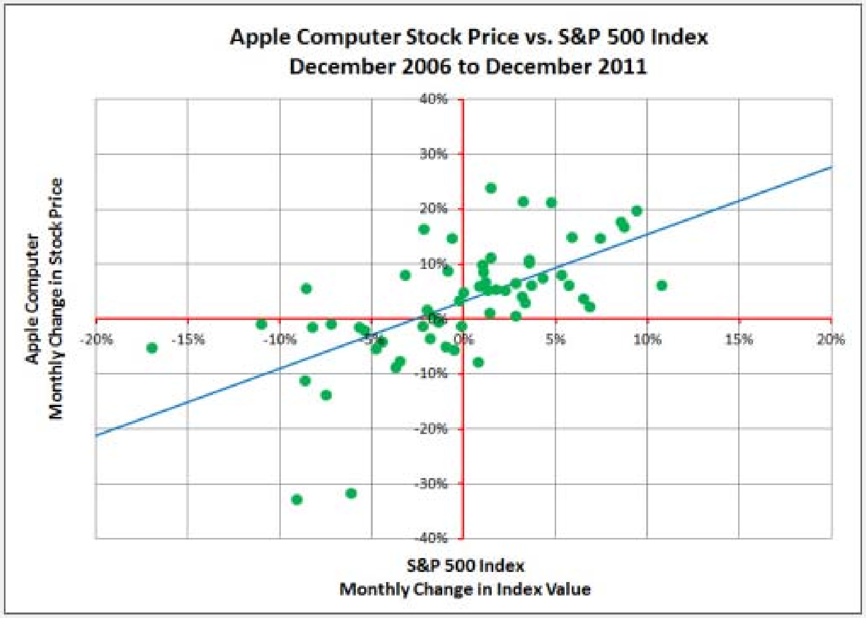
Scatter Plot Example

Real World Example of Using a Scatter Plot



Investing in Stocks

The science of investing money in stocks begins with an analysis of the historical behavior of a stock relative to an index, such as the S&P 500.

Changes in the stock price are plotted against changes in the index. Plotting a least-squares regression line through the data provides significant information about the stock (see the example for Apple Computer below).

Stocks with various levels of alpha and beta are typically selected based on the investor's risk tolerance and their anticipated changes in the overall market (represented by the index) going forward.

In simplest terms, it is best to have high-beta stocks when the market is expected to increase, and low beta stocks when the market is expected to decline. The problem with this is that it is very difficult to anticipate whether the market will increase or decline in the near future.

Enter Statistics. By evaluating a series of stocks' statistical properties over time, it is possible to purchase a set of stocks that maximizes expected return for an individual investor's specific risk tolerance.

By developing sets of stocks that maximize expected returns over various risk levels, we can create an "Efficient Frontier" of stocks. An investor can optimize their financial return by selecting the set of stocks on the Frontier that matches their individual risk tolerance.

Apple Computer

The above chart was developed in Microsoft Excel, but could have been developed using this app. The following steps were used:

1. Record the price of Apple stock (AAPL) and the S&P 500 index at the end of each month from December 2006 to December 2007.
2. Calculate the percentage change in the stock price and in the index for each month in the 5-year period.
3. For each month, create a data point where the change in the index is the x-value and the change in the stock price is the y-value. Plot each point and draw the least-squares regression line.

What do we learn?

The regression line equation for Apple Computer looks like this:

$$y = .033 + 1.221\,x$$

Alpha

The constant in the regression line is called the stock's alpha, and is a measure of the monthly change in the stock price that is independent of the monthly change of the index.

Apple Computer's alpha = 0.033, indicating that the stock appreciated by 3.3% per month in addition to any movement in overall stock prices. This is a very high value of alpha.

Beta

The coefficient of x in the regression line is called the stock's beta, and is a measure of the monthly change in the stock price that is dependent on the monthly change of the index.

Apple Computer's beta = 1.221, indicating that the stock price tended to change by 22.1% more than the index, and in the same direction as the index (up or down) over the 5-year period.

What does this imply for Apple?

In a month where the S&P index dropped by 4%, Apple would be expected to change by 3.3% + 1.221 (-4%), or a drop of 1.6%.

In a month where the S&P index increased by 4%, Apple would be expected to change by 3.3% + 1.221 (4%), or an increase of 8.2%.

There are not many stocks that behave this nicely!

Glossary | Print | Close

Calculation of Pearson's Coefficient of Correlation: Example in Microsoft Excel

n = 4 Biased estimator of variance and standard deviation

n or (n-1) = 4

x	$x - m_x$	$(x - m_x)^2$	z-score	y	$y - m_y$	$(y - m_y)^2$	z-score	$z_x * z_y$	$(x - m_x)(y - m_y)$		
2	-2	4	-1.0690	3	-4.25	18.0625	-0.9233	0.9871	8.5	r=	0.9580
4	0	0	0.0000	5	-2.25	5.0625	-0.4888	0.0000	0		0.9580
3	-1	1	-0.5345	6	-1.25	1.5625	-0.2716	0.1452	1.25		0.9580
7	3	9	1.6036	15	7.75	60.0625	1.6837	2.6999	23.25		0.9580
16		14	0.0000	29		84.75	0.0000	3.8321	33		
4	mean			7.25	mean						

s_x^2=	3.5	s_y^2=	21.1875	s_{xy}=	8.25 covariance
s_x=	1.871	s_y=	4.603		

n = 4 Unbiased estimator of variance and standard deviation

n or (n-1) = 3

x	$x - m_x$	$(x - m_x)^2$	z-score	y	$y - m_y$	$(y - m_y)^2$	z-score	$z_x * z_y$	$(x - m_x)(y - m_y)$		
2	-2	4	-0.9258	3	-4.25	18.0625	-0.7996	0.7403	8.5	r=	0.9580
4	0	0	0.0000	5	-2.25	5.0625	-0.4233	0.0000	0		0.9580
3	-1	1	-0.4629	6	-1.25	1.5625	-0.2352	0.1089	1.25		0.9580
7	3	9	1.3887	15	7.75	60.0625	1.4581	2.0249	23.25		0.9580
16		14	0.0000	29		84.75	0.0000	2.8741	33		
4	mean			7.25	mean						

s_x^2=	4.666667	s_y^2=	28.25	s_{xy}=	11 covariance
s_x=	2.160	s_y=	5.315		