Regression Analyzer for Individual Market Securities

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The S&P 500

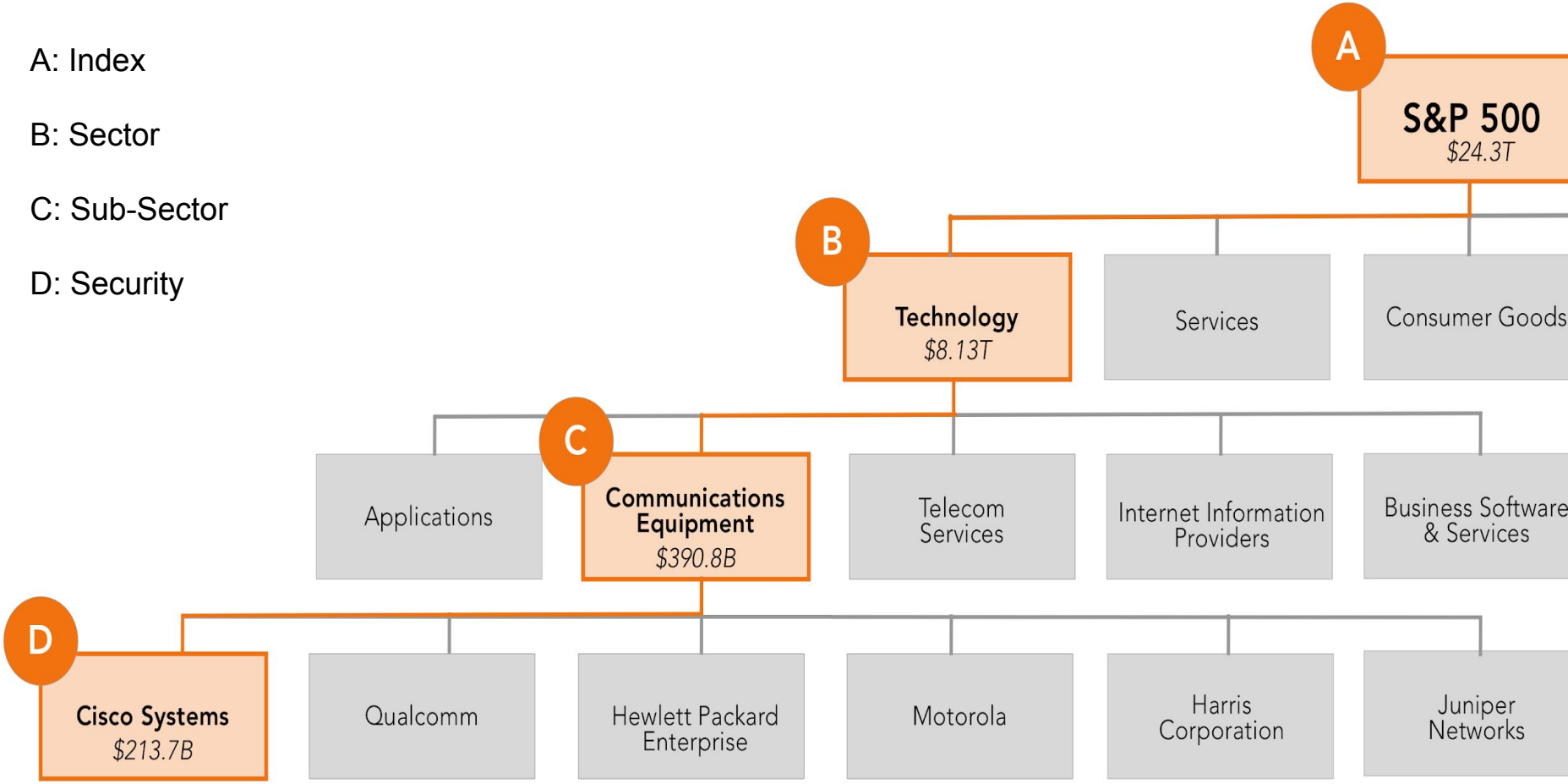
- The S&P 500 Index is a market-cap-weighted index of the 500 largest publicly traded companies in the U.S.
- The top 10 companies with the greatest weights account for 26% of public market capitalization.
- Index funds that track the S&P 500 have often been suggested as more worthwhile investments than 90% of the portfolios produced by individual traders and hedge funds.
- This assertion, made by Warren Buffet and many others, relies on measurements of risk and risk adjusted returns to assess the quality of investments.

A: Index

B: Sector

C: Sub-Sector

D: Security



Cont.

- The S&P 500 is internally organized into 11 sectors, which are comprised of smaller sub-sectors, which are further comprised of a number of individual company securities.
- Historically, the S&P has grown about 7% a year over the past 100 years. In the past 10 years it has grown roughly 10% a year.
- Given the level of steady, real gains over the long term, the S&P is often used as a benchmark to assess the performance of individual stocks and investor portfolios.

Measures of Performance

- Jensen's measure was first developed by mutual fund manager Michael Jensen in 1968, and has since been used alongside the CAPM method and other standard measures of alpha and beta to assess past performance. It uses simple linear regression to quantify these features.
- Alpha
  - The return on an investment after adjusting for market-related volatility and random fluctuations.
- Beta
  - Covariance of stock and index returns, divided by variance of index returns. Otherwise stated as the volatility of a stock or portfolio with respect to its index.
- Jensen's Measure
  - [R(i) - R(f)] = Beta x [R(m) - R(f)] + Alpha
  - **Where:**
    - R(i) = the realized return of the portfolio or investment
    - R(m) = the realized return of the appropriate market index
    - R(f) = the risk-free rate of return for the given time period
      - Determined using appropriate Treasury Bills (see next page)

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Daily Treasury Yield Curve Rates

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Daily Treasury Yield Curve Rates Go

Select Time Period

2015 Go

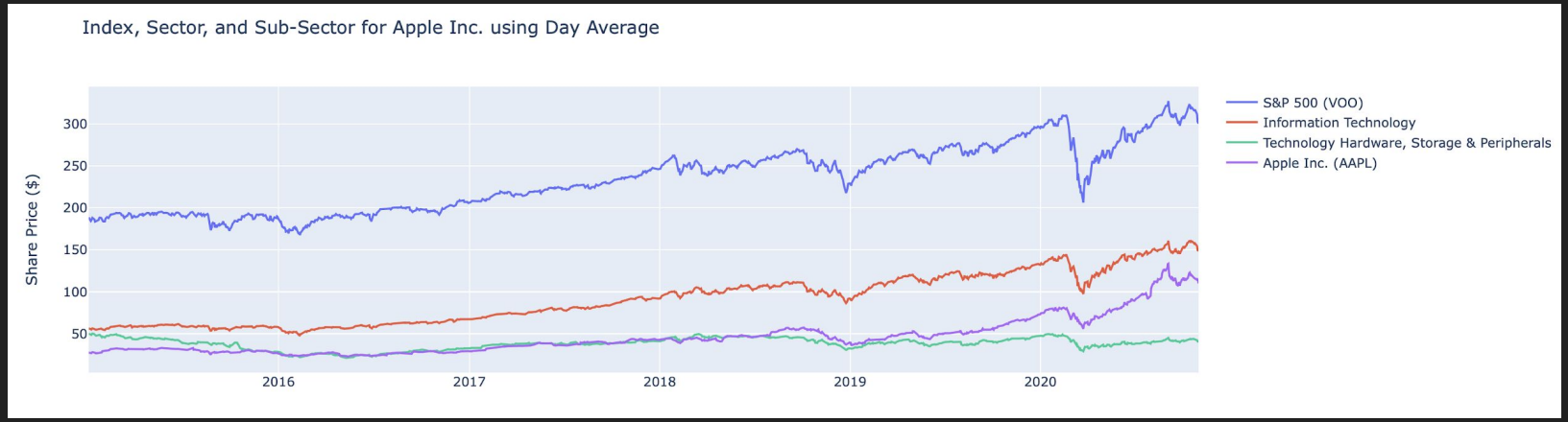
Date	1 Mo	2 Mo	3 Mo	6 Mo	1 Yr	2 Yr	3 Yr	5 Yr	7 Yr	10 Yr	20 Yr	30 Yr
01/02/15	0.02	N/A	0.02	0.11	0.25	0.66	1.07	1.61	1.92	2.12	2.41	2.69
01/05/15	0.02	N/A	0.03	0.10	0.26	0.68	1.06	1.57	1.85	2.04	2.32	2.60
01/06/15	0.02	N/A	0.03	0.10	0.25	0.65	1.02	1.50	1.78	1.97	2.25	2.52
01/07/15	0.02	N/A	0.03	0.09	0.25	0.62	1.00	1.47	1.76	1.96	2.25	2.52
01/08/15	0.01	N/A	0.03	0.08	0.23	0.62	1.00	1.50	1.81	2.03	2.33	2.59
01/09/15	0.02	N/A	0.02	0.08	0.22	0.59	0.96	1.45	1.75	1.98	2.29	2.55
01/12/15	0.02	N/A	0.03	0.09	0.19	0.56	0.91	1.39	1.69	1.92	2.23	2.49

Jensen’s App

- The application will take any of the 505 securities currently listed on the S&P 500, along with a time window and moving average (1 day, 7 day, 50 day, or 200 day).
- Upon hitting submit, it will render 3 figures.

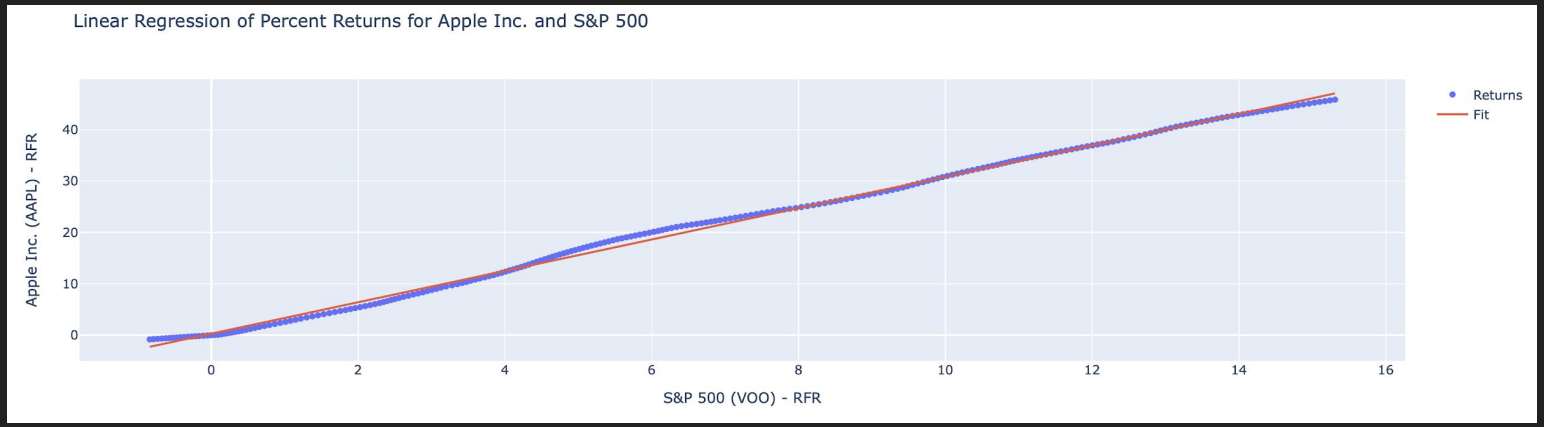
Times Series

- The first figure displays a time series of share prices for the selected stock, its sub-sector average, sector average, and an index fund of the S&P 500 (VOO).
- In this instance we can see Apple Inc.'s outperformance of the rest of its sub-sector starting in mid 2018, along with its increase in parallel market volatility in the last two quarters of this past year.
- Given Apple's large weight in the index, it's share price could actually be the cause of index volatility in this period, rather than a consequence.



Linear Regression

- This regression tracks Apple's percent returns with respect to those of the market from January 1, 2017 to January 1, 2018.
- It uses a longer moving average to buff out day to day volatility.



Metrics Table

- The application uses the start date and length of time to source the appropriate treasury bill used in the RFR.
- Beta describes the volatility of the returns. In the case just shown, Apple returned ~45% of it's initial share price in the time the S&P returned 15%. This produces a slope, or beta, of ~3.
- Alpha, the y-intercept of the regression, marks whether or not the stock has produced returns that are worth any additional volatility taken on. Despite the high volatility described by beta in this case, Alpha is roughly breakeven, meaning the choice still "matches" the quality of our benchmark investment. It is riskier, but the risk is quality risk.

Regression Metric	Values (%)
Risk-Free Rate (RFR)	0.89
Alpha	0.317
Beta	3.057
R-Squared	99.8
Root Mean Squared Error	0.638

Metrics Cont.

- R-Squared can be used as a measure for how well our regression line fits the data. An R-squared of 99.8% is of course about as high as it gets, especially for 2 dimensional regression.
- Adjusted R-Squared has been omitted on account of the data being two dimensional.
- If I had more time I would use statsmodels instead of sklearn to render other metrics such as F-Test, p-value, and Log-Likelihood.
- Not everyone agrees on the importance of these different features, but as a starting point for deeper assessment of regression quality it would worthwhile to have them.

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Conclusion

- What makes this application useful is its simple method and its reach. Jensen's Measure relies on long standing financial principles for assessing the past performance of stocks and portfolios.
- A user can input any of the 505 securities on the S&P 500, and get a quick sense of its performance with respect to relevant indices, along with a short analysis of its volatility and risk adjusted returns for the selected period.
- This application does not provide a deep analysis of individual instances, as there are an infinite number of potential regressions. Some will be poor fits, some ideal, but most will fair better in local pipelines for assessment.