

## **Beta Boot Camp: Teaching Students to Properly Apply Systematic Risk**

**Wayland T. Coppedge**

Department of Economics and Geography  
Coggin College of Business  
University of North Florida  
Jacksonville, FL 32003, USA.

**Reinhold P. Lamb**

Department of Accounting and Finance  
Coggin College of Business  
University of North Florida  
Jacksonville, FL 32003, USA.

**James E. McCague**

Department of Accounting and Finance  
Coggin College of Business  
University of North Florida  
Jacksonville, FL 32003, USA.

### **Abstract**

*Beta can be a misunderstood and misused measure of risk, as there exists a large collection of beta values on various websites, like Yahoo!Finance, in published sources, like Value Line Investment Survey, and from news services, like Thomson Reuters and Standard and Poor's. For finance students that may one day have clients of varying sophistication, the inconsistency in reported beta values can produce confusion for the client when trying to validate that the account is being managed properly. A scenario is presented whereby a client becomes disgruntled with a new advisor because it appears that the risk exhibited in the account is inconsistent with the client's risk tolerance. A solution is offered that permits the advisor to educate the client about the interpretation of beta values, misunderstandings about published betas, and portfolio risk using the very example on which the client's concerns are based.*

**Keywords:** beta, systematic risk

### **1. Introduction**

Risk is a consideration in every investment decision and, for a stock, risk is quantified by beta. Fortunately, the widespread availability of published betas on many financial websites makes the acquisition of this risk metric conveniently available. On the other hand, the calculation of beta does not include consistent factors, thus making the interpretation of published betas and the ensuing risk difficult and incomplete. Too often, students obtain from a website the beta for a company and then carelessly or naively integrate that value into the assessment of risk. Consequently, two students analyzing the same firm could submit work that describes risk that does not match. If they used different websites, or if one of the students calculated beta themselves and the other referred to a website, or even if they both calculated beta but used different parameters, the values could be different – even very different. It could be that one of the students would even recommend the stock as appropriate for an investor given the risk, while the other student recommends it as inappropriate to the same investor. How can this be? Too often, finance students, who are aspiring financial advisors with clients, obtain a beta value from a website and then blindly integrate it into a valuation model or some other decision-making process. What follows is the solution to a scenario between financial advisor and disgruntled client to provide an understanding of the fact that beta is more than a simple number. In fact, beta will be misunderstood or incorrectly interpreted if that number is not decomposed to expose the specific factors of the calculation. The following classroom presentation and assignment demonstrate that the only way to interpret the beta value properly is to understand how that value was calculated.

## ***2. Establishing the Risk Level of the Client***

Fast forward past your graduation. Assume you are a financial advisor who has been hired by a client to design a portfolio or allocate the assets in an account in a way that reflects the risk the client is willing to bear. The client will accept some risk but is not a bungee jumper when it comes to investing money. The acceptable level of risk is around the middle of the scale; that is, the client is comfortable with average risk but becomes very uncomfortable quickly as risk rises above average. The client is quite resolute that above average risk is outside the comfort zone and that average risk or slightly below average risk is the only acceptable level. You indicate that the client has been very clear on how much risk is acceptable and that you understand how to construct and manage the portfolio given the risk parameters.

## ***3. Client Confrontation about the Risk in the Portfolio***

After the first quarter (or year) of management, you prepare a performance report for the client. Each of the positions comprising the account is presented with the corresponding performance. The overall performance is also presented. The client is savvy enough to scrutinize the report, especially since it is the first one from you – the new financial advisor. In the process, the client utilizes mainstream websites to judge the composition of the portfolio and the performance of the manager. Yahoo!Finance shows several statistics for each ticker symbol entered and some of them are unfamiliar to the client. The client sees beta on a webpage, searches for information about what it means, and learns that it is a measure of risk whereby a value of 1.0 represents average risk. Values greater (less) than 1.0 indicate greater (less) than average risk. After noting the betas for each of the companies (exchange traded funds, mutual funds) in the account, the client is surprised to learn that several of the positions have a beta substantially exceeding 1.0, indicating a level of risk above that expressed to you. For example, Yahoo!Finance shows the beta for eBay (EBAY), one of the holdings, is 1.56. The outraged client calls you for an immediate meeting to resolve the perceived trouble. At the meeting, the client presents a copy of the webpage with the EBAY beta and date circled and asks for an explanation for why the desired risk level was not respected. Exhibit 1 is the page of evidence.

The challenge to you is how to now respond. What do you tell the client? The client clearly articulated that the acceptable level of risk is average to slightly below average, yet the client has produced evidence that at least one of the positions in the portfolio is in violation of the established risk parameters. As this relationship is still in the early stage, the client may begin to develop doubts or suspicions about your commitment to following instructions and managing the account as desired. Your credibility and competence is being questioned and, since the client is visibly upset, a continuation of the relationship may be dependent on how you respond to this confrontation.

## ***4. Responses to the Client to Defuse the Misunderstanding***

This scenario requires tact and patience. It also requires you to educate the client about risk and beta in order to preserve the relationship and the account. What follows is a series of responses that should convince the client that you do, indeed, understand the risk preferences of the client in customizing a personalized account, that you are knowledgeable about portfolio management, and that you have the ability to explain complex information in a manner easily understood by the client. Credibility should be restored.

### **4.1 Betas are not Consistent**

You look at the Yahoo!Finance printout of the EBAY beta (1.56) and then begin to explain that beta is a mathematical calculation that utilizes the returns of the company and the returns on some market index, like the S&P 500 Index. The beta value is the slope of the regression line between those two inputs. The client is correct in interpreting the Yahoo beta for EBAY as riskier than average and, consequently, seemingly outside of the risk parameters communicated. However, you should then proceed to describe how the beta value is sensitive to the inputs in that regression calculation and that the details of those inputs are subjectively determined by whoever is making the calculation. The subjective inputs involve (a) index choice, (b) calendar period of interest (number of years), and (c) return time frame (daily, weekly, monthly). Since there are many choices within each input, beta values for the same company can be very different. Yahoo!Finance describes that its beta is calculated using the S&P 500 Index and three years of monthly data. It is from this data that the EBAY beta is calculated, and it is mathematically correct. The slope of the regression line using those inputs is 1.56, indicating greater than average risk.

You can then open your notebook computer to a Thomson Reuters stock report (via E\*Trade or many other online brokerage firms that subscribe to Thomson Reuters research). The most recent report on EBAY, dated within the same week as the Yahoo!Finance page from the client, shows a beta value of 1.02, indicating risk is about average and consistent with the desires of the client. Exhibit 2 presents the Thomson Reuters page. How is this possible? One service reports beta risk higher than average at 1.56 while another service reports it at about average at 1.02? And if they are both correct because they both involve a mathematical operation, what good is beta if it can vary so much? The answer to that question is that the only way to properly interpret beta and integrate it into decision-making is to understand how it is calculated through the use of varying input options. Otherwise, the application of the beta value for framing future expectations must be done with great caution at best. The Thomson Reuters beta of 1.02 was calculated by using the S&P 500 Index and daily returns over twelve months. You could further refer the client to research that reports the instability of beta across other popular websites and publications [(Reilly and Wright, 1988), (Lamb and Northington, 2001), (Aggrawal and Waggle, 2010)].

Furthermore, you could present evidence of beta inconsistency by producing the Standard and Poor's stock report for EBAY dated the same week as the other two sources. Exhibit 3 shows an even higher beta of 2.12, indicating more than double average risk.

The parameters for calculating beta from five popular published sources are presented below. Market index, calendar period and return time frame are not consistent across the services, consequently different beta values are produced. Although Smartmoney and Yahoo!Finance have the same parameters, their beta values can still be different because they have different rolling data reset periods.

| <u>Website</u> | <u>Market Index</u> | <u>Calendar Period</u> | <u>Return Time Frame</u> |
|----------------|---------------------|------------------------|--------------------------|
| Smartmoney     | S&P 500             | Monthly                | 36 Months                |
| Yahoo.Finance  | S&P 500             | Monthly                | 36 Months                |
| Reuters        | S&P 500             | Monthly                | 60 Months                |
| Bloomberg      | S&P 500             | Weekly                 | 2 Years                  |
| Value Line     | NYSE Composite      | Weekly                 | 5 Years                  |

All of the published beta values are correct in a mathematical sense over the history of behavior for EBAY given the inputs; however, you believe that the Thomson Reuters beta value of 1.02 is a better measure of the risk of EBAY because it spans a period that you believe to be more reflective of the future. The Yahoo!Finance beta is much higher because it includes a period that was very volatile. The financial crisis of 2009 is included in that beta calculation and it distorts the risk value by overstating it going forward, unless it is believed that the economy (and EBAY) will experience another 2008-2009 behavior in the near future, specifically, during the expected investment holding period. Since the application of beta is to predict future risk based on a historical risk calculation, it is important to select a historical period that represents the belief of how the stock will perform going forward. For example, if you believe the recent past includes a period that the stock will likely not experience in the future, then including that period in a forward looking application can be misleading. You conclude by stating that although all three beta calculations are mathematically correct, the one year beta from Thomson Reuters is more reflective of your risk expectation of EBAY going forward and, therefore, is the more appropriate measure to integrate into the client's total portfolio risk assessment.

Exhibit 4 provides an example of the application of a sample period selection in the beta calculation or beta choice. All sectors, and especially the financial sector, experienced a tremendous shock during the market collapse beginning in late 2008 and spilling into 2009 with the failure of Lehman Brothers. The arrows marked "1" represent the three years over which the Yahoo!Finance beta is calculated. The circle ("2") indicates that this period includes the subperiod of the financial crisis and the behavior indicates unusual volatility and a break from how XLF (financial sector ETF) tracked the market. Consequently, any beta calculated from that three year sample period includes the crisis, and imputed into the use of that beta is the belief or assumption that the investment holding period future will include another period like that represented in "2". Number "3" shows that the return behavior in the last year has stabilized and resembles the period in "4" prior to the crisis.

An investor, analyst or financial advisor using beta to represent risk should select the sample period of calculation that best reflects the belief of that risk relationship going forward.

One believing that another financial crisis like the one depicted in Exhibit 4 is unlikely would have a distorted risk metric if that three year sample period was selected or if the beta from Yahoo!Finance was used. If one believes XLF has stabilized and reverted back to the relationship with the market prior to the crisis, then a one year sample period would more accurately reflect that belief. The lesson learned by the client in this presentation is that betas are not consistent and one must understand where the inputs come from in the calculation in order to apply the beta properly in decision-making situations like portfolio construction.

Appendix 1 provides an assignment that requires students to calculate betas using three different market indexes. Students are also required to find betas from two published sources. The result is five different beta values and demonstrates the dilemma that an advisor faces when simply going to a website to obtain a measure of risk. All five betas are correctly calculated and do reflect risk, but since they are all different the one used in decision-making must be understood as appropriate.

#### 4.2 Betas are not Constant

A stable beta implies that the systematic risk of a firm does not change; that is to say that the relationship between the stock and the market is continuous. A company (fund) is like a living entity that changes through time, bringing in managers with a higher(lower) risk appetite, developing new products, expanding into new markets, and being exposed to new regulations and new competition. Consequently, the firm is not static and should not be expected to behave and perform at a constant measurable level. For example, Exhibit 5 shows the beta for AT&T (T) reported on smartmoney.com on November 11, 2008 is 1.17. The same website with the same inputs reported about three years later, on February 2, 2011, a T beta of 0.66. This is presented in Exhibit 6. The same company (T), the same website and index and return time frame parameters produced two very different values for risk when the calendar period changed. Such evidence of instability in beta values should produce caution in the client in putting too much weight into identifying and applying any beta value without the knowledge of the period over which it represents.

#### 4.3 Portfolio Risk

After the consistency and stability of beta are described to the client, it would then be good to reinforce the point that it is a portfolio that is being managed, not a collection of individual securities. In managing risk, a portfolio provides benefits of diversification through the interaction of individual securities. Each pair of securities is correlated to some degree, and an active and engaged manager constructs the portfolio to satisfy the risk and expectation of the client. That is what you have done for the client. In a way, it is the portfolio as a whole that represents the risk to the client, not the individual risks manifested in the lineup of individual securities comprising the portfolio. It would be naïve for a client to select one security, identify the risk of that security, and jump to the conclusion that it represents the risk of the entire portfolio. You would emphasize that although EBAY, with a Yahoo!Finance beta of 1.56, may be riskier than the average security given the respective inputs, the risk of the portfolio is the weighted average of the risks of all the individual securities. Perhaps the weight of EBAY is low and so the impact of a 1.56 beta is small. Perhaps most of the other securities have betas in the 0.7-0.9 range and easily counterbalance EBAY and any other securities with betas greater than 1.0. When considering the portfolio as a whole, the risk is, indeed, lower than average and is within the parameters of what the client desired, despite at least one of the securities exhibiting higher than average risk. The example below demonstrates that although one security (EBAY) has greater than average risk and even the largest weight in the portfolio, the weighting of the securities produces a portfolio beta (0.942), still within the parameters of the client's risk preference.

| <u>Stock</u> | <u>\$ Exposure</u> | <u>Beta</u> | <u>Weight</u> | <u>Weighted Average</u> |
|--------------|--------------------|-------------|---------------|-------------------------|
| DDD          | 40,000             | 0.40        | 20%           | 0.080                   |
| AFG          | 30,000             | 0.50        | 15%           | 0.075                   |
| LMN          | 30,000             | 0.30        | 15%           | 0.045                   |
| EBAY         | 90,000             | 1.56        | 45%           | 0.702                   |
| TU           | <u>10,000</u>      | 0.80        | <u>5%</u>     | <u>0.040</u>            |
|              | 200,000            |             | 100%          | 0.942                   |

#### 5. Conclusions

A frustrated client confronts a new financial advisor questioning competence and credibility in the mismanagement of the risk averse portfolio by investing in a security with a beta greater than 1.0.

Such questioning is realistic and could jeopardize the relationship between client and advisor. The root of the trouble is an insufficient understanding on the part of the client of how beta is calculated and what it represents on both an individual scale and within the context of a portfolio. At the same time, it provides an opportunity for the advisor to regain trust by educating the client that the only way to properly interpret beta is to understand how it is calculated and how it interacts with the portfolio. Financial professionals are called upon to understand how risk is calculated and to thoughtfully select a beta that reflects the inputs they believe are most relevant for the client going forward. Consequently, a realistic and potentially uncomfortable misunderstanding can be diffused and turned into a positive outcome if the advisor will take the time to educate the client. It is very important for students to understand these issues involving beta before they become financial professionals.

### References

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- Reilly, Frank K. and David J. Wright, 1988, "A Comparison of Published Betas," *Journal of Portfolio Management*, 14, 64-69.

### Appendix 1: Beta Calculation Assignment and Interpretation

- a) Select a company that has been publicly traded for at least three years and that has published betas on both smartmoney.com and reuters.com. (*Note to Instructor: The reason for using these two websites is they typically publish different beta values. Smartmoney uses a 36 month sample period and Reuters uses 60 months.*) Record the two published betas for your company and email to me the company name, ticker symbol and two beta values.
- b) After I have approved your choice (first come first served), collect 37 months (August 2008 – August 2011) of adjusted closing prices from yahoo.finance for your company and for the Dow Jones Industrial Average, the S&P 500 Index and the NASDAQ Composite Index. Calculate 36 monthly % return values for each.
- c) Enter the data in a spreadsheet in the following format:
- |             | Stock Firm          | DJIA                | S&P500              | NASDAQ              |
|-------------|---------------------|---------------------|---------------------|---------------------|
| <u>Date</u> | <u>Price Return</u> | <u>Price Return</u> | <u>Price Return</u> | <u>Price Return</u> |
|             |                     |                     |                     |                     |
- d) Calculate beta for your firm based on each of the three market indices. If using Excel, you can simply go to an empty cell in your spreadsheet and type =slope. The beta calculation is generated by SLOPE(Dependent, Independent). The Dependent Variable is the return column for your firm; the Independent variable is the return column for each of your market representatives. You can also calculate beta through a regression in Data Analysis which may require you to open an Add-In from the Tool Pak. Either way, you will perform three separate regressions (stock vs. DJIA, stock vs. S&P500; stock vs. NASDAQ) that will produce three different betas.
- e) Present one graph showing the relative monthly %return behavior of your firm against the three markets during your sample period. You must generate this graph and it must match your data. The graph should have four monthly return % lines: your stock, DJIA, S&P 500 Index, NASDAQ Composite Index.
- f) Compare the five betas for your firm. Explain possible reasons for the differences. Attach all of your data, calculations/output and published beta pages from smartmoney and reuters.

Exhibit 1: eBay (EBAY) Key Statistics from Yahoo!Finance, February 1, 2011

**eBay Inc. (EBAY)** At 4:00PM EST: **31.64** ↑ 1.28 (4.22%)

**Key Statistics**

Data provided by Capital IQ, except where noted.

| Valuation Measures                            |        |
|---|--------|
| Market Cap (intraday) <sup>5</sup> :          | 41.20B |
| Enterprise Value (Feb 1, 2011) <sup>3</sup> : | 34.64B |
| Trailing P/E (ttm, intraday):                 | 23.26  |
| Forward P/E (fye Dec 31, 2012) <sup>1</sup> : | 14.79  |
| PEG Ratio (5 yr expected) <sup>1</sup> :      | 1.87   |
| Price/Sales (ttm):                            | 4.32   |
| Price/Book (mrq):                             | 2.58   |
| Enterprise Value/Revenue (ttm) <sup>3</sup> : | 3.78   |
| Enterprise Value/EBITDA (ttm) <sup>3</sup> :  | 12.21  |

| Financial Highlights       |              |
|----------------------------|--------------|
| Fiscal Year                |              |
| Fiscal Year Ends:          | Dec 31       |
| Most Recent Quarter (mrq): | Dec 31, 2010 |
| Profitability              |              |

| Trading Information           |        |
|-------------------------------|--------|
| Stock Price History           |        |
| Beta:                         | 1.56   |
| 52-Week Change <sup>3</sup> : | 31.03% |

Source: www.finance.yahoo.com

Exhibit 2: eBay (EBAY) Stock Report from Thomson Reuters, January 28, 2011

**Stock Report (10-Page)** Updated January 28, 2011 for EBAY-O

**Risk**

The Risk Indicator displays stocks on a scale of 1-10 with 10 being awarded to the least risky stocks. 'Risk' is derived by looking at a series of long (60-month) and short (90-day) term stock performance measures including volatility (standard deviation), magnitude of returns (best and worst day and month), beta (movement versus broader market), and correlation to the relevant index.

| Indicator                | Peers       | Averages  |
|--------------------------|-------------|-----------|
| <b>RISK 10</b>           | CPRT        | 10        |
|                          | EDU         | 10        |
|                          | APOL        | 6         |
|                          | HRB         | 6         |
|                          | <b>EBAY</b> | <b>10</b> |
| General Retailers Sector | 5.6         |           |
| Retail Supersector       | 5.8         |           |
| S&P 500 Index            | 7.7         |           |
| Giant Market Cap         | 8           |           |

**Indicator Trend**

**Indicator Sub-Components**

| Magnitude of Returns (25% weight)   | Volatility (25% weight)   | Beta (1-year) (25% weight)   | Correlation (25% weight)  |
|---|---|--|---|
| LOW 10<br>9 ← CPRT<br>8<br>7<br>6 ← EBAY, EDU, HRB, APOL<br>5<br>4<br>3<br>2<br>1<br>HIGH | LOW 10<br>9 ← CPRT, EBAY, EDU<br>8<br>7<br>6 ← APOL, HRB<br>5<br>4<br>3<br>2<br>1<br>HIGH | LOW 10<br>9 ← APOL, EDU<br>8<br>7<br>6 ← HRB, EBAY<br>5 ← CPRT<br>4<br>3<br>2<br>1<br>HIGH | LOW 10<br>9 ← CPRT, EBAY, EDU<br>8<br>7<br>6<br>5<br>4<br>3<br>2 ← APOL, HRB<br>1<br>HIGH |

| Daily Returns (last 90) | Standard Deviation   | Beta vs. S&P 500        | Correlation vs. S&P 500 |
|-------------------------|----------------------|-------------------------|-------------------------|
| Best 5.8%               | Last 90 Days 1.75    | 1.02                    | Last 90 Days 42%        |
| Worst -3.6%             | Last 60 Months 11.40 | Positive Days Only 0.81 | Last 60 Months 69%      |
|                         |                      | Negative Days Only 1.04 |                         |

Source: Thomson Reuters, 2011

**Exhibit 3: eBAY (EBAY) Stock Report from Standard & Poor's, January 29, 2011**

Stock Report | January 29, 2011 | NNM Symbol: **EBAY** | **EBAY** is in the S&P 500



**eBay Inc**

S&P Recommendation **HOLD** ★★☆☆

Price  
\$30.31 (as of Jan 28, 2011)

12-Mo. Target Price  
\$31.00

Investment Style  
Large-Cap Growth

GICS Sector Information Technology  
Sub-Industry Internet Software & Services

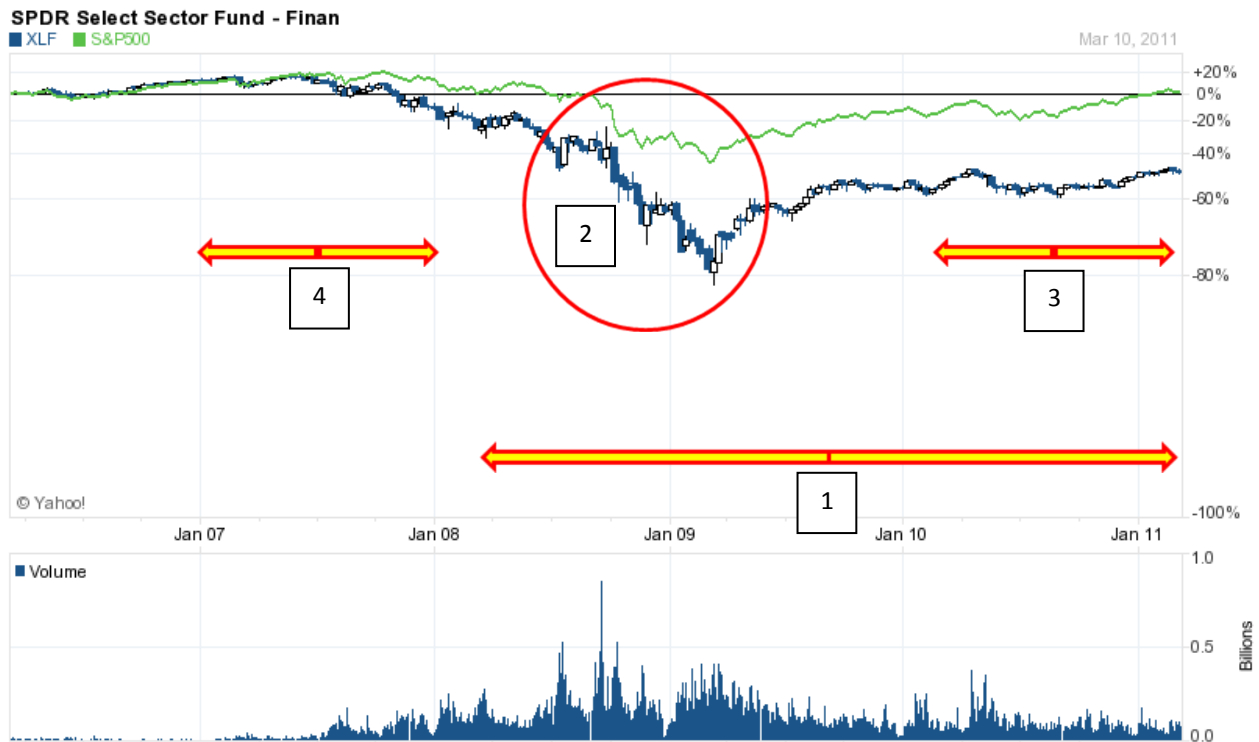
**Summary** EBAY owns one of the world's most popular e-commerce destinations, which bears its name, as well as PayPal (an online payments company), 30% of Skype (an Internet communications business), and other online business interests.

**Key Stock Statistics** (Source S&P, Vickers, company reports)

|                          |                |                            |         |                             |          |                             |      |
|--------------------------|----------------|----------------------------|---------|-----------------------------|----------|-----------------------------|------|
| 52-Wk Range              | \$31.64– 19.06 | S&P Oper. EPS 2011E        | 1.60    | Market Capitalization(B)    | \$39,516 | Beta                        | 2.12 |
| Trailing 12-Month EPS    | \$1.36         | S&P Oper. EPS 2012E        | 1.90    | Yield (%)                   | Nil      | S&P 3-Yr. Proj. EPS CAGR(%) | 18   |
| Trailing 12-Month P/E    | 22.3           | P/E on S&P Oper. EPS 2011E | 18.9    | Dividend Rate/Share         | Nil      | S&P Credit Rating           | A    |
| \$10K Invested 5 Yrs Ago | \$6,878        | Common Shares Outstg. (M)  | 1,303.7 | Institutional Ownership (%) | 80       |                             |      |

Source: The McGraw Hill Companies, Inc., 2011

**Exhibit 4: Return Behavior of XLF (Financial Sector ETF) and the S&P 500 Index**



Source: adapted from www.Yahoo!Finance.com



**Exhibit 5: AT&T (T) Snapshot on SmartMoney.com, November 11, 2008**

**T (AT&T Inc.)**

Exchange: NYSE Industry: Telecom Services/Domestic  
 Last Trade 2:22:50 PM ET **11/3/2008**

Share Price (\$): **27.86**

Price Change: **1.09 (4.07%)**

Last 10 Quotes ..... What is this?

**Share Liquidity & Volatility**

|                             |               |
|-----------------------------|---------------|
| Beta                        | 1.17          |
| Liquidity Ratio             | 267,000       |
| Float                       | 5,887,425,584 |
| Shares Outstanding, Basic   | 5,893,000,000 |
| Shares Outstanding, Diluted | 5,921,000,000 |
| Float as a % of Shares Out  | 99.90%        |

Source: www.smartmoney.com

**Exhibit 6: AT&T (T) Snapshot on SmartMoney.com, February 2, 2011**

**T (AT&T Inc.)** Share Price (\$): **27.67**

Exchange: NYSE Industry: Telecom Services/Domestic Price Change: **-0.20 (-0.71%)**

Last Trade 3:15:19 PM ET **2/2/2011** Last 10 Quotes ..... What is this?

TRADE FREE  
FOR 60 DAYS  
E-TRADE SECURITIES, LLC

ING DIRECT  
Save your money

TD Ameritrade

Fidelity

Overview | Chart | News | Profile | Key Stats | Financials | Earnings | Ratings | Compare | Holders | Insiders | Options

|                 |             |                |            |
|-----------------|-------------|----------------|------------|
| Volume:         | 16,718,127  | Avg Volume:    | 27,441,400 |
| Day's Low:      | \$27.56     | Day's High:    | \$28.05    |
| 52-wk Low:      | \$23.78     | 52-wk High:    | \$30.10    |
| Previous Close: | \$27.87     | Open Price:    | \$28.04    |
| Dividend:       | \$0.43      | Yield:         | 6.17%      |
| Market Cap:     | 164,711,700 | P/E (Forward): | 11.61      |

1d 5d 3m 6m 1y 5y 10y YTD

**Key Statistics** More | Compare

|               | T     | Industry Average |
|---------------|-------|------------------|
| P/E (TTM)     | 8.29  | 17.20            |
| P/E (Forward) | 11.61 | 11.20            |
| PEG Ratio     | 2.12  | 0.97             |
| Price/Sales   | 1.33  | 1.29             |
| Beta          | 0.66  | 0.60             |

Source: www.smartmoney.com