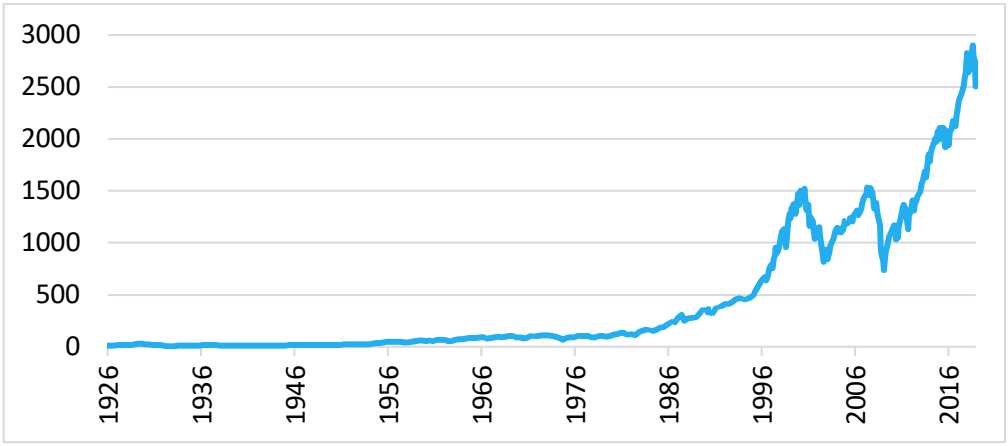
Making stock graphs

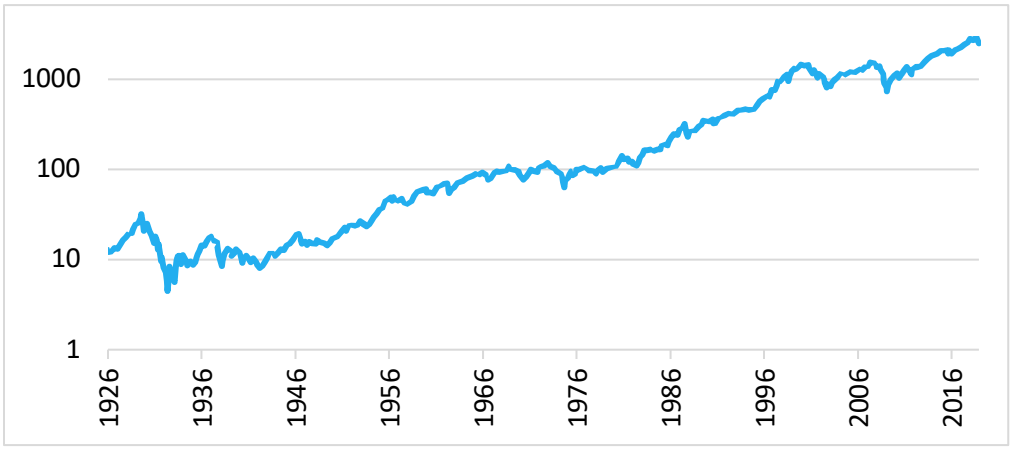
This document shows how we can make simple and effective graphs of stock returns. I will review how we can improve the appearance of graphs, how we can use logarithmic scales and secondary axes to mitigate deception, how we can effectively present multiple stock price series in the same graph, and how we can label graphs.

1. Historical levels of the S&P 500 index

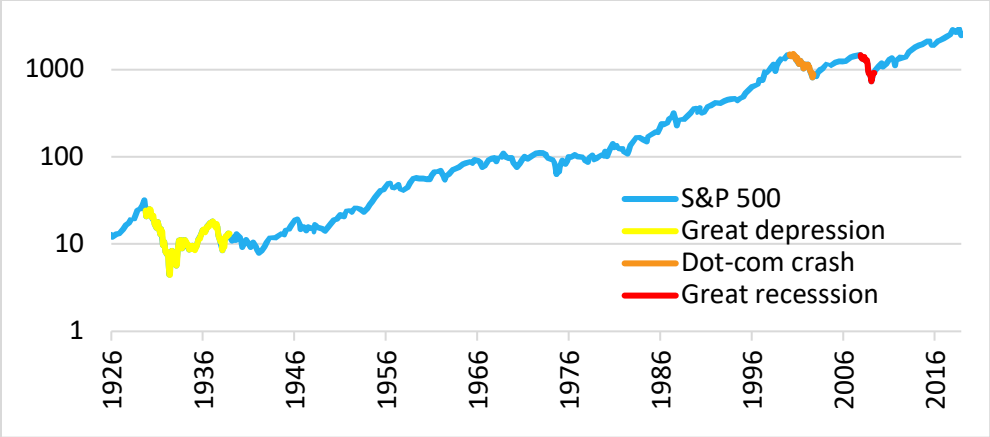
Let us start by making a simple graph of the S&P 500 index levels from 1926 through 2018.



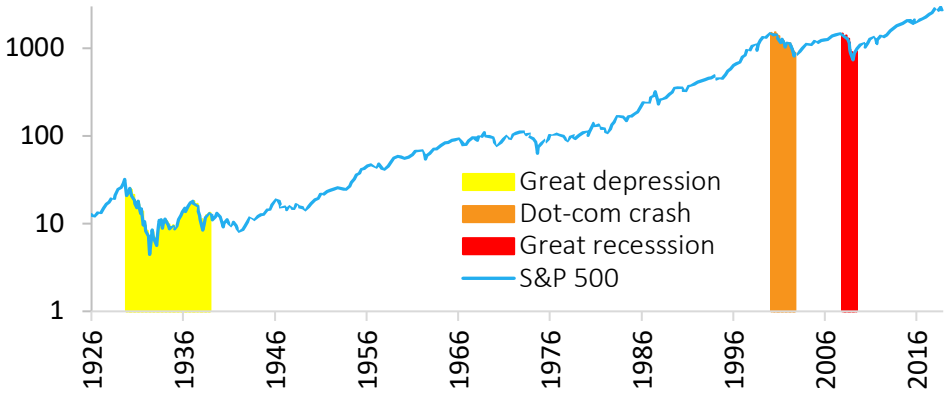
The graph suggests that the index is fairly flat until the 1980s, followed by considerable volatility in the last three decades. However, this is deceptive; the first third (roughly the first thirty years) has a return volatility of 25%, while both the middle and last thirds have a return volatility of 15%. To mitigate the deception, we can use a logarithmic scale for the vertical axis.



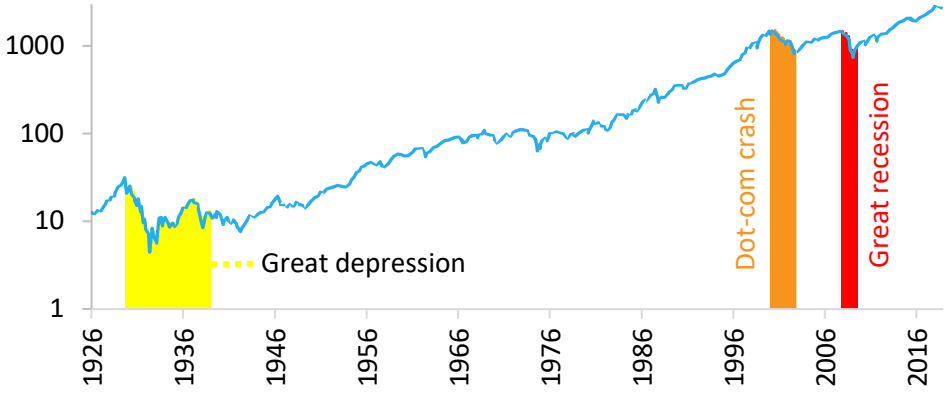
Suppose that we also wish to shade certain periods, e.g., the great depression, the dot-com crash, and the great recession. To do so, I created three columns in the spreadsheet, one for each of the three periods I wish to shade, and copied the data from the S&P 500 data series only for the respective periods and left the cells in the columns blank otherwise. Then I added these three columns with data to the graph.



Then I right-clicked on one of the data series, selected Change Series Chart Type and chose Column chart types for the three data series that capture the great depression, the dot-com crash, and the great recession. I also removed the border. (The Fill and the Border of the columns could also be changed.)

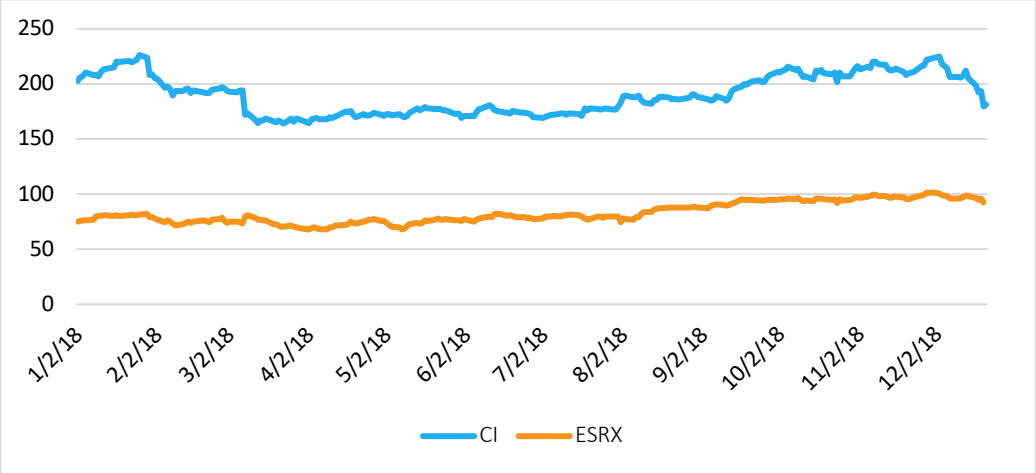


This shows that value declines during the dot-com crash and the great recession (aka the financial crisis) were both modest compared to the decline during the great depression. As an alternative, I replaced the legend with textboxes.

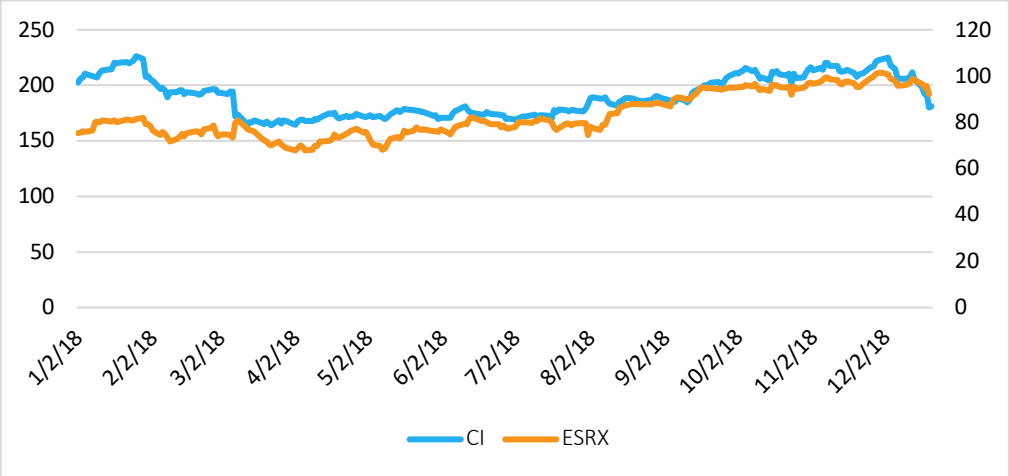


2. Stock returns around an acquisition announcement

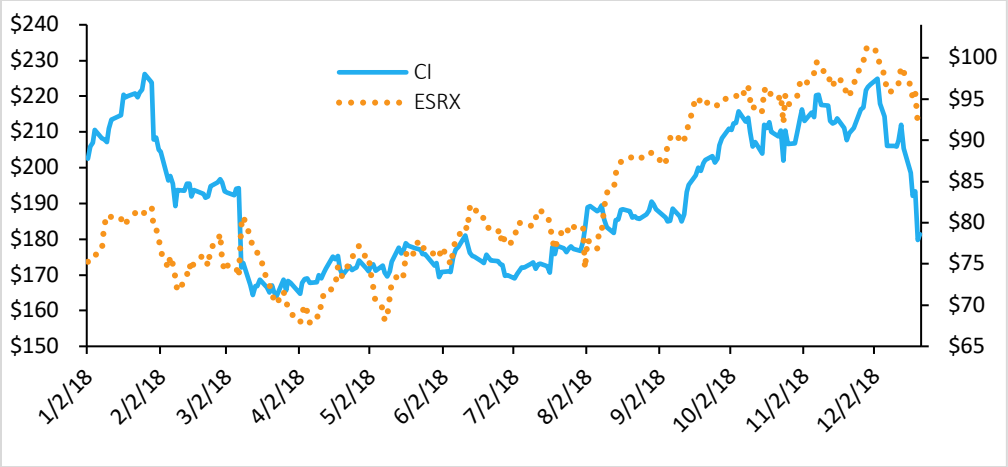
Let us graph the stock prices around the announcement that Cigna would acquire Express Scripts in March 2008. I downloaded data from the beginning of 2008 until the closing of the merger at the end of the same year. Based on the data, I made a line graph.



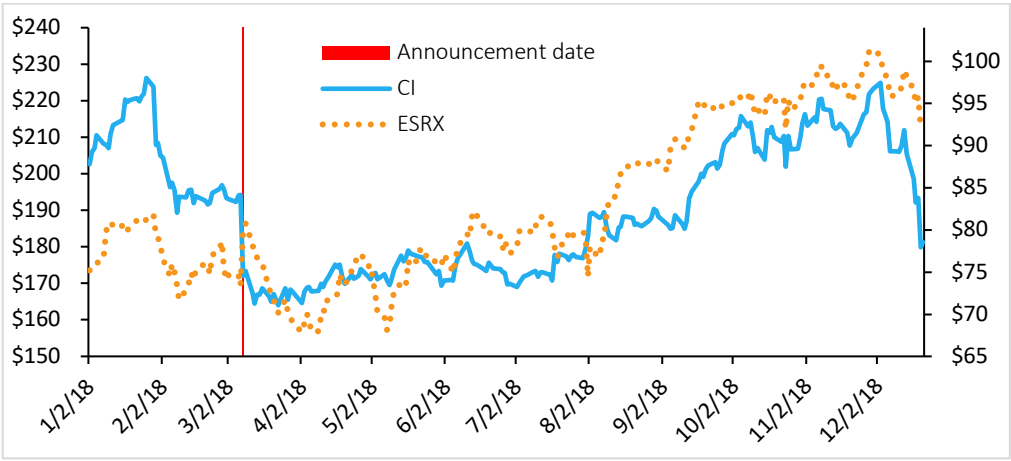
Then I clicked on the data series for ESRX, selected Format Data Series and Secondary Axis to get the two lines closer together.



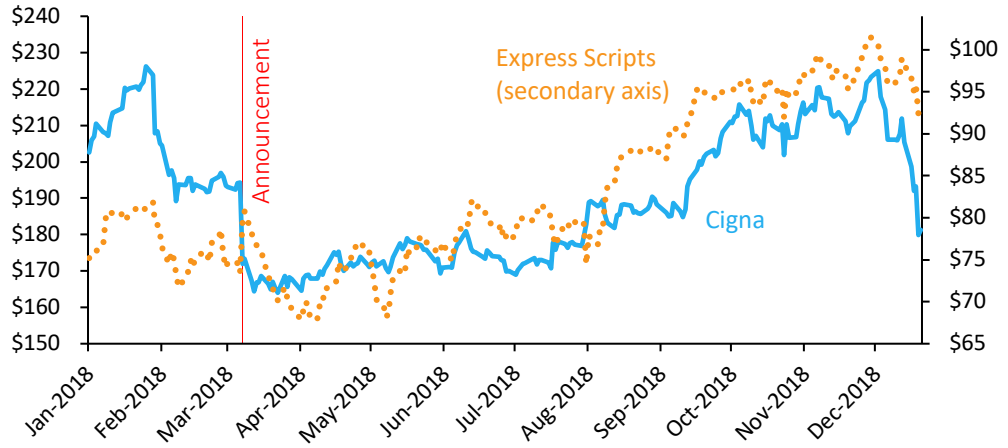
To zoom in on the action, I clicked on the axes and changed their minimum and maximum values. I wanted the same ratios between the maximum and minimum values for the two axes to minimize deception, so for the primary axis I chose a minimum value of 150 and a maximum value of 240 (such that the ratio between them is 240/150 = 1.6), and for the secondary axis I chose a minimum value of 65 and a maximum value of 104 (so the ratio is 104/65 = 1.6). I also added lines for the axes with tick marks, changed the number formatting, changed the formatting for the ESRX to make it more distinct, and moved the legend up.



To insert a line for the announcement date, I added a new data column with a random high value beyond the max values in the graph for the announcement date and kept the other cells in the column blank. Then I included this column in the graph, right clicked on this new data series, and chose Change Series Chart Type to change it to Clustered Column.



Finally, I added some text boxes and arrows and removed the legend and the border.

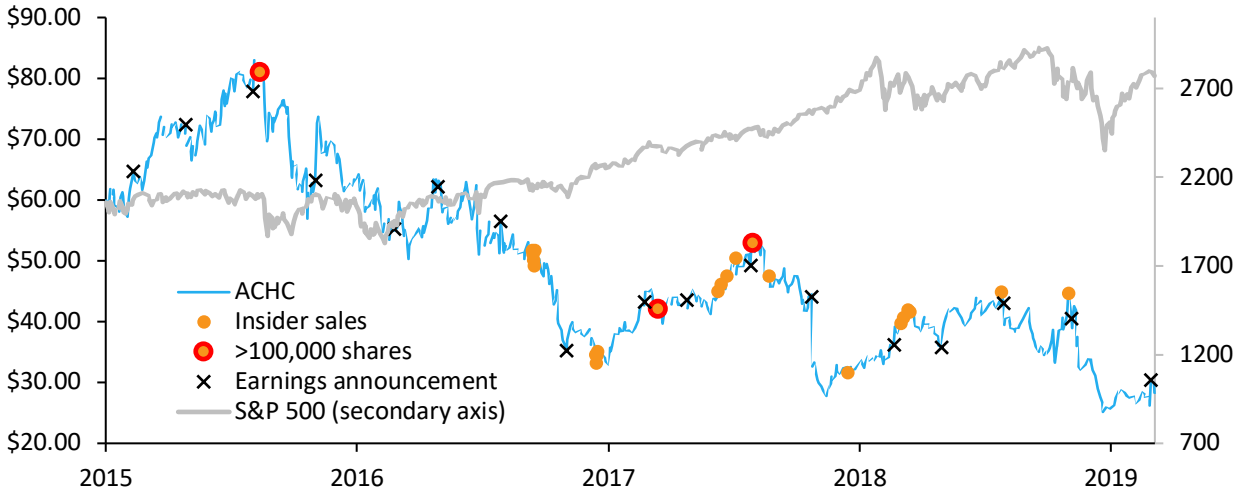


3. Stock prices around insider transactions

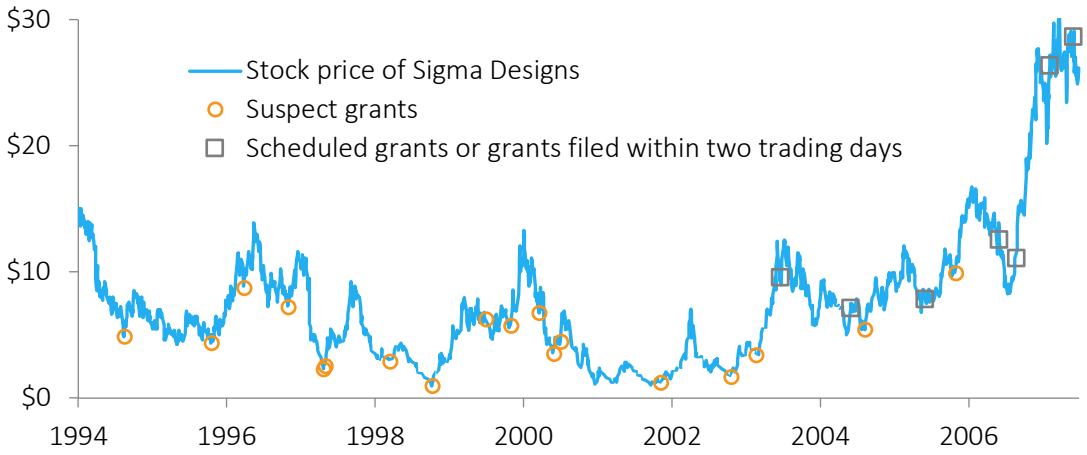
In the graphs below, I used many of the same modificatins as I did in the acquisition graph. In the first graph, my objective was to show the stock prices around insider sales of shares. In particular, I wanted to see whether the insider sales occurred (a) at peaks in the stock prices and (b) shortly before earnings announcement. This is a lot of information and events, so I need to be careful not to clutter the graph too much.

I created line graphs for the stock prices of ACHC (primary axis) and the level of the S&P 500 index as a benchmark (secondary axis). The underlying spreadsheet alo includes three columns to indicate insider sales, large insider sales (those that exceed 100,000 shares), and earnings announcements. These three columns contain the ACHC stock prices for the dates with action (e.g., date of an insider sale), and otherwise they contain blank cells (which effectvely means that most of the cells are blank). The time series data in the three columns are also depicted as lines, but I have formated them such that they show markers but no lines.

Is there a tendency for the insider sales to occur at price peaks? Are there many insider sales leading up to earnings announcements? I will leave the interpretations to you.

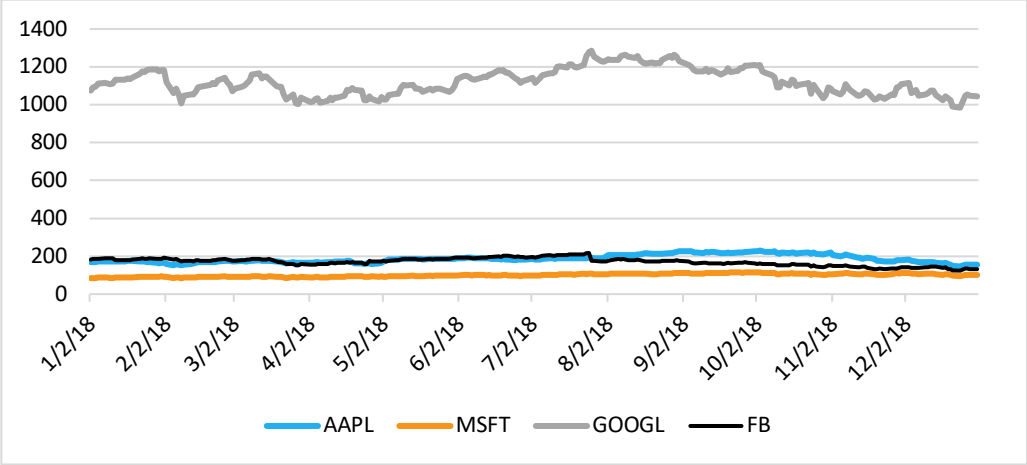


In the second graph, my objective was to see whether stock options were granted to executives on days when prices were particularly low. I split the grants into two groups based on whether the grant dates could readily have been manipulated. As is evident from the graph, the suspect grants occur on dates with particularly low prices, suggesting manipulation.

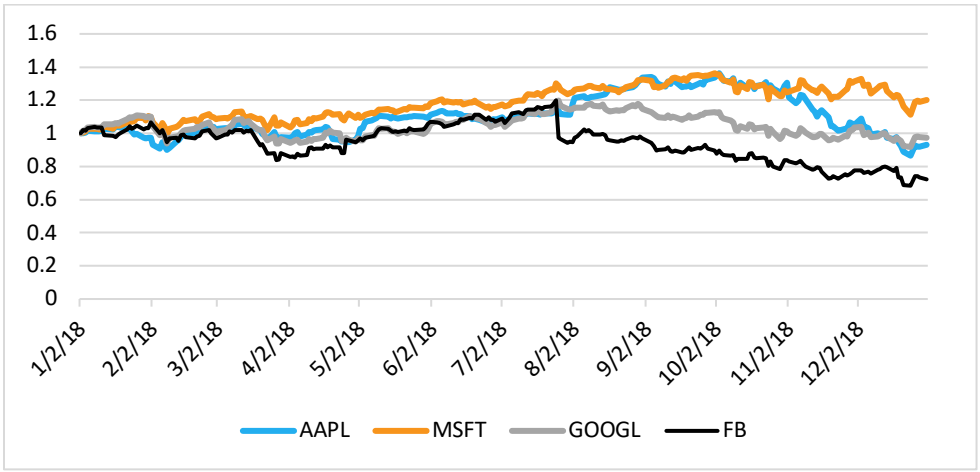

$30
$20
$10
$0
1994
1996
1998
2000
2002
2004
2006
Stock price of Sigma Designs
Suspect grants
Scheduled grants or grants filed within two trading days

4. Stock performance of large tech companies

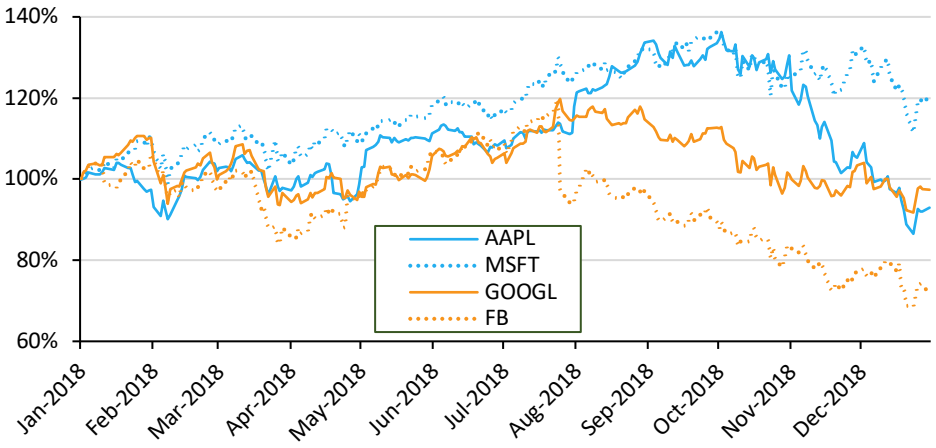
I downloaded stock prices for 2018 for four tech companies, Apple, Microsoft, Google, and Facebook, to compare their stock performance. First, I made a line graph based on the prices.



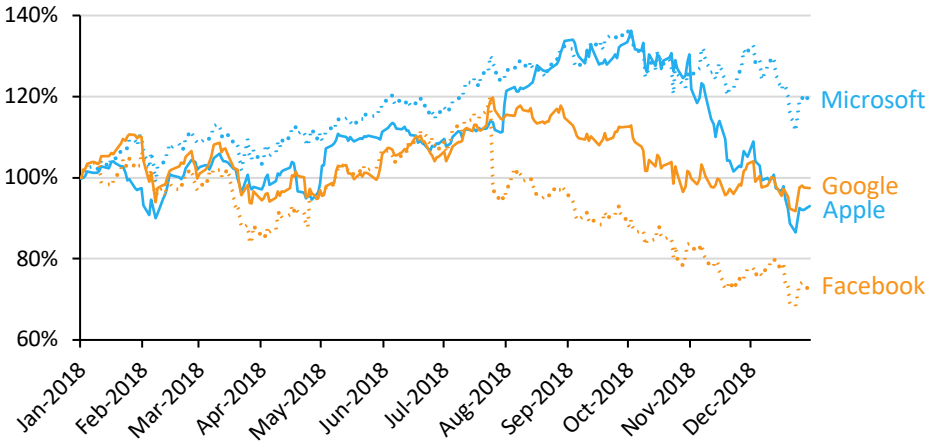
It is hard to interpret this graph because the price levels differ greatly. If I only had two companies in the graph, I could have created a secondary axis. Because I have four companies, I instead standardized the prices so they all started at one. In particular, for each stock, I divided all the stock prices by the very first one in the time series. Then I redid the graph based on these standardized prices.



It is certainly a whole lot easier to compare the stock performance of the four companies with this graph. An additional advantage is that we can easily read the percentage gain or loss during the year. To improve the graph further, I also changed the formatting of the lines and axes and moved the legend.



As an alternative, I replaced the legend with textboxes.



And the winner (and the only one with a positive stock return for the year) is: Microsoft!