

# MGMT 675

# AI-ASSISTED FINANCIAL ANALYSIS



RICE | BUSINESS  
Jones Graduate School of Business

# ALPHAS AND BETAS

# OBJECTIVES FOR THIS WEEK

1. Estimate the cost of equity capital for CVX
2. Evaluate the performance of Fidelity Magellan relative to a Fama-French benchmark

# **COST OF EQUITY CAPITAL**

# CAPITAL ASSET PRICING MODEL

Expected stock return is  $r_f + \beta \times \overline{r_m - r_f}$

1. Get today's  $r_f$  from FRED
2. Get historical  $\overline{r_m - r_f}$  from French's data library
3. Estimate beta by running regression

$$r - r_f = \alpha + \beta(r_m - r_f) + \varepsilon$$

Let's estimate the beta first.

# DATA FOR REGRESSION

The regression is:

$$r - r_f = \alpha + \beta(r_m - r_f) + \varepsilon$$

- a. CVX return  $r$  from Yahoo adjusted closing prices
- b. Risk-free rate  $r_f$  from French's data library
- c. Market excess return  $r_m - r_f$  from French's data library

# COMPUTE CVX RETURNS

- Ask Julius to pip install yfinance==0.1.70 and import yfinance as yf
- Then (all instructions at once to avoid repeated downloads) ask Julius to:
  - use yf.Ticker to get CVX closing prices (= adjusted closing prices) since 2010
  - downsample to end-of-month and compute returns as 100 times percent change
  - convert dates to pandas monthly period format

# GET FAMA-FRENCH FACTORS

Ask Julius to use the pandas datareader get the monthly Fama-French factors since 2010 from French's data library,



# PREPARE DATA FOR THE REGRESSION

- Ask Julius to do an inner merge on the dates of the CVX returns and Fama-French factors.
- Ask Julius to keep only the last 120 rows.
- Ask Julius to add the excess CVX return to the dataframe by subtracting RF from the CVX return.
- Ask Julius to show the head and tail of the dataframe.

# RUN THE REGRESSION

- Ask Julius to regress the excess CVX return on MKT-RF, including an intercept, and show a summary of the results.
- Ask Julius to assign the MKT-RF regression coefficient to a new variable called beta.

# ESTIMATE THE MARKET RISK PREMIUM

- Ask Julius to use pandas datareader to get the annual Fama-French factors from French's data library starting in 1926.
- Ask Julius to compute the mean of MKT-RF and assign it to a new variable called market\_premium.

# GET THE CURRENT RISK-FREE RATE

- Ask Julius to use pandas datareader to get 1-month Treasury bill yields from FRED.
- Ask Julius to get the most recent 1-month Treasury bill yield and assign it to a new variable called rf.

# CVX COST OF EQUITY CAPITAL

Ask Julius to compute  $rf + \beta * \text{market\_premium}$ .

# VISUALIZE THE REGRESSION

- Ask Julius to produce a scatter plot with the excess CVX return on the y axis and MKT-RF on the x axis.
  - Tip: we might need to give Julius the name of the dataframe containing the excess CVX return and MKT-RF.
  - Look back at the code where Julius showed the head and tail of the dataframe to find the name.
- Ask Julius to include the regression line on the scatter plot.

# VISUALIZATION TIPS

- We can ask Julius to set the style of the plot. I like the seaborn whitegrid style.
- There are other choices: **seaborn plot styles**
- If Julius is balky at including the regression line, ask it to create a seaborn regplot with `ci=None`.
- You can also specify the colors of the points and the line (the line could be a different color than the points).

# INTERACTIVE PLOTS

- Suppose we're giving a presentation in which we show the regression plot.
  - We anticipate there might be questions about some of the points - e.g., extreme values.
  - We could tag them with annotations, but it creates clutter.
  - It might be useful to be able to hover over points and have pop-ups with details.
- This requires html.



# USE PLOTLY

- Ask Julius to use the dataframe containing the CVX excess return and MKT-RF and to convert the dates to strings.
- Ask Julius to use plotly to create a scatter plot with a regression line, the CVX excess return on the y-axis, and MKT-RF on the x-axis.
- Ask Julius to include the date in the hover data.
- Ask Julius to save the figure as html.

# SEE THE RESULTS

- Download the html file.
- Open it from Windows Explorer or the Mac Finder (it probably won't work opening it from your web browser).
- Try out different **plotly templates** - e.g., plotly\_dark.
- More visualization coming next week.

# MUTUAL FUND PERFORMANCE

# PERFORMANCE MEASURES

- Rankings
- Performance relative to benchmark (large cap, ...)
- Performance after adjusting for risk exposures
  - relative to benchmark adjusting for benchmark beta
  - or including other risk exposures
  - alpha = average return after adjustments

# FAMA-FRENCH FACTORS: MOTIVATION

- Certain types of stocks have beaten others historically
- Efficient markets view: must be due to risk exposures that investors care about
- Not sure what risks are, but use difference in returns of different types of stocks as proxies

# FAMA-FRENCH 5 FACTORS

- $\text{MKT-RF} = \text{market return} - \text{T-bill return}$
- $\text{SMB} = \text{Small stock return} - \text{Big stock return}$
- $\text{HML} = \text{High book-to-market (value) return} - \text{Low book-to-market return}$
- $\text{CMA} = \text{Conservative (low asset growth) return} - \text{Aggressive return}$
- $\text{RMW} = \text{Robust (high profitability) return} - \text{Weak return}$

# DATA

- Start a new chat.
- Repeat the steps in the Yahoo/Fama-French merge, except
  - Get FMAGX (Fidelity Magellan) from Yahoo for the maximum history possible
  - Get the monthly 5-factor Fama-French factors from French's data library for the maximum history possible
  - Keep all months after doing an inner merge (not just last 120)

# RUN REGRESSION

- The regression is

$$r - \text{RF} = \alpha + \beta_1 \times \text{MKT-RF} + \beta_2 \times \text{SMB} \\ + \beta_3 \times \text{HML} + \beta_4 \times \text{CMA} + \beta_5 \times \text{RMW} + \varepsilon$$

- Ask Julius to add the excess FMAGX return to the dataframe (FMAGX return minus RF).
- Ask Julius to regress the excess FMAGX return on the Fama-French factors and report the summary.



# INTERPRETATION

- A risk-adjusted benchmark for FMAGX is

$$(1 - \beta_1) \times \text{RF} + \beta_1 \times \text{MKT} + \beta_2 \times \text{SMB} \\ + \beta_3 \times \text{HML} + \beta_4 \times \text{CMA} + \beta_5 \times \text{RMW} + \varepsilon$$

- Call this BMARK. The regression can be restated as

$$r - \text{BMARK} = \alpha + \varepsilon$$

- $\alpha + \varepsilon$  is over-performance when positive and under-performance when negative.

# HISTORY OF OVER OR UNDER-PERFORMANCE

- Ask Julius to add a variable called `over_under` to the dataset defined as  $(\text{regression intercept} + \text{regression residuals}) / 100$ .
- Ask Julius to compute the cumulative product of  $(1 + \text{over\_under})$  and to plot it.

# ATTRIBUTION ANALYSIS

- Attribution analysis is breaking down the benchmark.
- How much return comes from market exposure? size exposure? value exposure? ...
- We can calculate the average return to the value exposure as  $\beta_3 \overline{\text{HML}}$ , etc.
- We can visualize these by plotting the cumulative product of  $1 + \beta_3 \times \text{HML}/100$ , etc.
- Ask Julius.