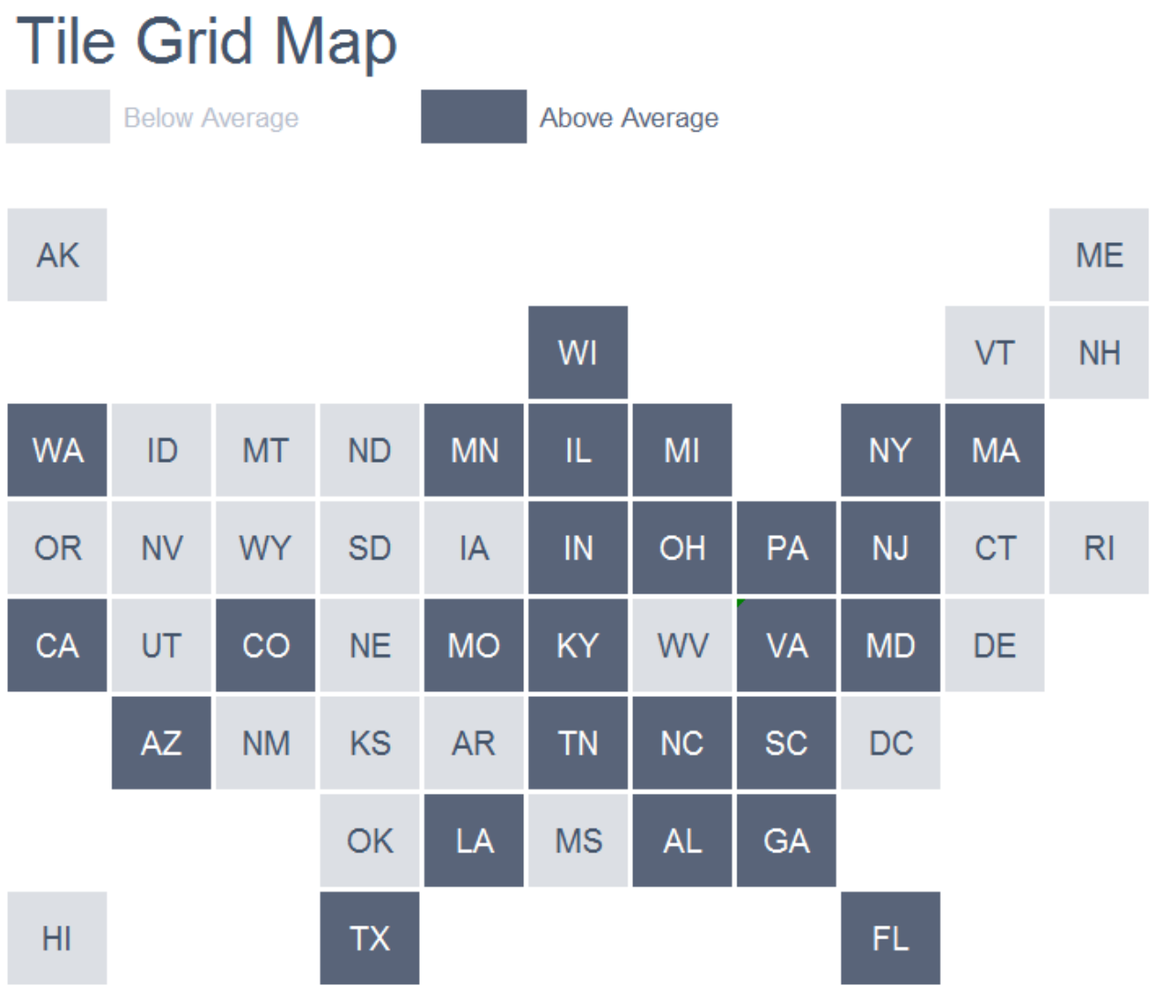
You can change the cutoff value from the median to something else by changing the formula in that cell.



8. Finish by formatting the title and legend as desired.

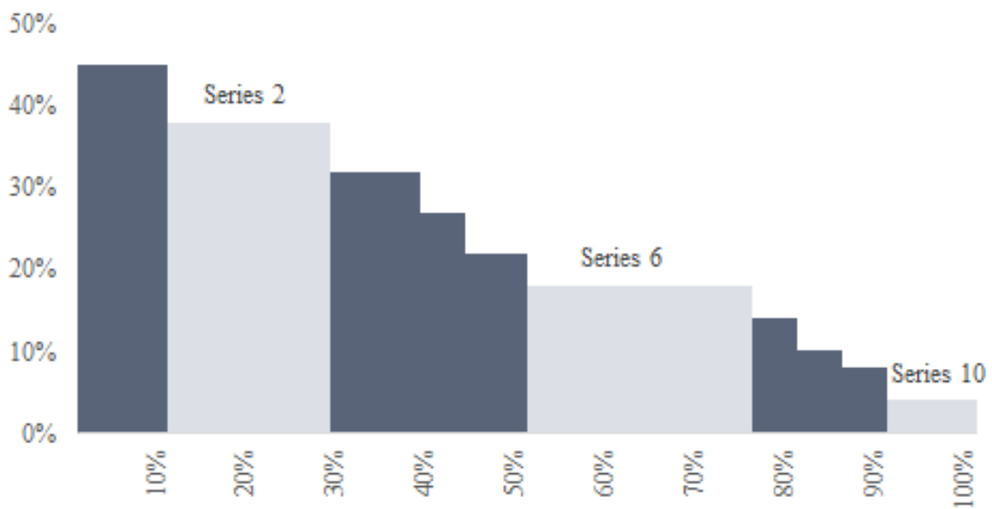


## Final Version with Styling



# Marimekko

The Marimekko chart encodes two variables: one along the height of the vertical axis and another along the width of the columns. The basic approach of this chart is to create a column chart with 100 columns, repeating values as necessary. We'll group the data to make it easier to color each series separately instead of having to select and recolor each of the 100 columns. This will require working with a number of formulas, but it will be more flexible in the end. Use the *Marimekko tab* in the *Advanced Data Visualizations with Excel 2016 Hands-On.xlsx spreadsheet* to create the chart.



| Item# | % Purchased | % of Total |
|---|---|---|
| Item 1 | 45% | 10% |
| Item 2 | 38% | 18% |
| Item 3 | 32% | 10% |
| Item 4 | 27% | 5% |
| Item 5 | 22% | 7% |
| Item 6 | 18% | 25% |
| Item 7 | 14% | 5% |
| Item 8 | 10% | 5% |
| Item 9 | 8% | 5% |
| Item 10 | 4% | 10% |

The data for this example consists of 10 items and for each item we have the percent purchased (*% Purchased*). We also have the share of the total sold for each item (*% of Total*), which sums to 100%. For the Marimekko chart, we'll put *% Purchased* along the vertical axis and *% of Total* on the horizontal axis.

The data are found in columns B and C; the rest of the worksheet is constructed to build the graph, and much of it repeats so that we can use the VLOOKUP formula. This version of the Marimekko uses rounded data values; if your data have decimals, simply multiply everything by 10 or 100 and use 1,000 or 10,000 columns in the chart.

# Setting up the Data

## COLUMN 1 [E]

Create a new column for the *% of Total* variable, but change it from a percentage to an integer. You could copy and paste the original data and change the format of the new cells (select the cells and right-click or use the CTRL-1 keyboard shortcut), or use a formula [E5=C5*100] so that the data can be easily updated.

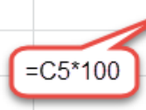
## COLUMN 2 [F]

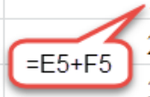
Create a *Count* variable that denotes the cumulative count of each item. We'll start with the number 1, which is hard-coded in cell F3. A simple formula [F6=F5+E5, F7=F6+E6, …] sets the number of cells for each value. Thus, the first *Item* will ultimately be represented by the 1st through 10th columns; the second *Item* starts with the 11th column; and so on.

## COLUMN 3 [G]

Repeat the *% Purchased* series; again, the formula [G5=B5] will make it easier to update if the data change.

| B | C | D | E | F | G |
|---|---|---|---|---|---|
| **finitions Summary** | | | | | |
| up | | | Convert % of Total from % to Number | Create Count variable (cumulative # obs) | Repeat % Purchased variable |
| OKUPs | | | | | |
| r Chart | | | | | |
| | | | 1 | 2 | 3 |
| **% Purchased** | **% of Total** | | % of Total | Count | % Purchased |
| 45% | 10% | | 10 | 1 | 45% |
| 38% | 18% | | 18 | 11 | 38% |
| 32% | 10% | | 10 | 29 | 32% |
| 27% | 5% | | 5 | 39 | 27% |
| 22% | 7% | | 7 | 44 | 22% |
| 18% | 25% | | 25 | 51 | 18% |
| 14% | 5% | | 5 | 76 | 14% |
| 10% | 5% | | 5 | 81 | 10% |
| 8% | 5% | | 5 | 86 | 8% |
| 4% | 10% | | 10 | 91 | 4% |




## COLUMN 4 [I]

Repeat the *Count* variable [I5=F5]. (Note: Column H is left blank to simply separate the groups of data.)

## Column 5 [J]

Simple *Item #* here, counting up from 1 to 10.

## Column 6 [L]

Repeat the *Item #* series [L5=J5]. (Note: Column K is left blank to simply separate the groups of data.)

## Column 7 [M]

Repeat the *% Purchased* variable [M5=G5]

| F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|
| Create Count variable (cumulative # obs) | Repeat % Purchased variable | | Repeat Count variable | Counter for Item Number (just pulling out label) | | Repeat Item Number variable | Repeat % Purchased variable |
| 2 | 3 | | 4 | 5 | | 6 | 7 |
| Count | % Purchased | | Count | Item# | | Item# | % Purchased |
| 1 | 45% | | 1 | 1 | | 1 | 45% |
| 11 | 38% | | =F5 11 | 2 | | =J5 2 | =G5 38% |
| 29 | 32% | | 29 | 3 | | 3 | 32% |
| 39 | 27% | | 39 | 4 | | 4 | 27% |
| 44 | 22% | | 44 | 5 | | 5 | 22% |
| 51 | 18% | | 51 | 6 | | 6 | 18% |
| 76 | 14% | | 76 | 7 | | 7 | 14% |
| 81 | 10% | | 81 | 8 | | 8 | 10% |
| 86 | 8% | | 86 | 9 | | 9 | 8% |
| 91 | 4% | | 91 | 10 | | 10 | 4% |

## Column 8 [O]

You can think of starting to build the chart by setting up this column first. This *Counter* simply counts from 1 to 100. Don't type this manually—type a "1" in cell O4 and then the formula [O5=O4+1] in the cell just below and drag it down to row 103.

## [Column 9 [P]

We'll use a VLOOKUP formula to bring over the data for the chart. In cell P4, we put =VLOOKUP(O4,$I$5:$J$14,2,1) and drag it down to row 103.

## [Column 10 [Q]

In cell Q4, we put =VLOOKUP(O4,$F$5:$G$14,2,1) and drag it down to row 103.

| I | J | K | L | M | N | O | P | Q |
|---|---|---|---|---|---|---|---|---|
| Repeat Count variable | Counter for Item Number (just pulling out label) | | Repeat Item Number variable | Repeat % Purchased variable | | Counter: 1 to 100 | VLOOKUP: Use column 4 and 5 to create labels | VLOOKUP: Use column 2 and 3 to stretch out the % Purchased variable |
| 4 | 5 | | 6 | 7 | | 8 | 9 | 10 |
| | | | | | | Counter | Item # | % Purchased |
| Count | Item# | | Item# | % Purchase | | 1 | 1 | 45% |
| 1 | 1 | | 1 | 45% | | 2 | 1 | 45% |
| 11 | 2 | | 2 | 38% | | 3 | 1 | 45% |
| 29 | 3 | | 3 | 32% | | 4 | 1 | 45% |
| 39 | 4 | | 4 | 27% | | 5 | 1 | 45% |
| 44 | 5 | | 5 | 22% | | 6 | 1 | 45% |
| 51 | 6 | | 6 | 18% | | 7 | 1 | 45% |
| 76 | 7 | | 7 | 14% | | 8 | 1 | 45% |
| 81 | 8 | | 8 | 10% | | 9 | 1 | 45% |
| 86 | 9 | | 9 | 8% | | 10 | 1 | 45% |
| 91 | 10 | | 10 | 4% | | 11 | 2 | 38% |
| | | | | | | 12 | 2 | 38% |
| | | | | | | 13 | 2 | 38% |
| | | | | | | 14 | 2 | 38% |
| | | | | | | 15 | 2 | 38% |
| | | | | | | 16 | 2 | 38% |
| | | | | | | 17 | 2 | 38% |
| | | | | | | 18 | 2 | 38% |
| | | | | | | 19 | 2 | 38% |
| | | | | | | 20 | 2 | 38% |

=O4+1

=VLOOKUP(O4,$I$5:$J$14,2,1)

=VLOOKUP(O4,$F$5:$G$14,2,1)

## How the Formula Works

| =VLOOKUP(O4, | $F$5:$G$14, | 2, | 1) |
|---|---|---|---|

=VLOOKUP(O4,

This is the thing we look up. We are going to match each entry in this *Counter* series to another look-up table to pull out corresponding values.

$F$5:$G$14

We're going to query the data we created earlier that consists of the *Count* and *Item #* data in columns I and J. VLOOKUP matches the first argument in the VLOOKUP formula to the first column in the I-J table, which is why we needed to order things the way we did in the first set of steps. (The dollar signs ($) act as the absolute references so that we can copy and paste this formula without changing the cell references.)

2

This corresponds to the column number we want to extract, so this refers to the *Item #* data in column J.

1

This is the "*range_lookup*" value and tells Excel we want an "approximate match" of the value in cell O3 instead of an "exact match." It's good practice to specify this argument whenever you use VLOOKUP. This is the key part of the formula for this exercise. What the approximate match does, is only fill in those cells for which the lookup value (in column I) does not exceed the lookup reference (the *Counter* series). Thus, you'll notice how the values in column P equal the first item number for the first 10 entries and then, starting on the 11th entry, starts with the second item number.

In sum, this VLOOKUP queries the *Counter* series and pulls out the *Item #* from Column J to denote each series that will populate the chart.

## COLUMNS 11-20 [R-AA]

We're going to create 10 different data series (one for each *Item*) so that we can add them all to one chart and then color each by simply grabbing the entire group. The numbers at the top of the series (in Row 2) are important here and correspond to each *Item Number*. This formula is a little complicated, but once it's inserted into the first column, we can just drag it horizontally and vertically.

So, in cell Q3, we have
=IF($P4=R$3,VLOOKUP($P4,$L$5:$M$14,2,1),0)

| O | P | Q | R | S | T | U | V | W | X | Y | Z | AA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Counter: 1 to 100 | VLOOKUP: Use column 4 and 5 to create labels | VLOOKUP: Use column 2 and 3 to stretch out the % Purchased variable | VLOOKUP: Use column 6 and 7 to fill in the different series Row 3 labels corresponds to each Item number | | | | | | | | | |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| Counter | Item # | % Purchased | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | 1 | 45% | 45% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| 2 | 1 | 45% | 45% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| | | | | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| | | | | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| 5 | 1 | 45% | 45% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| 6 | 1 | 45% | 45% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| 7 | 1 | 45% | 45% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| 8 | 1 | 45% | 45% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| 9 | 1 | 45% | 45% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| 10 | 1 | 45% | 45% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| 11 | 2 | 38% | 0% | 38% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| 12 | 2 | 38% | 0% | 38% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| 13 | 2 | 38% | 0% | 38% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| 14 | 2 | 38% | 0% | 38% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |

=IF($P4=R$3,VLOOKUP($P4,$L$5:$M$14,2,1),0)

## Let's Break It Down Again

| =IF($P4=R$3, | VLOOKUP($P4,$L$5:$M$14,2,1), | 0) |
|---|---|---|

=IF($P4=R$3,

To start, the *IF* statement evaluates the first argument, here $P4=R$3. We're simply comparing the *Item Number* entered in the second row to how many times each series will repeat in Column P. Notice the strategic use of the absolute/relative reference "$" symbol; we use the references so the cell specifications don't move when we drag the formula across the worksheet.

VLOOKUP($P4,$L$5:$M$14,2,1),

If the first argument is *True,* the second argument is evaluated and placed in the cell. That argument uses another VLOOKUP: Here, the first argument ($P3) looks up the *Item #* from column P in the last set of data placed in columns L and M, specified in the second argument by [$L$5:$M$14]. The third argument in the VLOOKUP (the number 2) looks in the second column (column M). The final piece of the VLOOKUP (the number 1) specifies an approximate match. The VLOOKUP formula pulls out the *% Purchased* variable, which is the thing we're going to plot.

0)

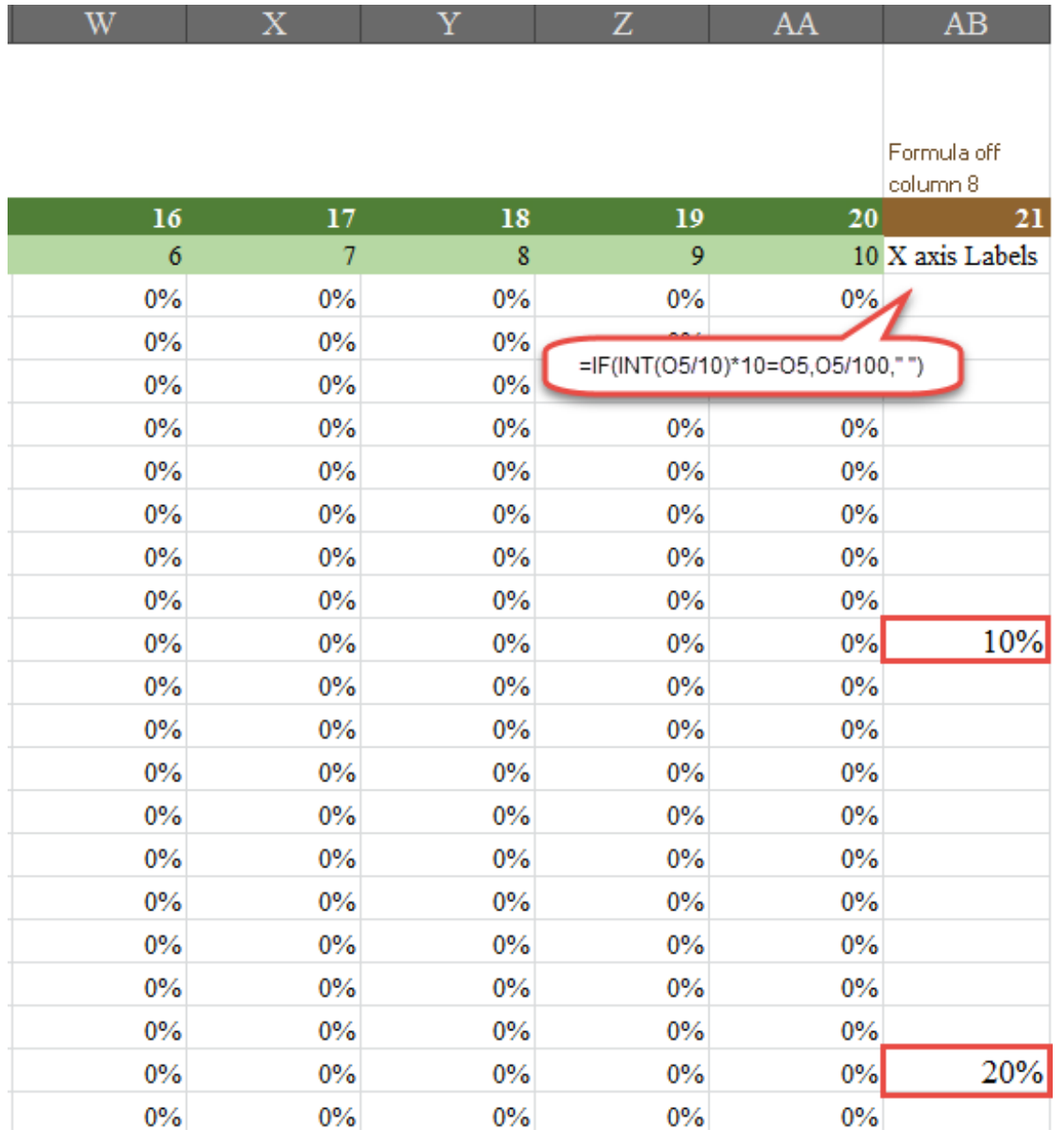
If the first argument is *False,* the formula places a 0 in the cell, as specified by the "0" at the end of the *IF* statement. As an example, for the first Item [Column P], the first 10 rows fill with 45% and the remainder fills with 0%; for the second Item, the first 10 rows are set to 0%, the next 18 rows are 38%, and the remaining 72 rows are 0%.

Dragging this formula across and down will give you blocks of numbers that repeat the *% Purchased* values corresponding to their shares of the total.

You could also use the formula =IF($P4=R$3,VLOOKUP(R$3,$P$4:$Q$103,2,1),0) which uses the data we set up in Columns 9 and 10 instead of Columns 6 and 7. Both formulas will return the same values.

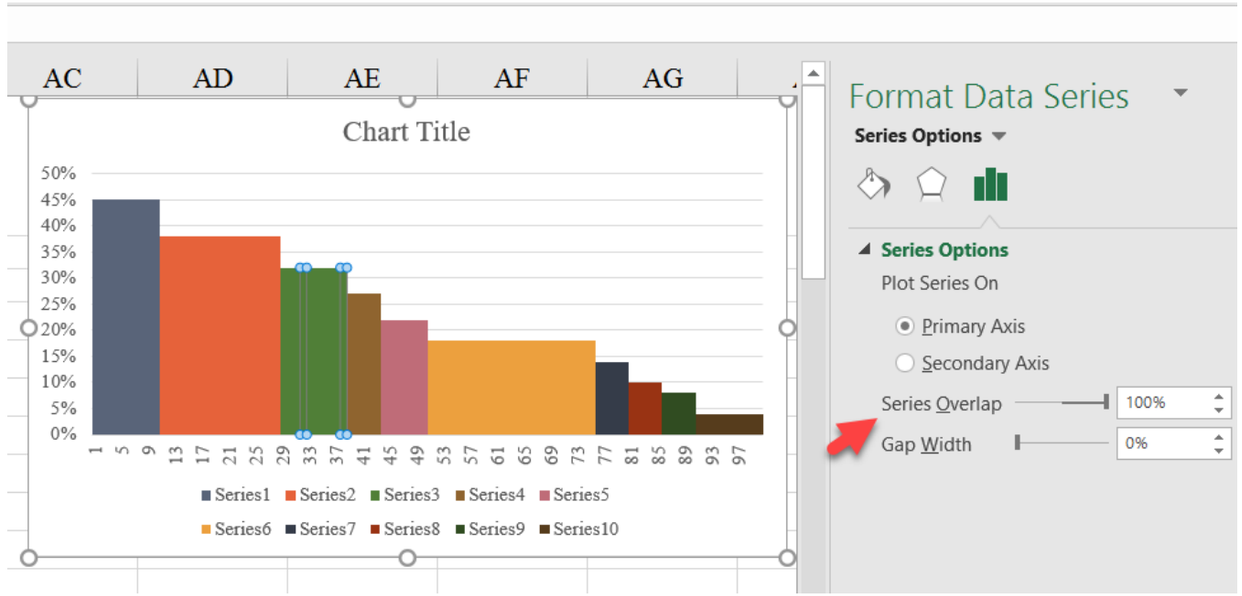
## [Column 21 [AB]

In this example, we'll place x-axis labels at every 10% increment. To do so, we'll create a custom x-axis series to add to the chart. Here's the formula: =IF(INT(O5/10)*10=O5,O5/100,""). This formula uses the INT function to round the number down to the nearest integer. If we divide the *Counter* series (in column O) by 10 and round down to the nearest integer [INT(O5/10)] and then multiply by 10, we get whole numbers. If those whole numbers equal increments of ten (which works because we divided by 10 in the INT formula), we set the cell value to that percentage; if not, the formula returns return an empty cell, denoted by the " " in the IF statement. If you enter this formula in cell AB4 and drag it down the column, you'll only see "10%", "20%", "30%", etc. show up in the cells.

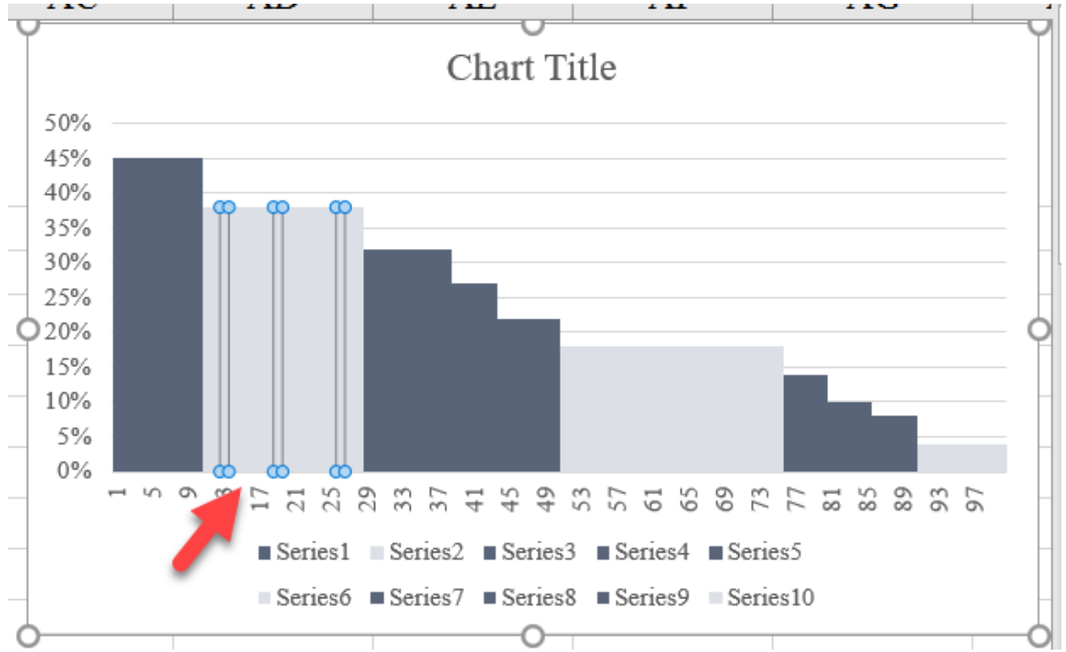


# Create the Chart

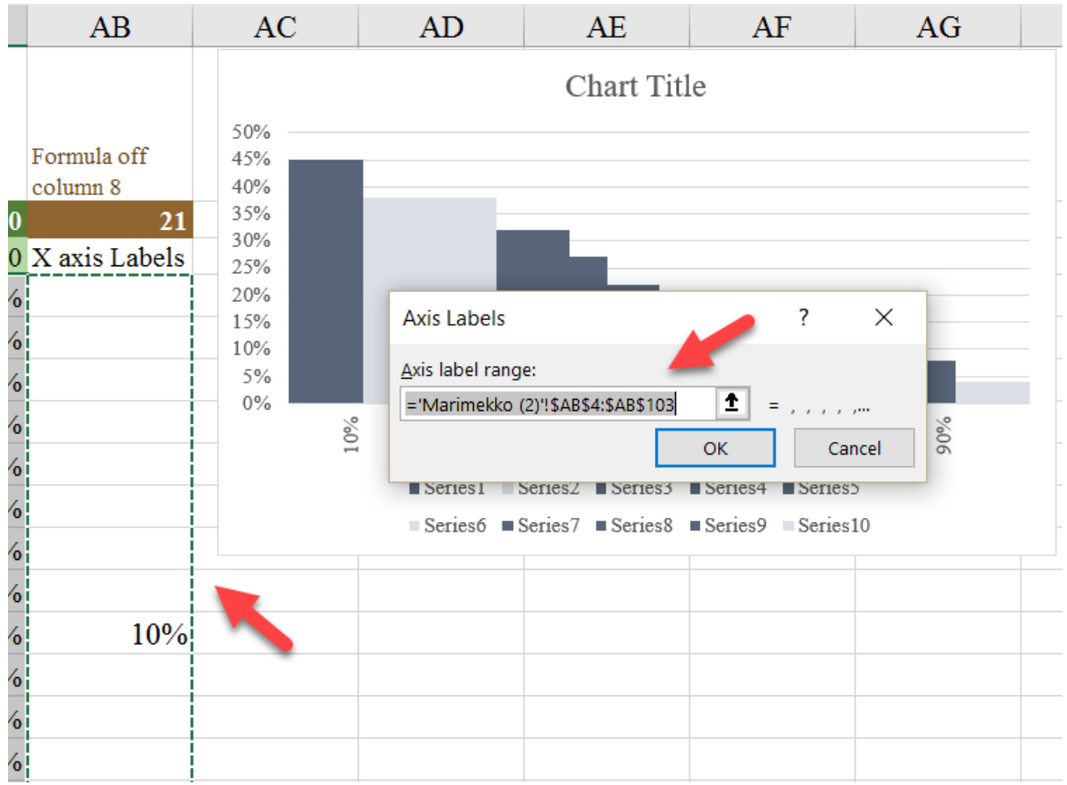
1. We now create a column chart using the data in columns R4-AA103. To close the gaps between the columns, right-click on the series and change the *Gap Width* to 0% and the *Series Overlap* to 100%.



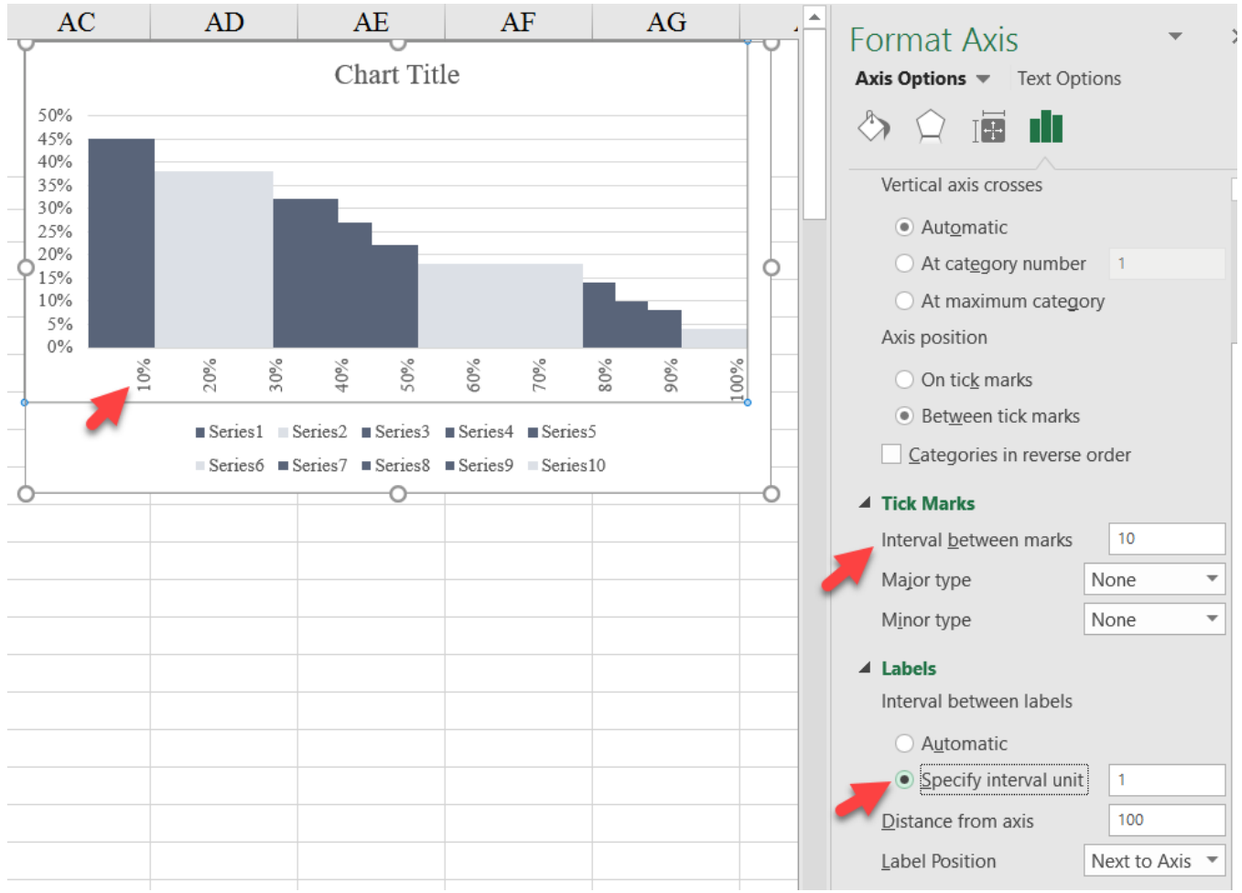
2. You can now easily change the color of each series (i.e., each *Item*) by selecting it on the chart and using the "Fill" options in the "Format" menu.



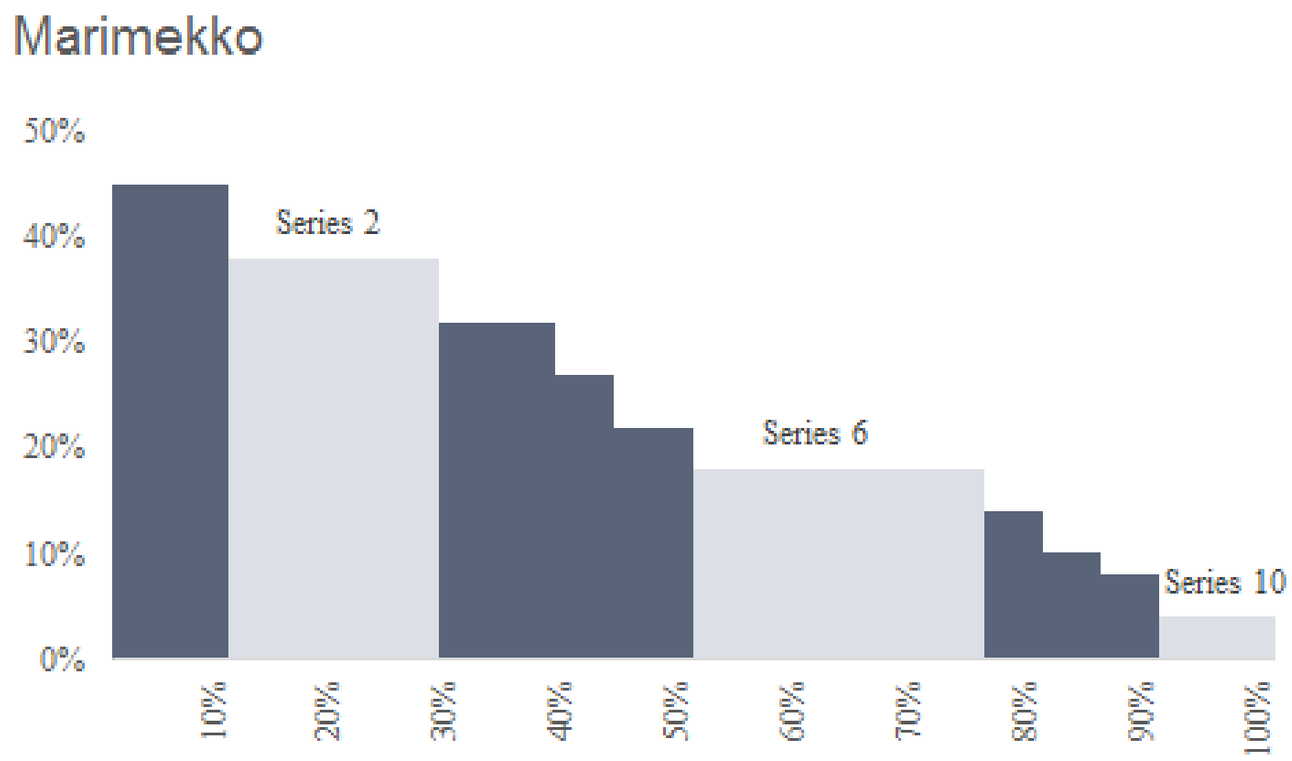
3. To add the x-axis labels to the chart, right-click on your chart and choose *Select Data* and select Column AB4:AB103 as the *Horizontal (Category) Axis Labels.*



4. Now go back to the chart and format the x-axis by right-clicking (or CTRL-1). Change the *Interval between tick marks* from 1 to 10. You'll also need to select the *Specify interval unit* option in the *Interval between labels* menu, and Excel should fill in the 1 for you. Format chart as desired.



# Final Version with Styling



# Data Visualization Books

If you wish to learn more about data visualization, there exists a large and growing set of books that will help you dive deeper into best practices and strategies to effectively create and present your data. More books, blogs, and other resources can be found at PolicyViz.com.

Alberto Cairo. Cairo is a journalism professor, so his books primarily focus on data visualizations geared towards a wide audience. His first two books on data visualization, *The Functional Art* and *The Truthful Art*, cover fundamental overviews of data, some statistics, and data visualization.

Jorge Camões. All of the visuals in *Data at Work* are built in Excel (though it is not a step-by-step guide) and covers covers a wide range of data visualization principles and strategies.

Stephen Few. Few's *Show Me the Numbers* and *Now You See It: Simple Visualization Techniques for Quantitative Analysis* demonstrate how to present data effectively and strategically.

Andy Kirk. Kirk's *Data Visualisation: A Handbook for Data Driven Design* is one of the few books that offers a system to conceptualize and develop data visualizations.

Cole Nussbaumer Knaflic. Knaflic's *Storytelling with Data* (she has a blog of the same name) is a great introductory treatment to data visualization, and how to pair text with graphs to lead your reader or user to a conclusion.

Naomi Robbins. A succinct guide to creating effective graphs, Robbins' *Creating More Effective Graphs* gives you the basic knowledge and techniques required to choose and create appropriate graphs for a broad range of applications.

Jonathan Schwabish. Designed for presenters of scholarly or data-intensive content, *Better Presentations: A Guide for Scholars, Researchers, and Wonks* details essential strategies for developing clear, sophisticated, and visually captivating presentations.

Edward Tufte. Author of four books, Tufte's books are sometimes viewed as classics in the field of data visualization. His *The Visual Display of Quantitative Information* is especially relevant to introductory data visualization with different examples and techniques.

Dona Wong. Wong dedicates individual pages in her book, *The Wall Street Journal Guide to Information Graphics*, to specific graph types, and how and why to choose the best chart to fit the data.