

Estimating Beta

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- The standard procedure for estimating betas is to regress stock returns (R_j) against market returns (R_m):

$$R_j = a + b R_m$$

where a is the intercept and b is the slope of the regression.

- The slope of the regression corresponds to the beta of the stock and measures the riskiness of the stock.
- The R squared (R^2) of the regression provides an estimate of the proportion of the risk (variance) of a firm that can be attributed to market risk. The balance ($1 - R^2$) can be attributed to firm specific risk.

Estimating Performance

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- The intercept of the regression provides a simple measure of performance during the period of the regression, relative to the capital asset pricing model.

$$\begin{aligned} R_j &= R_f + b (R_m - R_f) \\ &= R_f (1-b) + b R_m \end{aligned} \quad \text{..... Capital Asset Pricing Model}$$

$$R_j = a + b R_m \quad \text{..... Regression Equation}$$

- If
 - $a > R_f (1-b)$ Stock did better than expected during regression period
 - $a = R_f (1-b)$ Stock did as well as expected during regression period
 - $a < R_f (1-b)$ Stock did worse than expected during regression period
- The difference between the intercept and $R_f (1-b)$ is Jensen's alpha. If it is positive, your stock did perform better than expected during the period of the regression.

Setting up for the Estimation

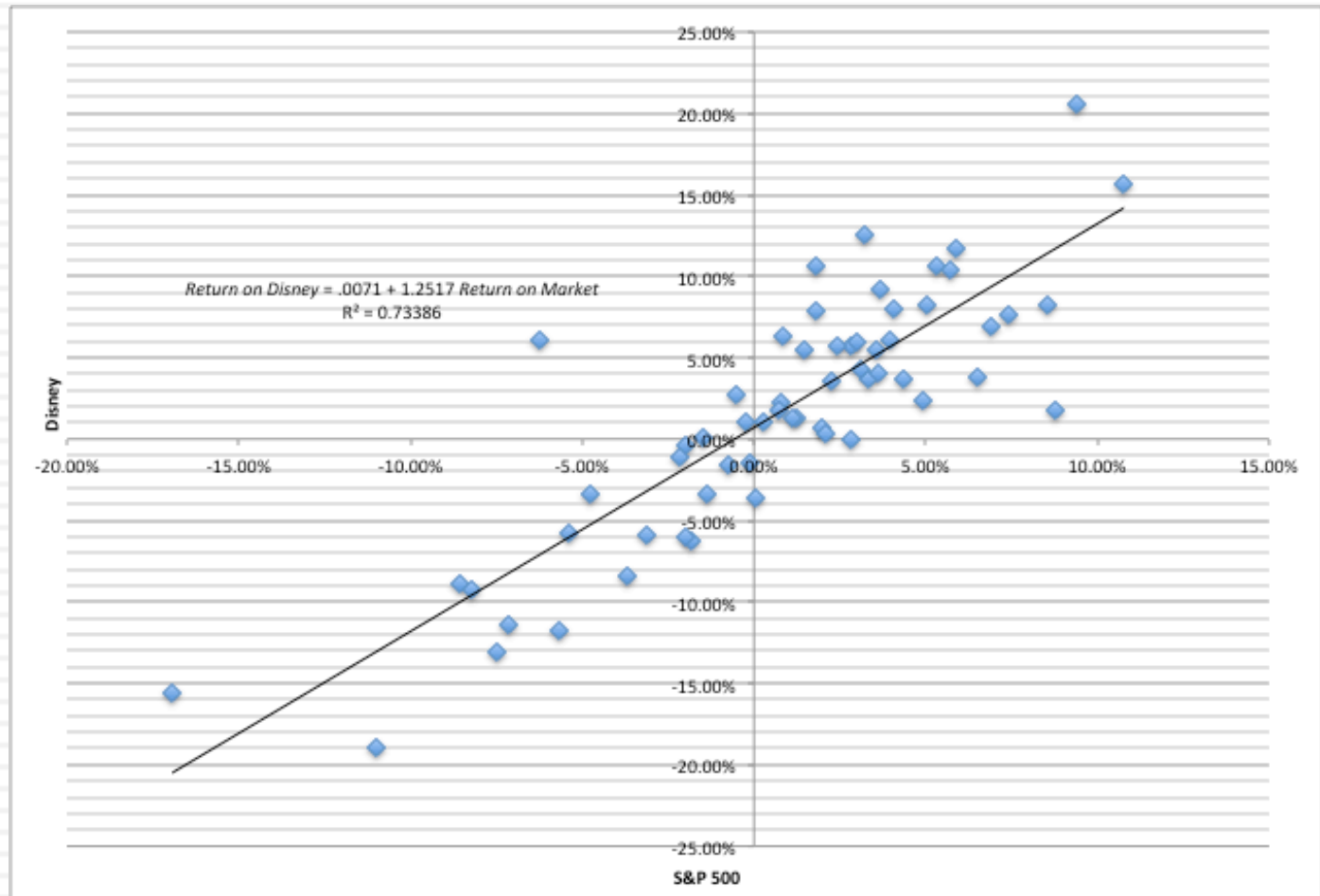
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- Decide on an estimation period
 - ▣ Services use periods ranging from 2 to 5 years for the regression
 - ▣ Longer estimation period provides more data, but firms change.
 - ▣ Shorter periods can be affected more easily by significant firm-specific event that occurred during the period
- ▣ Decide on a return interval - daily, weekly, monthly
 - ▣ Shorter intervals yield more observations, but suffer from more noise.
 - ▣ Noise is created by stocks not trading and biases all betas towards one.
- Estimate returns (including dividends) on stock
 - ▣ $\text{Return} = (\text{Price}_{\text{End}} - \text{Price}_{\text{Beginning}} + \text{Dividends}_{\text{Period}}) / \text{Price}_{\text{Beginning}}$
 - ▣ Included dividends only in ex-dividend month
- Choose a market index, and estimate returns (inclusive of dividends) on the index for each interval for the period.

Choosing the Parameters: Disney

- Period used: 5 years
- Return Interval: Monthly
- Market Index: S&P 500 Index.
- For instance, to calculate returns on Disney in December 2009,
 - ▣ Price for Disney at end of November 2009 = \$ 30.22
 - ▣ Price for Disney at end of December 2009 = \$ 32.25
 - ▣ Dividends during month = \$0.35 (It was an ex-dividend month)
 - ▣ **Disney Return = $(\$32.25 - \$30.22 + \$ 0.35) / \$30.22 = 7.88\%$**
- To estimate returns on the index in the same month
 - ▣ Index level at end of November 2009 = 1095.63
 - ▣ Index level at end of December 2009 = 1115.10
 - ▣ Dividends on index in December 2009 = 1.683
 - ▣ **S&P 500 Return = $(1115.1 - 1095.63 + 1.683) / 1095.63 = 1.78\%$**

Disney's Historical Beta



$\text{Return on Disney} = .0071 + 1.2517 \text{ Return on Market}$
(.0053) (0.10)

$R^2 = 0.73386$

Analyzing Disney's Performance

- Intercept = 0.712%
 - This is an intercept based on monthly returns. Thus, it has to be compared to a monthly riskfree rate.
 - Between 2008 and 2013
 - Average Annualized T.Bill rate = 0.50%
 - Monthly Riskfree Rate = $0.5\%/12 = 0.042\%$
 - Riskfree Rate (1-Beta) = $0.042\% (1-1.252) = -0.0105\%$
- The Comparison is then between
 - Intercept versus Riskfree Rate (1 - Beta)
 - 0.712% versus 0.0105%
 - Jensen's Alpha = $0.712\% - (-0.0105)\% = 0.723\%$
- Disney did 0.723% better than expected, per month, between October 2008 and September 2013
 - Annualized, Disney's annual excess return = $(1.00723)^{12} - 1 = 9.02\%$

More on Jensen's Alpha

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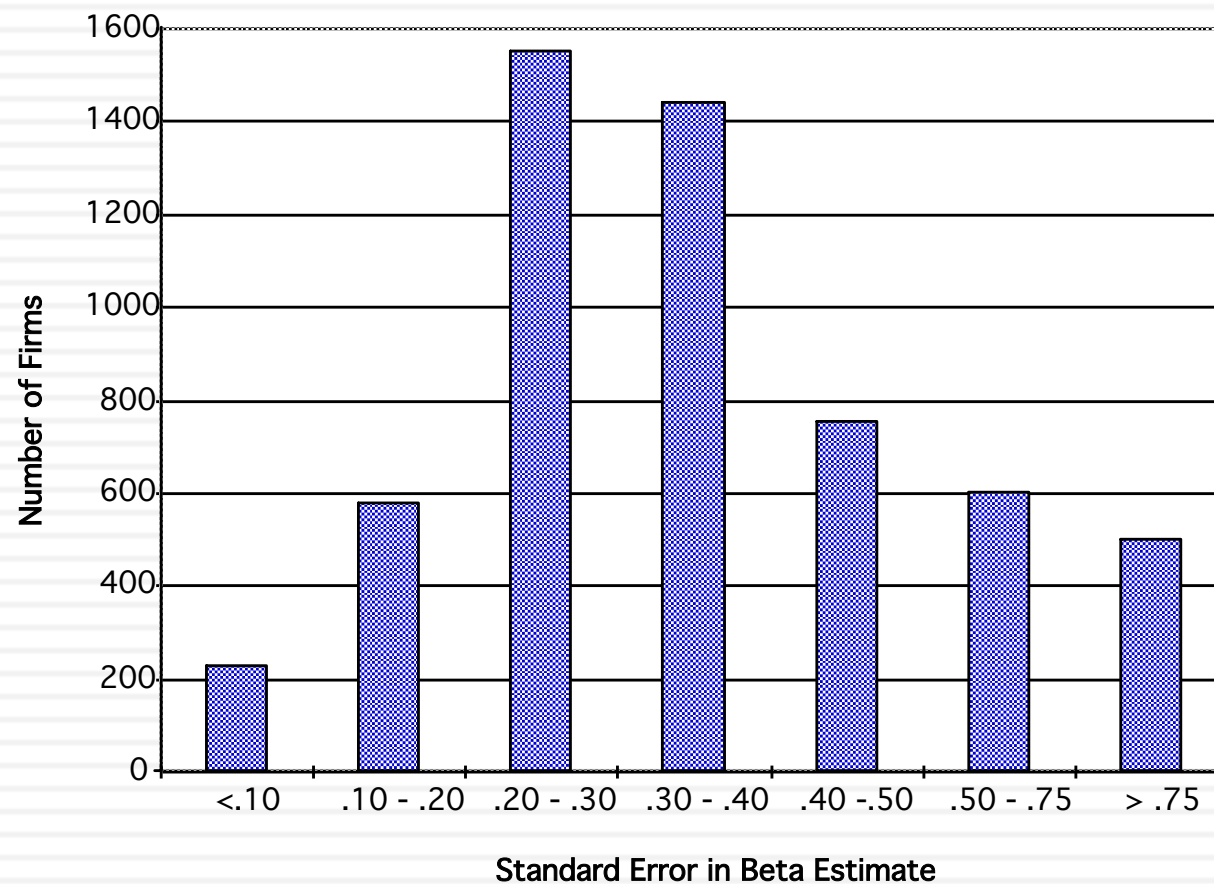
- If you did this analysis on every stock listed on an exchange, what would the average Jensen's alpha be across all stocks?
 - a. Depend upon whether the market went up or down during the period
 - b. Should be zero
 - c. Should be greater than zero, because stocks tend to go up more often than down.
- Disney has a positive Jensen's alpha of 9.02% a year between 2008 and 2013. This can be viewed as a sign that management in the firm did a good job, managing the firm during the period.
 - a. True
 - b. False
- Disney has had a positive Jensen's alpha between 2008 and 2013. If you were an investor in early 2014, looking at the stock, you would view this as a sign that the stock will be a:
 - a. Good investment for the future
 - b. Bad investment for the future
 - c. No information about the future

Estimating Disney's Beta

- The slope of the regression of 1.25 is the beta.
- The regression parameters are always estimated with error. The error is captured in the standard error of the beta estimate, which in the case of Disney is 0.10.
- Assume that I asked you what Disney's true beta is, after this regression.
 - ▣ What is your best point estimate?
 - ▣ What range would you give me, with 67% confidence?
 - ▣ What range would you give me, with 95% confidence?

The Dirty Secret of “Standard Error”

Distribution of Standard Errors: Beta Estimates for U.S. stocks



Breaking down Disney's Risk

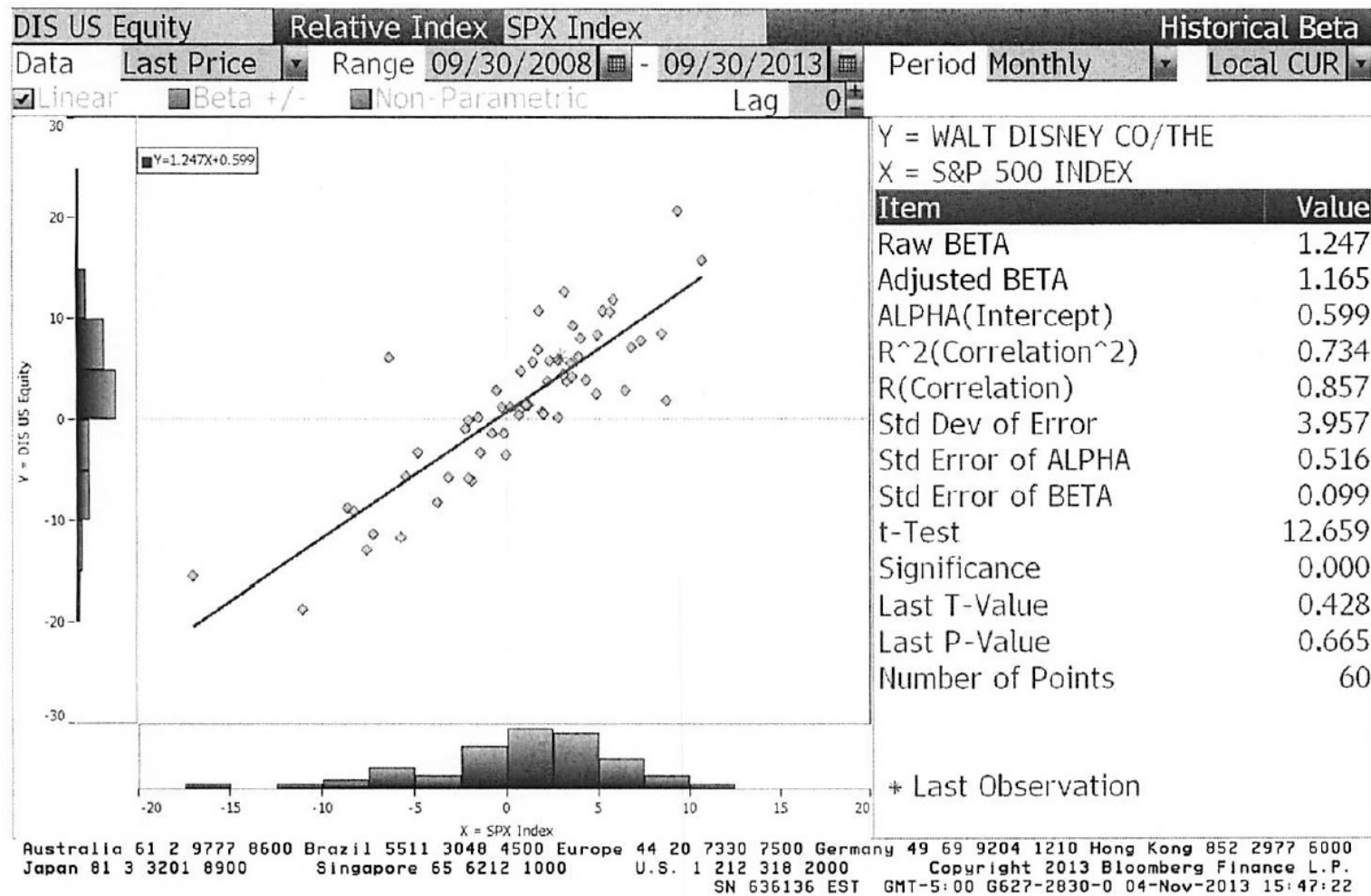
- The R Squared = 73%. This implies that
 - ▣ 73% of the risk at Disney comes from market sources
 - ▣ 27%, therefore, comes from firm-specific sources
- If investors diversify, the firm-specific risk is diversifiable and will not be rewarded. It is only the market risk that will be rewarded with a higher expected return.
- The R-squared for companies, globally, has increased significantly since 2008. Why might this be happening?
- What are the implications for investors?

The Relevance of R Squared

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- You are a diversified investor trying to decide whether you should invest in Disney or Amgen. Both companies have betas of 1.25, but Disney has an R Squared of 73% while Amgen's R squared is only 25%. Which one would you invest in?
 - ▣ Amgen, because it has the lower R squared
 - ▣ Disney, because it has the higher R squared
 - ▣ You would be indifferent
- Would your answer be different if you were an undiversified investor?

Beta Estimation: Using a Service (Bloomberg)



Estimating Expected Returns for Disney in November 2013

- Inputs to the expected return calculation
 - Disney's Beta = 1.25
 - Riskfree Rate = 2.75% (U.S. ten-year T.Bond rate in November 2013)
 - Risk Premium = 5.76% (Based on Disney's operating exposure)

$$\begin{aligned}\text{Expected Return} &= \text{Riskfree Rate} + \text{Beta} (\text{Risk Premium}) \\ &= 2.75\% + 1.25 (5.76\%) = 9.95\%\end{aligned}$$

Use to a Potential Investor in Disney

- As a potential investor in Disney, what does this expected return of 9.95% tell you?
 - This is the return that I can expect to make in the long term on Disney, if the stock is correctly priced and the CAPM is the right model for risk,
 - This is the return that I need to make on Disney in the long term to break even on my investment in the stock
 - Both
- Assume now that you are an active investor and that your research suggests that an investment in Disney will yield 12.5% a year for the next 5 years. Based upon the expected return of 9.95%, you would
 - Buy the stock
 - Sell the stock

How managers use this expected return

- Managers at Disney
 - need to make at least 9.95% as a return for their equity investors to break even.
 - this is the hurdle rate for projects, when the investment is analyzed from an equity standpoint
- In other words, Disney's cost of equity is 9.95% and it should try to deliver a return on equity that exceeds this value.
- What is the cost of not delivering this cost of equity?

Application Test: Analyzing the Risk Regression

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- Using your Bloomberg risk and return print out, answer the following questions:
 - How well or badly did your stock do, relative to the market, during the period of the regression?
 - $\text{Intercept} - (\text{Riskfree Rate}/n) (1 - \text{Beta}) = \text{Jensen's Alpha}$
 - where n is the number of return periods in a year (12 if monthly; 52 if weekly)
 - What proportion of the risk in your stock is attributable to the market? What proportion is firm-specific?
 - What is the historical estimate of beta for your stock? What is the range on this estimate with 67% probability? With 95% probability?
 - Based upon this beta, what is your estimate of the required return on this stock?
 - $\text{Riskless Rate} + \text{Beta} * \text{Risk Premium}$

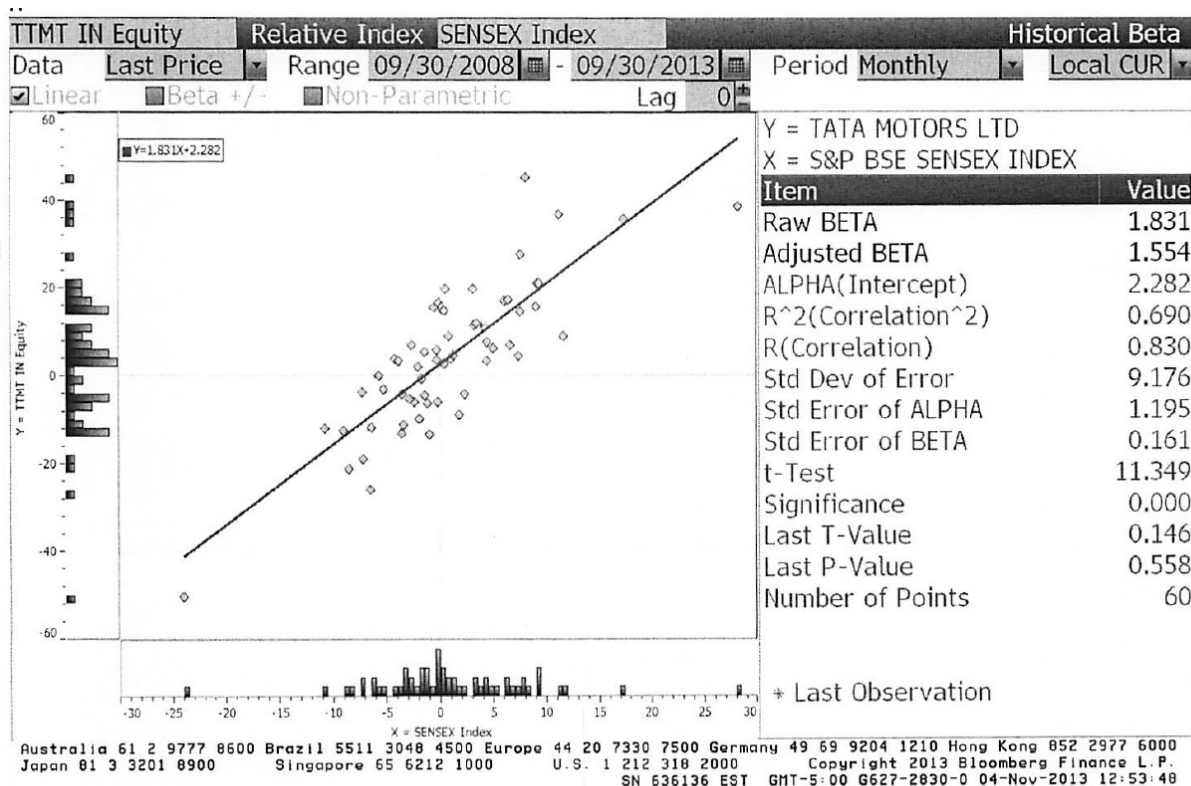
A Quick Test

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- You are advising a very risky software firm on the right cost of equity to use in project analysis. You estimate a beta of 3.0 for the firm and come up with a cost of equity of 20%. The CFO of the firm is concerned about the high cost of equity and wants to know whether there is anything he can do to lower his beta.
- How do you bring your beta down?

- Should you focus your attention on bringing your beta down?
 - ▣ Yes
 - ▣ No

Regression Diagnostics for Tata Motors



Beta = 1.83
67% range
1.67-1.99

69% market risk
31% firm specific

Jensen's α

$$= 2.28\% - 4\%/12 (1-1.83) = 2.56\%$$

$$\text{Annualized} = (1+0.0256)^{12}-1 = 35.42\%$$

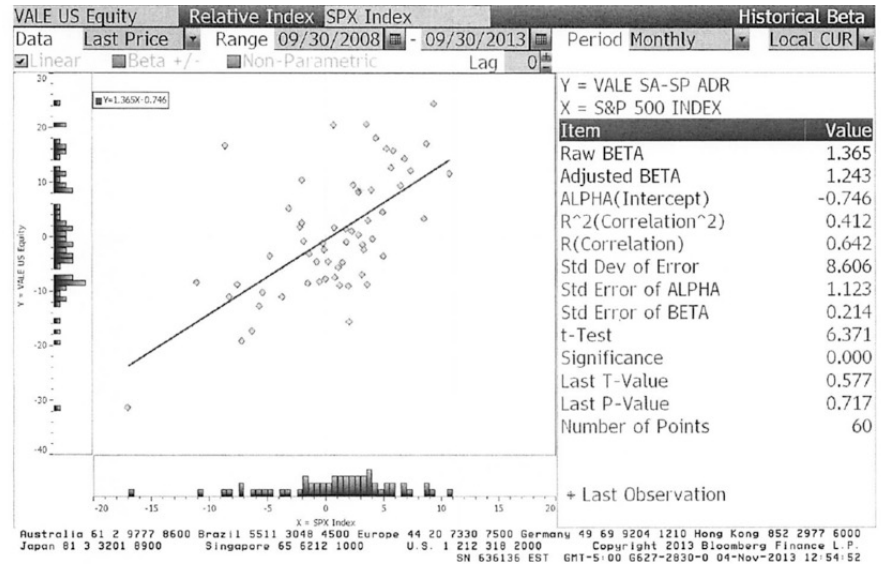
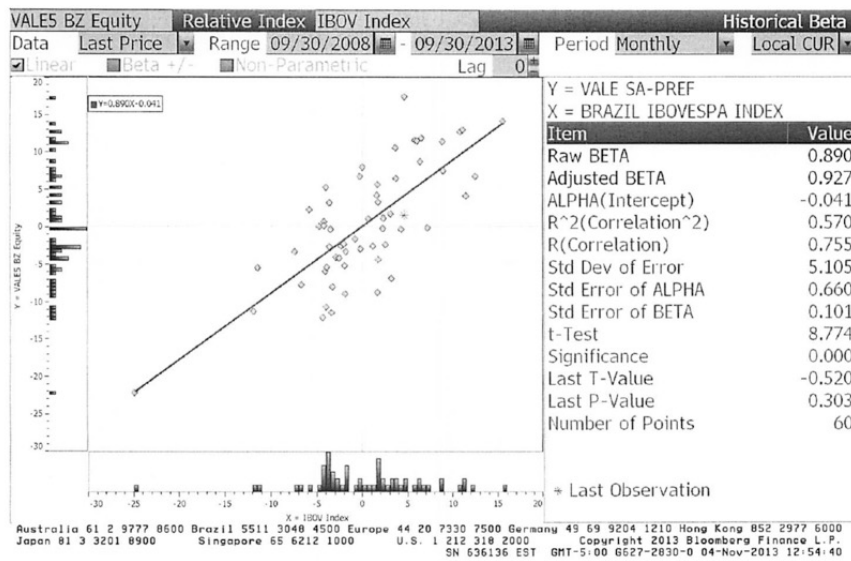
$$\text{Average monthly riskfree rate (2008-13)} = 4\%$$

Expected Return (in Rupees)

$$= \text{Riskfree Rate} + \text{Beta} * \text{Risk premium}$$

$$= 6.57\% + 1.83 (7.19\%) = 19.73\%$$

A better beta? For Vale..



Deutsche Bank and Baidu: Index Effects on Risk Parameters

- For Deutsche Bank, a widely held European stock, we tried both the DAX (German index) and the FTSE European index.

	<i>DAX</i>	<i>FTSE Euro 100</i>
Intercept	-0.90%	-0.15%
Beta	1.58	1.98
Std Error of beta	0.21	0.29
R^2	51%	29%

- For Baidu, a NASDAQ listed stock, we ran regressions against both the S&P 500 and the NASDAQ.

	<i>S&P 500</i>	<i>NASDAQ</i>
Intercept	2.84%	2.15%
Beta	1.63	1.65
Std Error of beta	0.28	0.23
R^2	37%	47%