Data Assignment 2: Simple Data Handling

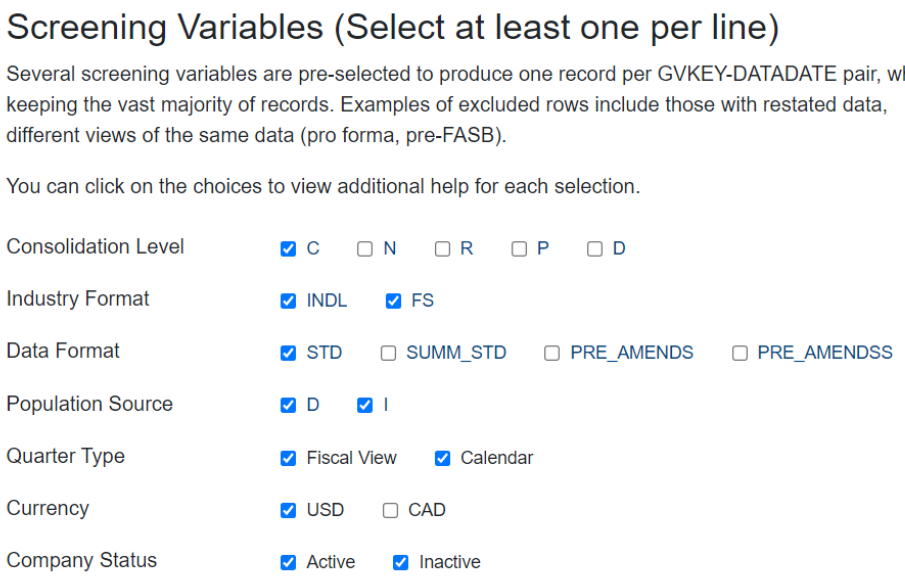
Financial Data Analytics

It's understood that all assignments are individual work. Failure to observe this may result in immediate failure of the course.

This assignment accounts for 8% of the course mark.

1. (5 pts) "nasdaq100_pop.xlsx" include the constituent firms of the Nasdaq 100 index. The file contains the permno's (in the "permno" tab) and the gvkey's (in the "gvkey" tab). Download the "Data Assignment 1" Q1 variables from CRSP for these permnos for the period of 1997-2021.

2. (5 pts) Download the following quarterly financial information for Nasdaq 100 firms (using the gvkey's) for the period of 1996-2021 from Compustat (North America Fundamentals Quarterly) using the following screening variables:



Variable	Label
GVKEY	Global Company Key
DATADATE	Data Date
FYEARQ	Fiscal Year
FQTR	Fiscal Quarter
TIC	Ticker Symbol
CONM	Company Name
ATQ	Assets – Total

CEQQ	Common/Ordinary Equity – Total
EPSPXQ	Earnings Per Share (Basic) - Excluding Extraordinary Items
IBQ	Income Before Extraordinary Items
SALEQ	Sales/Turnover (Net)
CONSOL	Level of Consolidation - Company Interim Descriptor
INDFMT	Industry Format
DATAFMT	Data Format
POPSRC	Population Source
DATAFQTR	Fiscal Data Year and Quarter
DATACQTR	Calendar Data Year and Quarter
CURCDQ	ISO Currency Code
COSTAT	Active/Inactive Status Marker

3. (10 pts) Merge the two data sets, creating a merged monthly data set containing the following information:
    a. All monthly pricing information from CRSP that you downloaded in Step 1.
    b. Firm financials yellow-highlighted in step 2, as well as "GVKEY" "DATADATE" FYEARQ" and "FQTR".
    c. Make sure that the nearest firm financials are aligned with the stock price month. To take into account that reporting time lags calendar quarter end, we generally use a three month lag rule, that is, we match price month with quarterly reporting with a three-month apart. For example, if a firm reports its financials for the quarter-end of March 31 ("DATADATE"), this financial reporting is assigned to stock months of July, August, and September of the same year (in other words, each month within the matching quarter receives the same quarterly financial value).
    d. Make sure that your end data does not contain duplicate observations. Each month for each stock ("PERMNO") should have only one observation.
    e. Keep the data from 2000 to 2021 for the remaining questions.[1]

4. (10 pts) Create three additional variables:
    a. Firm size proxied by the natural logarithm of the market value of equity (or market capitalization) called *lnSize*, from the multiplication of shares outstanding and closing price;
    b. Value proxy one: Book to market equity ratio (book-to-market), called *bk2mkt*.
    c. Value proxy two: the earnings-to-price (E/P) ratio, which is the inverse of the P/E ratio (price-to-earning ratio), called *eP*.

[1] Keep your original CRSP and Compustat data for future exercises.

i. Compare the mean and standard deviation of two ways of defining *eP*: IBQ/Market equity, and EPSPXQ/Prc. Which way do you think is better and why?

Check the data manual and note the unit difference between CRSP and Compusta. Plot the data in a histogram to visualize the distribution of *lnSize*, *bk2mkt*, and your chosen *eP* variable.

5. (5 pts) Calculate the following basic descriptive statistics for the three variables in Question 4: (a) measures of location and central tendency: mean and median; (b) measures of scale or dispersion: variance and standard deviation; and (c) measure of distribution or shape: i.e. 5%, 25%, 50%, 75%, and 95% percentiles.

6. (10 pts) Outliers are data values that are dramatically different from patterns in the rest of the data; for example, observations that are 3 standard deviations away from the variable's mean. Normally we need to address the outlier problem. There are two popular solutions: winsorization and truncation.

    a. For each month, winsorize any values that are greater than 3 standard deviations away from the respective monthly mean—that is, replace these values by the cutoff value (the cutoff value is the value that is 3 standard deviations away from mean).
    b. Truncation: for each month, remove any values that are greater than 3 standard deviations away from the respective monthly mean.

    To confirm the results, calculate the number of outliers, create three new columns that can differentiate the outliers and non-outliers (e.g., for truncation, keep the non-outliers as the original observations but replace the outliers as missing), and report the summary statistics (mean, median, and standard deviation, min, max, 1% and 99% percentiles) for the new variables.

7. (10 pts) Calculate the cross-sectional z-score for each of the three variables winsorized (after question 6a). At each point of time (i.e., at each cross section in time or each month), z-score is defined as the standardized value of the variable, i.e.:

$$\frac{\text{value of the variable} - \text{mean of the variable}}{\text{std of the variable}}.$$

    Make three new variables, and report the summary statistics (mean, median, and standard deviation, min, max, 1% and 99% percentiles) for the new variables.

If you are using Python, here are some help for the assigned material to complete this lab:

- Packages *numpy*, *pandas* and *matplotlib* for handling data frames (data tables) and plotting.

If you are using R, here are some R help for the assigned material to complete this lab:

- Required R tutorials and readings:

    - Learn the *readxl* package and its usage.
    - Learn the *data.table* package and its usage.
- Optional R tutorials and readings:
    - Learn the *apply* family in R as alternatives to loops.
    - Learn more about *data.frame*.

Please submit to Dropbox "WRDS Data Assignment 2", by 11:59 pm, Saturday, Feb. 4.

1. Three datasets (one from CRSP, one from Compustat, and one for merged and processed data for questions 3-7). To aid with grading, please output all your datasets in one excel file.

2. Your codes (can be Python, SAS, Stata, R, SPSS, Matlab, etc.) in Dropbox.

3. A final output report. Please make sure your output report is easy to read. Coefficient estimates do not exceed 4 decimal places, and *t*-statistics do not exceed 2 decimal places. Any submitted work with output that is *only* embedded into codes will automatically get at least 25% off the entire mark. We grade your work on your final output "report" and only recourse to your codes and data if needed.

4. Any notes if you wish to identify problems and any thoughts in the entire process. As it goes, the key to data analytics rests on good data cleaning work (called "data curation" if you want a fancy big-data word). A good note that has good understanding of data issues may have 5 bonus points.