RISK-ADJUSTED RETURN MEASURES: SHARPE RATIO

WHAT WILL YOU LEARN?

- Preliminary notation
- Reward-to-variability ratio or the Sharpe ratio
- How is it constructed?

RISK-ADJUSTED MEASURES: GENERAL NOTATION

SHARPE RATIO

SHARPE RATIO

- In the hypothetical world of CAPM, the maximum Sharpe ratio is that of the market portfolio.
- In the real world, Sharpe ratio provides a basis to rank portfolios.

WHAT DOES SHARPE RATIO NOT MEASURE?

- Sharpe ratio is generally not used to evaluate the performance individual securities because it does not account for correlation between securities.

SHARPE RATIOS FOR THREE U.S. EQUITY INDICES

	R3000	S&P500	R2000
Average excess return (%)	9.00	8.64	9.84
Standard deviation (%)	14.83	14.76	19.19
Sharpe ratio	**0.60**	**0.59**	**0.51**

Constructed from finance.yahoo.com data

SUMMARY

- Sharpe ratio is a measure of reward to variability.

RISK-ADJUSTED RETURN MEASURES: SORTINO RATIO

WHAT WILL YOU LEARN?

- What is the Sortino ratio?
- How is different than the Sharpe ratio?

SORTINO RATIO

SORTINO RATIOS FOR THREE U.S. EQUITY INDICES

	R3000	S&P500	R2000
Average return in excess of the risk-free rate (%)	9.00	8.64	9.84
Downside semideviation, target = 0 (%)	11.57	11.36	14.93
Sortino ratio	**0.77**	**0.76**	**0.66**

Constructed from finance.yahoo.com data

SUMMARY

- Sortino ratio is an extension of the Sharpe ratio that focuses on the downside risk.

RISK-ADJUSTED RETURN MEASURES: TREYNOR'S MEASURE

WHAT WILL YOU LEARN?

- ✓Sharpe ratio
- ✓Sortino ratio
- ▸Treynor's measure

TREYNOR'S MEASURE

TREYNOR'S MEASURE

- Like the Sharpe ratio, Treynor's measure gives the excess return per unit of risk, but it uses systematic risk instead of total risk.
- Not clear how to apply if there are multiple risk factors.

SUMMARY

- Treynor measure is a better measure for comparing assets that may be combined into portfolios.

RISK-ADJUSTED RETURN MEASURES: JENSEN'S ALPHA

WHAT WILL YOU LEARN?

- ✓Sharpe ratio
- ✓Sortino ratio
- ✓Treynor's measure
- ▸Jensen's alpha?

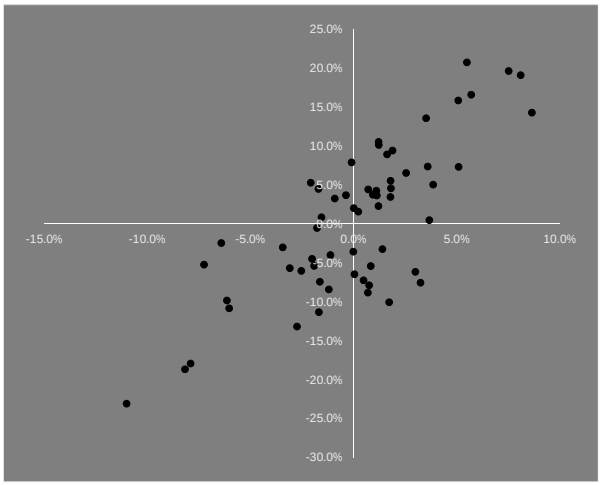
ALPHA

- Alpha is a measure of the risk-adjusted excess return.
  - Benchmark alpha
  - CAPM alpha
  - Multi-factor alpha

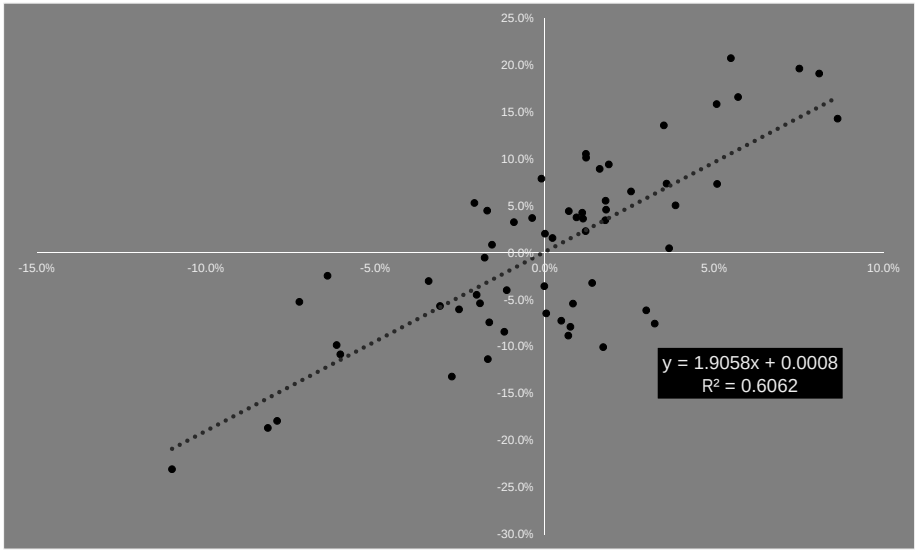
MEASURING ALPHA

ESTIMATING ALPHA AND BETA

Date	SP 500 Index ^SPX	Alcoa AA
Aug-01	-6.4%	-2.5%
Sep-01	-8.2%	-18.7%
Oct-01	1.8%	4.6%
Nov-01	7.5%	19.6%
Dec-01	0.8%	-7.9%
Jan-02	-1.6%	0.8%
Feb-02	-2.1%	5.3%
Mar-02	3.7%	0.5%
Apr-02	-6.1%	-9.8%
May-02	-0.9%	3.2%
Jun-02	-7.2%	-5.2%
Jul-02	-7.9%	-17.9%
Aug-02	0.5%	-7.3%
Sep-02	-11.0%	-23.1%
Oct-02	8.6%	14.3%
Nov-02	5.7%	16.6%
Dec-02	-6.0%	-10.8%
Jan-03	-2.7%	-13.2%
Feb-03	-1.7%	4.5%
Mar-03	0.8%	-5.4%
Apr-03	8.1%	19.1%
May-03	5.1%	7.3%
Jun-03	1.1%	3.6%
Jul-03	1.6%	8.9%
Aug-03	1.8%	3.4%
Sep-03	-1.2%	-8.4%
Oct-03	5.5%	20.7%
Nov-03	0.7%	4.4%
Dec-03	5.1%	15.8%
Jan-04	1.7%	-10.1%
Feb-04	1.2%	10.1%
Mar-04	-1.6%	-7.4%
Apr-04	-1.7%	-11.3%
May-04	1.2%	2.3%
Jun-04	1.8%	5.5%
Jul-04	-3.4%	-3.0%
Aug-04	0.2%	1.6%
Sep-04	0.9%	3.7%
Oct-04	1.4%	-3.2%
Nov-04	3.9%	5.0%
Dec-04	3.2%	-7.6%
Jan-05	-2.5%	-6.0%
Feb-05	1.9%	9.4%
Mar-05	-1.9%	-5.4%
Apr-05	-2.0%	-4.5%
May-05	3.0%	-6.2%
Jun-05	0.0%	-3.6%
Jul-05	3.6%	7.3%
Aug-05	-1.1%	-4.0%
Sep-05	0.7%	-8.8%
Oct-05	-1.8%	-0.5%
Nov-05	3.5%	13.5%
Dec-05	-0.1%	7.9%
Jan-06	2.5%	6.5%
Feb-06	0.0%	-6.5%
Mar-06	1.1%	4.2%
Apr-06	1.2%	10.5%
May-06	-3.1%	-5.7%
Jun-06	0.0%	2.0%
Jul-06	-0.4%	3.7%



ESTIMATING ALPHA AND BETA



ESTIMATING ALPHA AND BETA

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.77857
R Square	0.60618
Adjusted R Square	0.59939
Standard Error	0.06064
Observations	60

ANOVA

	df	SS	MS	F	Significance F
Regression	1	0.32826	0.32826	89.27434	2.43329E-13
Residual	58	0.21327	0.00368		
Total	59	0.54153			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	**0.00081**	**0.00783**	**0.10347**	0.91794	-0.01487	0.01649	-0.01487	0.01649
X Variable 1	**1.90576**	**0.20170**	**9.44851**	0.00000	1.50202	2.30951	1.50202	2.30951

ALPHA AND THE FAMA-FRENCH THREE-FACTOR MODEL

- Suppose you believe in the Fama-French three factor model:

JENSEN'S ALPHA

- Jensen's alpha is the maximum you should be willing to compensate a portfolio manager.
  - For example, if a fund has a pre-expense alpha of 0.0015 (monthly), this means we should be willing to pay up to 0.15% per month, or 1.8% per year.
  - Alternatively, were you to compensate the manager this much, your after-expense alpha would be zero.

SUMMARY

- Jensen's alpha is the excess return not explained by the CAPM (or your favorite risk-based model).
- To generate outperformance, we must have positive alpha's.

RISK-ADJUSTED RETURN MEASURES: APPRAISAL RATIO AND INFORMATION RATIO

WHAT WILL YOU LEARN?

- ✓Sharpe ratio
- ✓Sortino ratio
- ✓Treynor's measure
- ✓Jensen's alpha
- ▸Appraisal ratio and information ratio

APPRAISAL RATIO

- Jensen's alpha does not adjust for the amount of idiosnycratic risk in the portfolio.
- Appraisal ratio represents the expected abnormal return per unit of systematic risk taken.

APPRAISAL RATIO

INFORMATION RATIO

SUMMARY

- The appraisal ratio and information ratio are both measures of benefit and cost – how much abnormal return for how much residual risk.

COMPARING RISK-ADJUSTED RETURN MEASURES

WHAT WILL YOU LEARN?

- ✓Sharpe ratio
- ✓Sortino ratio
- ✓Treynor's measure
- ✓Jensen's alpha
- ✓Appraisal ratio and information ratio
- ▸When are these measures appropriate to use?

WHEN ARE THESE MEASURES APPROPRIATE TO USE?

- Sharpe Ratio is more appropriate for evaluating entire portfolios, rather than sub-portfolios or individual stocks.
  - Suppose the investor can choose only one fund and choosing among different funds, then choose the one with the highest Sharpe ratio.

WHEN ARE THESE MEASURES APPROPRIATE TO USE?

- The appraisal ratio and the information ratio are informative if the focus is on active management relative to a benchmark – effectively they are measures of active reward to active risk.
  - The basis for the risk adjustment is residual risk or tracking error.

WHEN ARE THESE MEASURES APPROPRIATE TO USE?

- Jensen's alpha and Treynor measure are better suited for evaluating individual stocks or sub-portfolios.
  - They use systematic risk as the basis for adjusting returns.

WHEN ARE THESE MEASURES APPROPRIATE TO USE?

- If the underlying return distribution is asymmetric or skewed, or if the investor has a particular return target that defines downside risk, then Sortino ratio is a good alternative to Sharpe ratio.

IMPORTANT CAVEAT

- Beware of estimation error!
- Averages, standard deviations, and regressions are notoriously susceptible to outliers.
- Distribution of future returns might not be the same as past returns.

SUMMARY

- It is advisable that you use more than one single measure.
- The objective is to separate excess returns due to stock selection/asset allocation skill from higher returns due to compensation for risk.