International Journal of Economics, Commerce and Management
United Kingdom Vol. V, Issue 2, February 2017
http://ijecm.co.uk/ ISSN 2348 0386

AN INSIGHT INTO THE DETERMINATION OF BETA BY FINANCIAL WEBSITES: REPLICATING APPLE, INC.'S BETA AS COMPUTED BY YAHOO! FINANCE

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Abstract

Beta has been used for deeper understanding of how the stock is expected to move relative to the market, and its effect on the portfolio. Despite this canon role of betas in the investment decision making, many individuals cannot justify them. This paper sought to explain how Yahoo! Finance determines its published betas. Apple, Inc. was used and its beta value replicated. For this, the paper presented a simple approach to calculating beta values by utilizing the spreadsheets and internet data. The paper offers an insight useful to the finance students and tutors, and financial advisors.

Keywords: Beta, risk, return, portfolio management, investor decisions

INTRODUCTION

Investors commit their finances in the form of investment with a view to earning good returns at the minimum possible level of risk. However, the realization of returns is based on the future, which is inherently uncertain. As a result, several models and theories have been developed to explain the relationship between the returns and risks. Notably is the Markowitz (1952)'s Modern Portfolio Theory that shows the trade-off between the stock's risks and returns. The

stocks that have high returns are also associated with high risks and vice versa. According to Gardner, McGowan and Moeller (2010) the Modern Portfolio Theory divides total risk into idiosyncratic risk, which can be eliminated from the portfolio through diversification, and the systematic risk, which is market wide and non-diversifiable.

The idiosyncratic or non-systematic risk is unique to a given entity and can be reduced to zero through a well-constructed portfolio. Systematic risk is determined through the computation of the beta value, which indicates the volatility of a stock relative to the market as a whole. Investors make their portfolio choices based on one's risk tolerance and an adequate understanding of the likelihood for gain or loss of investments (Shelor & Wright, 2011). The beta value, therefore, paints a snapshot of how much an investor expects a given stock's price to rise or drop compared to the movement of the market as a whole, proxied by an index.

Wahlstrom (2008) stated that a high beta value is not an indication that a stock's value is expected to rise; rather it means that the stock is much more volatile (likely to rise or drop) than the market as a whole. If the market rises, it is expected that the stock with a high beta rises at a higher rate, and if the market falls, that stock also falls a higher rate. A stock whose beta value is relatively small is expected to maintain a much steadier price over time than the market. The possible beta values for any given stock are as shown below.

Table 1. Beta values and their meaning relative to the market movement

$\beta < 0$	The stock's returns move in opposite direction with the market. As the market rises, the stock's value is expected to decrease. While this relationship theoretically exists, few stocks have a negative beta.
$\beta = 0$	The stock's returns are unrelated to market moves
$0 < \beta < 1$	The stock is expected to move more slowly than the market. If the market rises, this stock should also rise but not as drastically as the market; likewise if the market falls, this stock is expected to be less volatile than the market.
$\beta = 1$	The stock is expected to move in a manner very similar to the market as a whole.
$\beta > 1$	The stock has proven to be more volatile than the market. As the market rises, this stock should rise at a higher rate. Likewise, a more severe loss is anticipated in the event the market falls.

Source: Adopted form Wahlstrom (2008)

Problem statement

The challenge remains with the determination of the right beta, that which reflects the risk that the investor is willing to bear. Coppedge, Lamb and McCague (2012) noted that there are numerous financial websites that give published betas. However, the authors added that these

published betas make the determination of risk difficult and incomplete, especially where each gives a different beta value for the same stock. The authors appreciate that the different parameters used in the calculation of the beta values are responsible for their disparity. As a result, different financial advisors are likely to offer differing recommendations to an investor, given his/her risk appetite, concerning a given stock. In the academic arena, students too often obtain the beta for a company from one of the financial website and then carelessly or naively integrate it into the assessment of risk. Other than the students, Fernandez (2009) stated that even the finance professors use different betas. Fernandez carried out a survey on the beta used by professors across the world, and from the 2,510 answers received 1,791 used betas but 107 of them could not justify the betas they used. 97.3% of the respondents who justified the betas used textbooks, databases, websites or regression.

Reasons for different beta values

There is a dispersion of the beta values offered by websites and databases, and which the students, finance professors and investment advisors use. These results can be explained by first appreciating that beta is a mathematical calculation that uses historical data. As a result, each website or database will get a different beta value depending on: the reference day, the stock index used as the market reference, the historical period used (number of years), return time frame (daily, weekly or monthly), and whether a stock correlates with others (Coppedge, Lamb, & McCague, 2012; Fernandez, 2009).

Objective

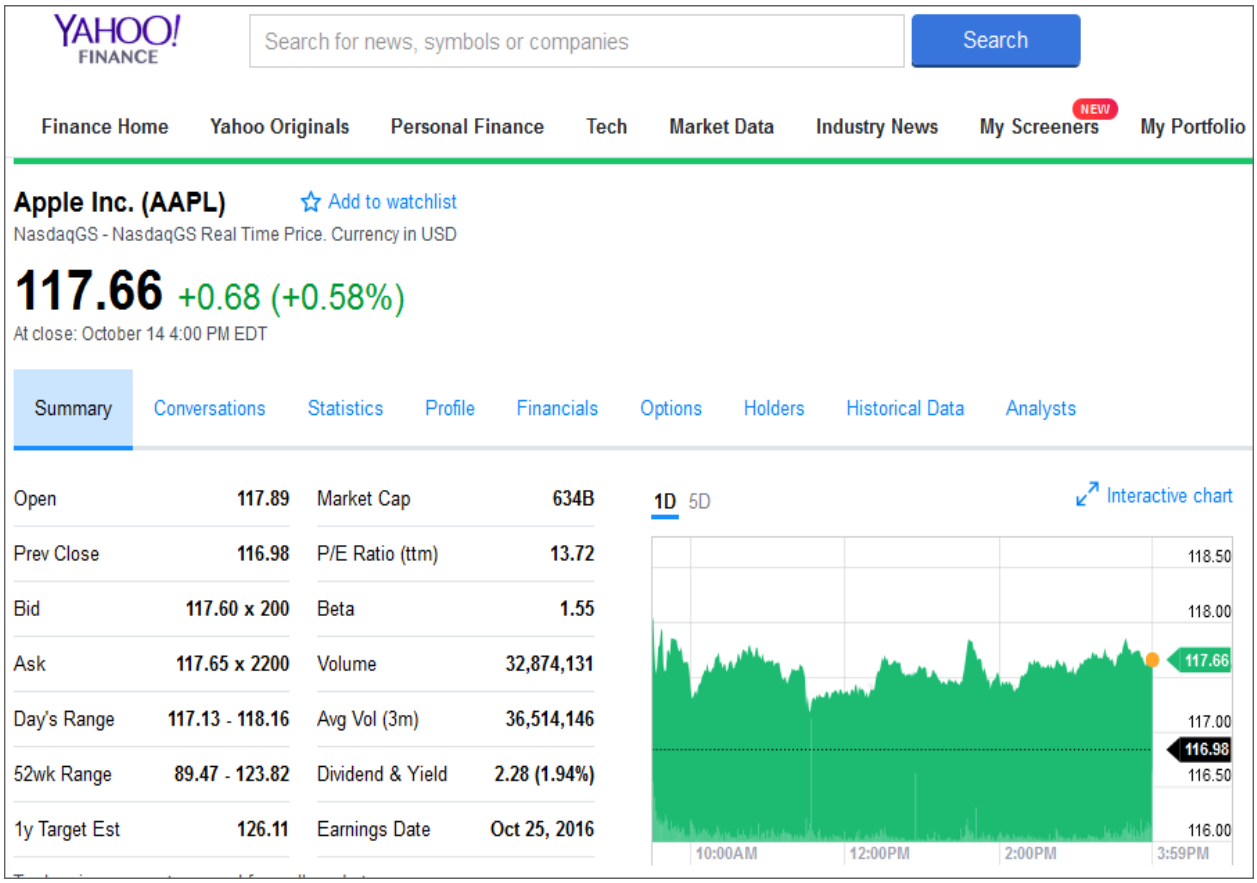
Having such a background of mixed beta values, this paper sought to unearth how Yahoo! Finance computes the beta values for a given stock. Empirically, the paper used Apple, Inc. to replicate the beta value of 1.55 as shown in figure 1 below.

Significance

This simple step by step approach to the computation of stocks' beta values as done by the Yahoo! Finance will be very useful in booth academic and investment arenas. First, it will act as a guide for students' use of actual data in the determination of stocks' risk and returns. For instance, students such as the one who posted this comment on a web - "I am trying to replicate the beta value that yahoo calculates but I am getting different results" - will find it very easy to reproduce such beta values. Second, the finance professors and other tutors will have a firm ground in explaining to the students how reputable financial websites arrive at their displayed betas. Third, the investment advisors will be able to explain to their clients the meaning of the

published betas and how they are obtained. Finally, this paper adds to the existing literature on the determination of beta values.

Figure 1. Apple, Inc.'s published beta



Determination of Beta Values by Yahoo

Coppedge, Lamb and McCague (2012) noted that Yahoo! Finance first identifies the stock's monthly prices for the previous three years and a data for a market proxy over the same period. At this point, it is paramount that one notes that Yahoo considers price data for 37 months in order to calculate returns for 36 months because the returns are first computed for the second month, whose base is the first month (Khan, 2015). It, therefore, implies that returns are computed from months 2-37. In particular, it uses the adjusted closing prices as opposed to closing prices, and uses the end month trading days closing data (Shelor & Wright, 2011). The choice of the adjusted close values is informed by the fact that it considers the total returns (capital gains plus dividend cashflows) that an investor gets (Plaehn, 2016). It also considers the data for the market proxy for the corresponding dates and computes their returns as well.

Replicating the Beta as Computed by Yahoo

In replicating the beta values for the Apple, Inc. as determined by Yahoo! Finance one goes to the Yahoo! Finance site and searches for the stock using its ticker (AAPL). Then, from the 'Historical Data' tab the needed range (37 months) is specified. Specifically, the period 1/9/2013 to 30/9/2016 was selected and the 'Apply' button clicked where data similar to the one shown in figure 2 below was displayed.

Figure 2. A snapshot of the price data for the specified period

Time Period: Sep 01, 2013 - Sep 30, 2016 Show: Historical Prices Frequency: Monthly Apply

Currency in USD. Download Data

Date	Open	High	Low	Close	Adj Close*	Volume
Sep 01, 2016	106.14	116.18	102.53	113.05	113.05	968,015,600
Aug 04, 2016				**0.57** Dividend		
Aug 01, 2016	104.41	110.23	104.00	106.10	106.10	630,128,500
Jul 01, 2016	95.49	104.55	94.37	104.21	104.21	685,779,600
Jun 01, 2016	99.02	101.89	91.50	95.60	95.60	778,364,300

Upon clicking the 'Download Data' link, the data is downloaded in an excel file to the computer where it is opened for view. Later the data is sorted from the oldest to the newest. For the same period, the market proxy (S&P 500 with a ticker 'GSPC') daily data was obtained from this site: "http://research.stlouisfed.org/fred2/series/SP500/downloaddata." The author used the daily data and filtered the end months trading days' data. After, fishing out all the required data and arranging it from the oldest to the newest, the stock's percentage return using the excel functions was calculated.

Considering table 1, the returns for the second month was arrived at by clicking inside cell E3, and then entering = (C3-C2) /C2; and to get the returns of the S&P 500, the author clicked inside cell F3 and entered = (D3-D2) /D2. The same formula was used in the subsequent cells.

Table 1: Apple, Inc. and S&P 500 37 Prices and 36 Returns Monthly Data

Date	Close	Adj Close	S&P 500	Apple, Inc.'s Stock returns	S&P 500 returns
9/30/2013	476.75	64.1135	1681.55		
10/31/2013	522.7	70.2929	1756.54	9.6%	4.5%
11/29/2013	556.07	75.2171	1805.81	7.0%	2.8%
12/31/2013	561.02	75.8867	1848.36	0.9%	2.4%
1/31/2014	500.6	67.7139	1782.59	-10.8%	-3.6%
2/28/2014	526.24	71.6082	1859.45	5.8%	4.3%
3/31/2014	536.74	73.037	1872.34	2.0%	0.7%
4/30/2014	590.09	80.2966	1883.95	9.9%	0.6%
5/30/2014	633	86.6167	1923.57	7.9%	2.1%
6/30/2014	92.93	89.0127	1960.23	2.8%	1.9%
7/31/2014	95.6	91.5701	1930.67	2.9%	-1.5%
8/29/2014	102.5	98.6676	2003.37	7.8%	3.8%
9/30/2014	100.75	96.9831	1972.29	-1.7%	-1.6%
10/31/2014	108	103.962	2018.05	7.2%	2.3%
11/28/2014	118.93	114.98	2067.56	10.6%	2.5%
12/31/2014	110.38	106.714	2058.90	-7.2%	-0.4%
1/30/2015	117.16	113.269	1994.99	6.1%	-3.1%
2/27/2015	128.46	124.683	2104.50	10.1%	5.5%
3/31/2015	124.43	120.772	2067.89	-3.1%	-1.7%
4/30/2015	125.15	121.471	2085.51	0.6%	0.9%
5/29/2015	130.28	126.978	2107.39	4.5%	1.0%
6/30/2015	125.43	122.251	2063.11	-3.7%	-2.1%
7/31/2015	121.3	118.226	2103.84	-3.3%	2.0%
8/31/2015	112.76	110.4	1972.18	-6.6%	-6.3%
9/30/2015	110.3	107.991	1920.03	-2.2%	-2.6%
10/30/2015	119.5	116.998	2079.36	8.3%	8.3%
11/30/2015	118.3	116.319	2080.41	-0.6%	0.1%
12/31/2015	105.26	103.498	2043.94	-11.0%	-1.8%
1/29/2016	97.34	95.7103	1940.24	-7.5%	-5.1%
2/29/2016	96.69	95.5871	1932.23	-0.1%	-0.4%
3/31/2016	108.99	107.747	2059.74	12.7%	6.6%
4/29/2016	93.74	92.6707	2065.30	-14.0%	0.3%
5/31/2016	99.86	99.322	2096.96	7.2%	1.5%
6/30/2016	95.6	95.0849	2098.86	-4.3%	0.1%
7/29/2016	104.21	103.649	2173.60	9.0%	3.6%
8/31/2016	106.1	106.1	2170.95	2.4%	-0.1%
9/30/2016	113.05	113.05	2168.27	6.6%	-0.1%

To compute the beta value for Apple, Inc., the data regression function of excel was used. This was done by going to the data tab of the Excel 2010, selecting the data Analysis icon, and from the appearing dialog box, Regression button was selected. Then, the range of data (returns) for the stock was entered and regressed against the relevant data range of the S&P 500. After clicking the OK button, the output of Excel regression was obtained and is as shown in figure 3 below.

Table 2. A summary output of Excel Regression Analysis of Apple, Inc.'s Returns and S&P 500

Regression Statistics	
Multiple R	0.69547
R^2	0.483678
Adjusted R^2	0.468492
Standard Error	0.050507
Observations	36

ANOVA

	df	SS	MS	F	Sign F
Regression	1	0.08125	0.08125	31.85041	2.5E-06
Residual	34	0.086734	0.002551		
Total	35	0.167984			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	0.006538	0.008669	0.75417	0.455939	-0.01108	0.024156	-0.01108	0.024156
Apple, Inc.	1.548137	0.274316	5.643617	2.5E-06	0.990659	2.105615	0.990659	2.105615

From the above, the beta value for Apple, Inc. was 1.548137, which when rounded up to two significant figures; it is equal to the 1.55 value as computed by Yahoo! Finance in figure 1 above. Other than the Regression Analysis approach to the determination of the beta value, the Excel 2010 SLOPE function can be used by specifying the range of the required returns data (=SLOPE(E3:E38,F3:F38). A similar answer 1.548137 is obtained.

CONCLUSION

The paper has presented a simple approach to calculating beta values by utilizing the spreadsheets and internet data. The students and their tutors are able to be more engaged in theoretical and empirical concepts by downloading data from financial websites and using spreadsheets to replicate the results offered by professional analysts. The various sites that compute and publish betas should agree on a more conventional approach to allow the financial advisors avoid issuing conflicting or inappropriate recommendation for a stock.

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APPENDIX I: Excerpt of Market proxy –S&P 500 Data

	A	B
1	Title:	
2	Series ID:	SP500
3	Source:	S&P Dow Jones Indices LLC
4	Release:	Standard & Poors (Not a Press Release)
5	Seasonal Adjustment:	Not Seasonally Adjusted
6	Frequency:	Daily
7	Units:	Index
8	Date Range:	2013-09-03 to 2016-09-30
9	Last Updated:	2016-10-14 7:36 PM CDT
10	Notes:	The S&P 500 is regarded as a gauge of the large cap U.S. equities
11		market. The index includes 500 leading companies in leading industries
12		of the U.S. economy, which are publicly held on either the NYSE or
13		NASDAQ, and covers 75% of U.S. equities. Since this is a price index
14		and not a total return index, the S&P 500 index here does not contain
15		dividends.
16		
17		
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33		http://us.spindices.com/contact-us/ including phone numbers for all of
34		its regional offices.
35		
36	DATE	VALUE
37	2013-09-03	1639.77
38	2013-09-04	1653.08
39	2013-09-05	1655.08
40	2013-09-06	1655.17
41	2013-09-09	1671.71
42	2013-09-10	1683.99
43	2013-09-11	1689.13
44	2013-09-12	1683.42
45	2013-09-13	1687.99
46	2013-09-16	1697.60