

## Excel Charts: Why? What kind? How?

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### Introduction

According to Karen A. Schriver (1997, page xxiii), an expert in document design, “Poor documents are so commonplace that deciphering bad writing and bad visual design have become part of the coping skills needed to navigate in the so-called information age.” Additionally, Stephen Few (2004, page 4) indicates that “the reason for this sad state of affairs is simple – very few of us have ever been trained to design tables and graphs effectively.”

A common form of visual design used in finance is a chart or graph. Excel’s chart feature is used to create virtually all charts. Most finance teachers and their students know how to use Excel to create basic charts, but many do not know how to decide when to create a chart, how to decide what kind of chart to create, and how to decide what features the chart should have.

Most Excel books emphasize only chart procedures. One example of this type of book is *Excel 2003 Bible* by John Walkenbach (2003). This book contains 40 chapters, two are devoted to charts (Chapters 16 and 17), and there is virtually no discussion of chart design. A book about Excel and finance is *Principles of Finance with Excel* by Simon Benninga (2006). There is one chapter devoted to charts. The only design issue mentioned, but not explained, is the suggestion to eliminate chart gridlines.

To illustrate better Excel chart design consider the following example from the book *Excel Charts* by Walkenbach (2003, pages 351 and 352). Table 1 contains four annual revenue observations that Walkenbach used to create Figures 1 and 2.

Year	Revenue
1999	\$2,125,300
2000	\$1,545,500
2001	\$2,253,400
2002	\$2,751,200

Table 1: Annual Revenue Data

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Figure 1 shows the chart Walkenbach creates using the default procedures in Excel 2003.

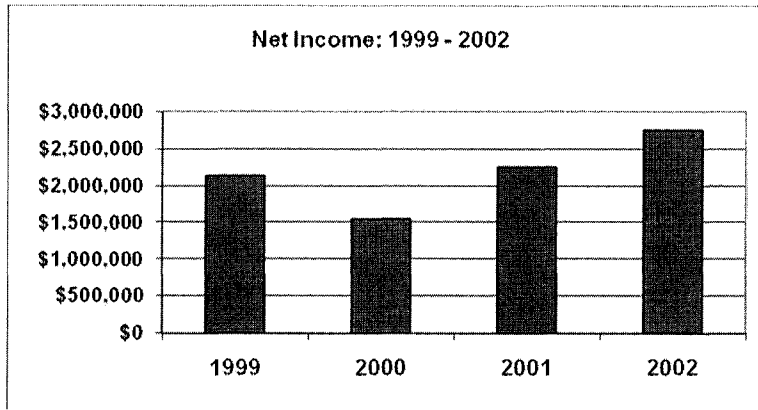


Figure 1: Default Excel 2003 Chart

This chart has all of the default features except the legend. It is deleted because there is only one Y-axis variable.

Using suggested guidelines, Walkenbach creates the revised column chart in Figure 2.

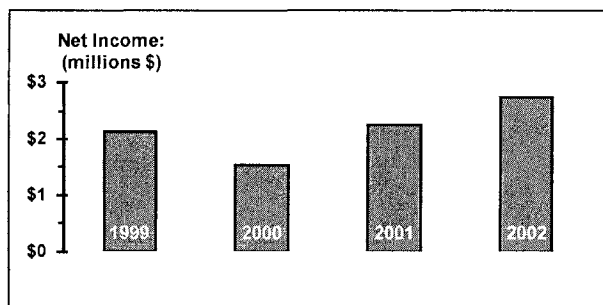


Figure 2: Revised column chart.

There are significant differences between these two charts, Figure 1 and Figure 2. What guidelines did Walkenbach use to create the desired chart? Notice, other than the gray columns the “revised” chart has much less “ink” (background color and values on the axes).

### Purpose

The primary purpose is to provide, explain, and illustrate chart guidelines (best practices). We provide guidelines that explain:

- How to decide when a chart is needed.
- How to determine the type of chart to create.
- The appropriate chart features.

There is also a discussion of specific Excel 2003 procedures or commands to use to create the charts discussed. The specific Excel chart procedures or commands mentioned are those that reduce the time needed to create a chart. Finally, we provide an example of Excel 2007 chart features.

### **Chart Guidelines**

The chart guidelines discussed here are ideas taken from Aitken (2006), Few (2004), Jelen (2007), Tufte (2001), and Walkenbach (2003). The chart guidelines are in outline format.

Charts in business communication should:

- Communicate important information effectively.
- Not entertain.
- Not indulge in self expression.
- Not make numbers interesting through flash and dazzle that you would otherwise deem boring.

Use a chart when:

- The message is contained in the shape of the values.
- The document is used to reveal relationships among multiple values.

Use a table instead of a chart when:

- The purpose is to look up individual values.
- The purpose is to compare specific values.
- Precise values are required.
- The quantitative information to communicate involves more than one unit of measure.

General design guidelines:

- Reduce the non-data ink. Examples of non-data ink are chart gridlines or chart borders. Reduce means to eliminate or make less visible (for instance, light gray rather than black).
- Enhance the data ink. An example of data ink is the chart line or chart columns.

General chart guidelines:

- Avoid 3D charts. They require non-data ink and in most cases are difficult to read.
- Avoid pie charts. It is usually difficult to interpret angles.
- Generally include the value zero in your quantitative scale, and alert your readers when you do not include zero.
- Include no more than eight data sets in a single graph.

Graphs with points (such as an Excel XY scatter chart):

- When points are obscured by lines (usually gridlines), make the points more prominent or mute the chart gridlines.
- When points cannot be distinguished
  - Enlarge the points.

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- Select objects that are more visually distinct.
- Remove fill color.
- If possible, enlarge the size of the graph.

### Bar charts:

- Use horizontal bars when the graph displays a ranking relationship in descending order.
- Use horizontal bars when the categorical subdivisions that label the bars do not fit side by side.
- Do not overlap bars.
- Set the width of white space separating bars that are labeled along the axis equal to the width of the bars, plus or minus 50 percent.
- Filling bars:
  - Avoid fill patterns.
  - Use fill colors that are clearly distinct.
- Use borders on the bars:
  - When the fill colors are not distinct.
  - To highlight one or more bars.

### Tick marks:

- Mute relative to data objects.
- Place outside the data range.
- Use with quantitative scales on the X-axis.
- Do not use with categorical scales on the X-axis.
- Avoid using them to mark values at odd intervals.
- Have one tick mark for each value.
- Use tick marks and values/categories judiciously. That is, there should not be too many or too few tick marks/values (this is illustrated below).

### Chart grid lines:

- Use to enhance specific values.
- Use to enhance comparison of values.
- Should be thin and light color (muted).

### Chart Legend:

- Use only when more than one Y-axis series.
- Remove legend border.
- Place legend inside plot area.
- Consider deleting Excel's legend and using text boxes for text placement.

### Value or Y-axis:

- Scale values (do not have numerous zeros, express in millions rather than have 1,000,000 and so forth on the chart).
- Use even increments between values.

- Use values that are rounded. For instance, 10,000 increments, starting at zero, not 8,000 increments.

Chart Titles and Notes: Place as close as possible to the data values.

The default Excel 2007 chart incorporates some of these guidelines. Examples are:

- The plot area background is white. It is gray when using Excel 2003.
- The chart and plot area border colors are muted. They are no longer black.
- The column borders (for a column chart) no longer have a black border. The border color is the same color as the rest of the column.

### Chart Examples

The next step is to illustrate some of these guidelines.

Figure 3 shows a pie chart to visually present market share data. Because the angles in the pie chart are difficult to interpret, the market share data is difficult to interpret. When looking at the Excel pie chart, Figure 3, can you easily compare the market share of one company with another?

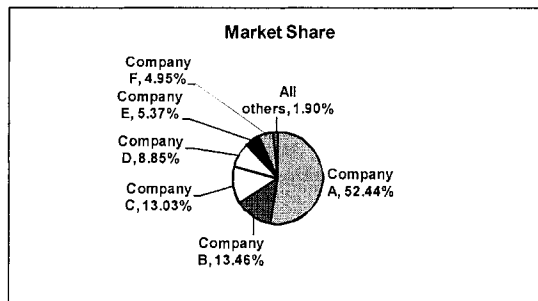


Figure 3: Pie chart.

Figure 4 shows a more effective way to display this information. It is an Excel bar chart (horizontal column chart). Notice the orientation and alignment of the words and numbers. Also, notice how easy it is to determine the ranking of any company.

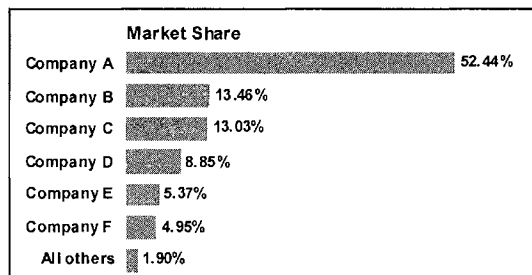


Figure 4, Pie chart data used for bar chart.

Figure 5 is an Excel column chart with sales orders on the Y-axis and salesperson on the category or X-axis.

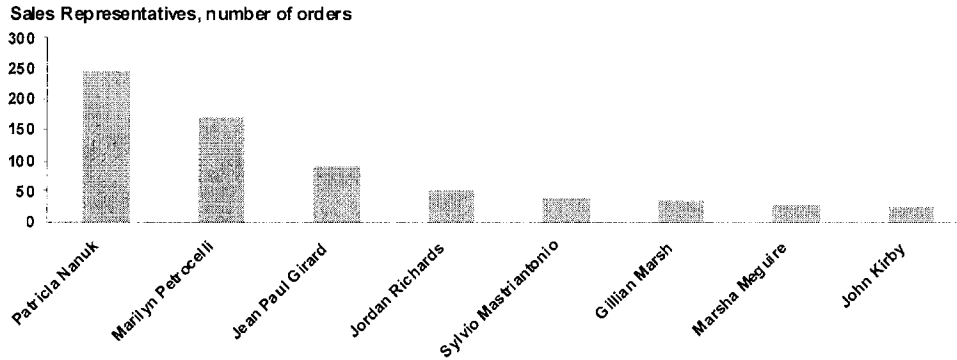


Figure 5: Column chart with Category values (names) on X-axis at an angle.

Ideally, the names on the X-axis or Category axis should be horizontal. They can be made horizontal by decreasing their font size or increasing the horizontal chart size. Doing either is not consistent with chart best practices. A better approach is to create a horizontal bar chart. Figure 6 is an illustration.

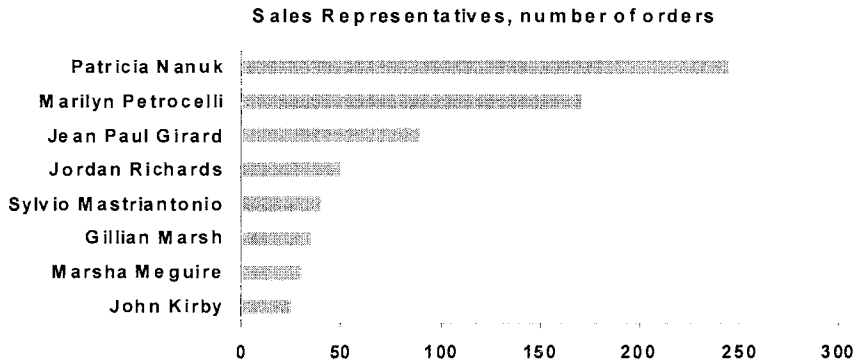


Figure 6: Bar chart (Horizontal column chart) with text and numbers horizontal.

Notice, this horizontal bar chart is much easier to interpret.

Figure 7 shows a line chart that illustrates what happens to a \$10,000 investment in the Standard and Poor 500 index and Medtronic (MDT) stock with and without dividends from the end of 1989-2006.

The legend is placed in Excel’s default position, to the right of the plot area. This is the default position for both Excel 2003 and Excel 2007. Chart best practices would suggest that it should be in the plot area. In this case, the most likely position would be in the upper left corner of the plot area. Why? Because this area is “empty” and the legend is closer to the chart data.

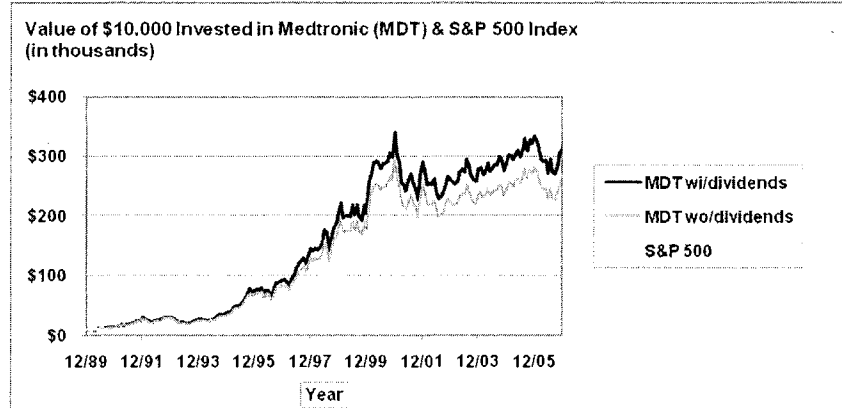


Figure 7: Value of \$10,000 investment (legend in Excel default position).

Another alternative is to delete Excel’s legend and create “legends.” Figure 8 shows the legend moved to the chart’s plot area.

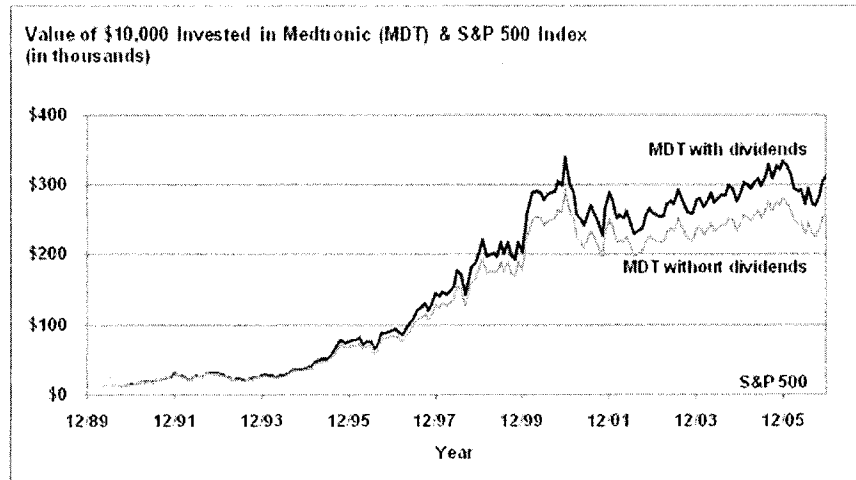


Figure 8: Value of \$10,000 investment (with legend moved to plot area).

Figure 9 illustrates the three types of tick marks, outside the axis, inside the axis and across the axis.

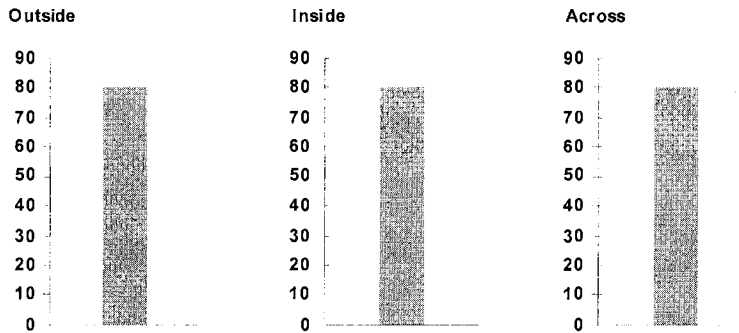


Figure 9: Three types of Y axis tick marks.

Few (2004, page 201) prefers placing tick marks on the outside. This leaves the Excel plot area free of all but the values. This provides a “clear backdrop” to view the values/data.

Figure 10 is a chart that illustrates the number of y or value axis tick marks and labels/values. There is no correct number. It is a balance between too many, which would clutter the chart, and too few, which makes it difficult to interpret the chart. The frequency of values and tick marks on the Y-axis applies also to the X-axis when it has values.

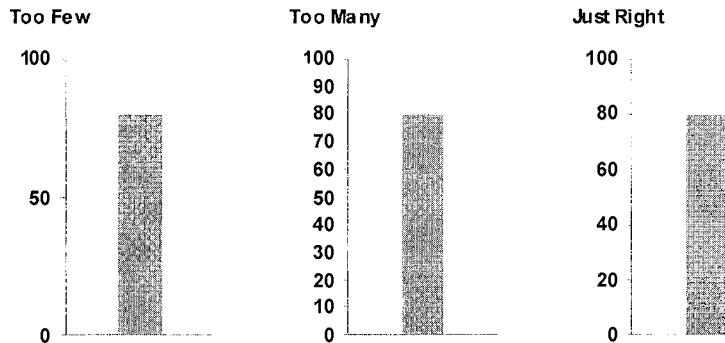


Figure 10: Three illustrations of frequency of Y axis tick marks and values.

Figure 11 is a 3-dimensional column chart. Does this chart need a third dimension? Does the third dimension enhance the chart? Is it consistent with chart best practices? No.

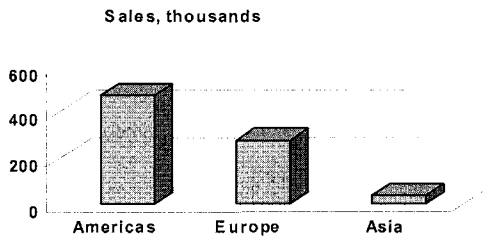


Figure 11: Two variables on a 3-dimension column chart.

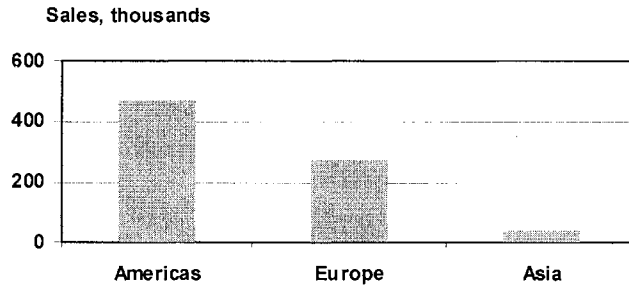


Figure 12: Two variables on a 2-dimension column chart.

Figure 12 shows the same data on a two-dimensional column chart. This chart is much easier to interpret.

**How**

When Excel 2003 is used to create a chart, there are some procedures that are important but are not stressed (or even mentioned) in most Excel books. We discuss two important procedures and five related tips.

Procedure 1: To create a chart using Excel 2003 use the Chart Wizard. The Chart Wizard has four steps. The most important step (or dialog box) is Step 2 of 4, Chart Source Data. This dialog box has two tabs. The most important is the Series tab (see Figure 13).

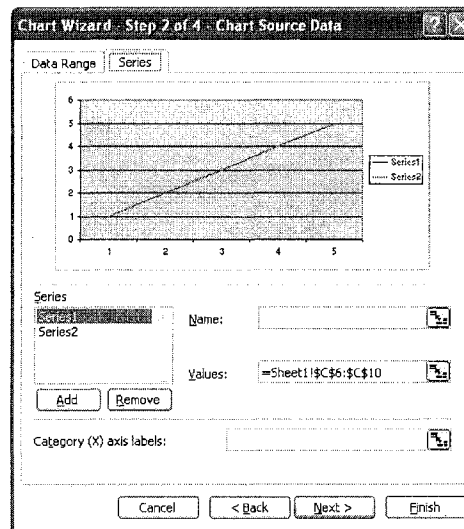


Figure 13: Chart Source Data, Series Tab.

This tab is not the default display. It shows what ranges or series (sets of data) are being used and on which axis (Series section displays Y-axis values). If a data series is assigned incorrectly, the chart is incorrect. In this example two data series are selected but Excel places both in the Series section (that is, both series are being used as Y-axis values), and no series is in the Category or X-axis text box. If no X-axis series is selected Excel assigns integer values starting with one.

Procedure 2: Once an Excel chart is created there are three ways to edit it:

- Select the chart and use the menu choice chart.
- Move the mouse pointer over the desired area of the chart, right click, and choose from the pop up menu.
- Use the chart toolbar.

Using the mouse pointer is usually the quickest way.

Once the basic chart is created it must be edited to be consistent with the above mentioned

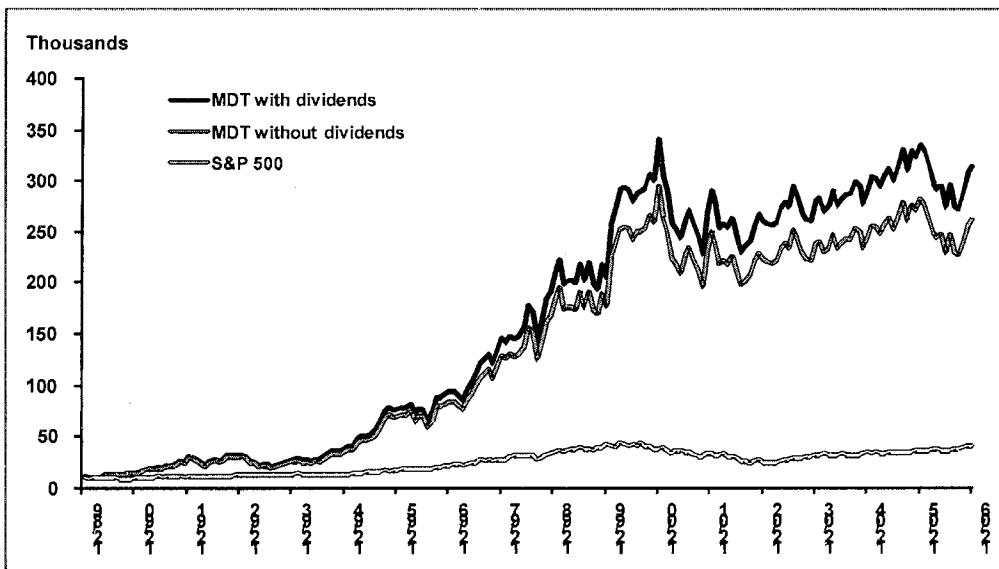


Figure 14: Line chart with Category X axis values/dates with vertical orientation.

guidelines. Here are five chart editing “tips.”

Tip 1: You create a chart and the values or dates on the category or X-axis are not “horizontal,” they are vertical or appear at an angle (see Figure 14).

If the chart is made significantly wider, the X-axis dates become horizontal. Sometimes this is not an option. Figure 14 is on a chart sheet that fills the screen. To make the values or dates on the category axis horizontal do the following:

1. Move the mouse pointer over the horizontal axis until Category Axis appears.
2. Right click. A pop up menu appears.
3. Choose Format Axis. The Format Axis dialog box appears.

4. Go to the alignment tab and the Orientation section.
5. In the orientation section there is a text arrow implies that the text is horizontal. Move the red rectangle away from the horizontal and then move it back to horizontal.
6. To return to the chart choose OK.

Tip 2: You create a chart and the legend shows Series1, Series2 and so forth (instead of the more descriptive text legend shown in Figure 14) and you want something more descriptive. To change the text in the legend:

1. Right click next to, but not over, the legend.
2. From the pop up menu select Source Data.
3. On the Source Data dialog box go to the series tab (see Figure 13).
4. Select a series in the Series section and then enter an appropriate name in the Name box.
5. When done, select OK.

Tip 3: You have just completed the fourth step of the chart wizard and placed an embedded chart on a worksheet. One procedure to format all of the text and numbers on the chart at once is to:

1. Right click in the chart area. From the pop up menu choose Format Chart Area. The Format Chart Area dialog box appears.
2. Select the Font tab.
3. On the font tab choose the Font, Font style, and Font size.
4. Also de-select Auto scale.
5. To exit select OK.

Note, this procedure does all of the numbers and text on the chart. Best Practices would suggest that the chart title should have a larger font size (relative to other text and numbers). This is quickly done by selecting the chart title and then using the formatting toolbar to increase its font size.

What is Auto scale and why deselect Auto scale? When Auto scale is selected the font size is selected by Excel and changes whenever the chart size is changed/resized. When Auto scale is de-selected the chart size does not change when the chart size is changed. Note, in Excel 2007 the size of the font does not change when the chart size is changed.

Tip 4: You have just completed a chart and placed it on a chart sheet (rather than embedded on a worksheet). The chart does not cover the screen. There is a significant gray area on the right and left side of the chart. To get the chart to fill the screen choose, from the menu, View and Size with Window. Note, Excel 2007 does not have this feature.

Tip 5: You create a time series chart with time on the horizontal axis (also called category axis or X-axis) and two variables, GDP and interest rates, on the vertical axis (also called value axis or Y-axis). This chart needs two Y-axes, one for the GDP values and one for the interest rates. The steps to add a second axis are:

1. Right click on line (in the plot area) that forms the series for which you want to create a second Y-axis.
2. From the pop up menu choose Format Data Series.

3. When the Format Data Series dialog box appears go to the Axis tab.
4. On the Axis tab select Secondary Axis.
5. To exit the dialog box select OK.

**Chart created using Excel 2007**

Figure 15 is an un-edited (default) XY scatter chart created using Excel 2003. A trend line with the best fit regression line and r-squared has been added.

The gray background in the plot area and the black borders easily identifies this as a chart created using Excel 2003.

Figure 16 shows the same un-edited (default) chart created using Excel 2007. The significant differences are:

1. There is no gray background in the plot area.
2. The horizontal chart gridlines, X-axis, and Y-axis are light gray, not black.
3. The legend does not have a border.

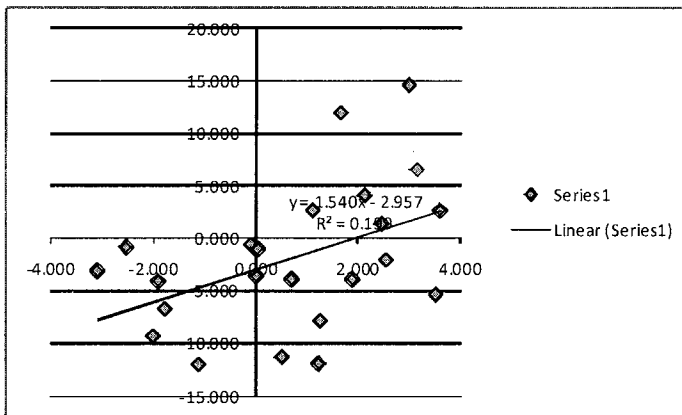


Figure 16: Excel 2007 default XY scatter chart.

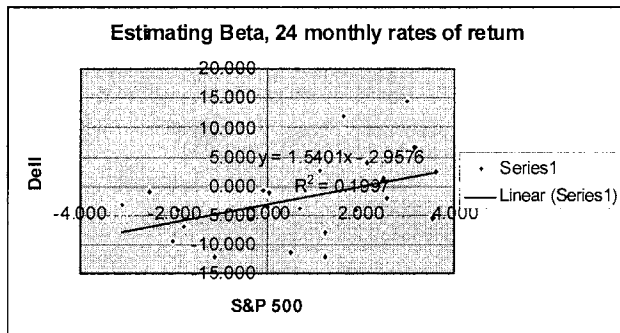


Figure 15: Excel 2003 default XY scatter chart.

These changes are all consistent with the suggested best practices for chart design.

### **Summary**

For finance teachers and students knowing how to use Excel to create charts is not enough. It is important that they also know some of the best practices to use to design charts.

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