Washington University
Department of Economics

Fall 2001
James Morley

Economics 487

Project
Proposal due Monday 10/22
Final Project due Monday 12/3

For this project, you will analyze the behaviour of 10 stocks listed on the NYSE or the Nasdaq using Excel to make calculations and answer questions. The project has two stages. The first stage is the proposal, for which you will choose the stocks, make basic return calculations, calculate summary statistics, and write up a short discussion about your data. In the second stage, you will make formal portfolio theory calculations, market model calculations, CAPM calculations, test the assumptions of your models, and write up a formal term paper following the guidelines set out below.

Project Tasks:
1. Downloading data
2. Return Calculations
3. Summary Statistics
4. Portfolio Theory Calculations
5. Market Model Calculations
6. CAPM Calculations
7. Testing Assumptions

1. Downloading Data

Collect price data for 10 stocks listed on the NYSE or Nasdaq exchanges over the period from December 1993 to the present. Try to have your stocks represent at least a few very different industries with what you would expect to be different levels of riskiness. You will also collect price data for a broad market index (e.g., the S&P500) and yield data for a short-term T-bill.

a. Go to www.yahoo.com and click on the *Finance/Quotes* link.
b. In the Get Quotes box, type the symbol of the stock for which you want data. For example, the symbol for Microsoft in MSFT. If you do not know the symbol for a company, select the *symbol lookup* link and type in the name of the company.
c. In the More Info box, select *Chart.*
d. Under the displayed Chart, click the Historical Quotes *monthly* link.
e. Change Start Date to December 1, 1993 and click *Get Historical Data*. This will bring up the table with price data for the selected time period. The price data are adjusted for dividends and stock splits. Make sure there is price data available at the beginning of the sample period.

f. Click on the *Download Spreadsheet Format* link at the bottom of the table. Change the name of the file to the symbol name (e.g., msft.csv). Note: csv stands for comma separated value file, which is easily read by Excel.
g. Open the Excel file. The file will have the price data in descending order (most recent data is at the top). You will want the data in ascending order. To do this, highlight all of the data (including column headers). Then, select Data/Sort, which brings up the Sort dialogue box. The default should have sort by date with ascending order selected. If so, click OK. Otherwise, select those options and then click OK.
h. Save the file. Note that the data you will use in the project are the **Close** price data.
i. When you have done this for 10 stocks, do the same for the market index. The symbol for the S&P 500 is "^spc". You can also find it by selecting the *Indices* link from the initial Yahoo! Financial Quotes page. Name the file "sp500.cvs".
j. Finally, you will need data for the risk-free asset. Again, you can get data from the *Indices* link. You want yield data for the 13-week bill under the Treasury Securities heading. The symbol is "^irx". For this series, you only need data from January 1, 1994 to the present. Name the file "tbill.cvs".

2. Return Calculations

The next thing to do is to calculate continuously compounded returns for the ten stocks, the market index, and the risk-free rate. For the price data, the procedure is standard. For the risk-free rate, the given data is not price data, but annualized percentage yields. To convert to a continuously compounded return, you need to first divide by 100 to get the yield as a decimal. Then, take the natural log of (1+yield). Finally, you can convert to a monthly continuously compounded return by dividing by 12. Put all of the return data in new Excel File.

3. Summary Statistics

a. Compute time plots of each of the 12 return series.
b. Compute histograms for each of the 12 series.
c. Compute mean, variance, standard deviation, skewness, and kurtosis for each of the 12 series.
d. Compute the 95% confidence intervals for the estimates of the means and standard deviations of each of the 12 series.
e. Compute the (10x10) sample covariance matrix for 10 return series for the individual stocks.

PROJECT PROPOSAL
Having done these first three tasks, you are ready to write up your project proposal. In the proposal, list the stocks you chose to examine, with some discussion of why you choose the particular stocks. Provide time plots of the data and histograms. Also, provide tables reporting the summary statistics. The proposal should be less than two pages of text plus charts and tables.

4. Portfolio Theory Calculations

a. Using the estimated means and the sample covariance matrix, compute the global minimum variance portfolio for the 10 risky assets.
b. Using the highest historical mean as a target, compute a second efficient portfolio.
c. Using the two efficient portfolios computed in a. and b., compute the Markowitz bullet (portfolio frontier for 10 risky assets).
d. Using the mean monthly risk-free return, compute the tangency portfolio and the efficient set for the 10 risky assets and a risk-free asset.

5. Market Model Calculations

a. Using the monthly return on the market portfolio, estimate the MM for the 10 stocks.
b. For each stock, test the hypothesis that beta=1 versus the alternative that it does not equal 1 using a 5% test. Calculate 95% confidence intervals for the betas.
c. Calculate the beta of the tangency portfolio. Recall that the beta of a portfolio is the weighted average of the betas of the assets in the portfolio.

6. CAPM Calculations

a. Using the risk-free rate data, calculate excess returns. Run the CAPM regression (MM using excess returns) for each stock.
b. For each stock, test the hypothesis that the intercept term alpha=0 versus the alternative that it does not. Again, use a 5% test. Also, calculate the 95% confidence intervals for the alphas.

7. Testing Assumptions

The last thing to do in terms of calculations is test a number of the assumptions made to justify the previous analysis. Always use the 5% level to determine significance.

a. Using the estimated skewness and kurtosis in 3, compute the Jarque-Bera statistic to test normality for each of the 12 return series.
b. Compute the 1,6, and 12 month lag sample autocorrelations and 95% confidence intervals for each return series, excluding the risk-free series. For the two assets with highest return correlation, calculate the 1, 6, and 12 month lag sample cross-autocorrelations.
c. Using the residuals from the CAPM regressions in 6, compute the Jarque-Bera statistic for each of the ten regressions.
d. Again, using the residuals from the CAPM regressions in 6, compute the White statistic to test homoskedasticity for each of the ten regressions.
e. Split the sample period in half and test for parameter stability in the CAPM regression parameters using the Chow test.
f. Compute the 1,6, and 12 month lag sample autocorrelations and 95% confidence intervals for each residual series. Calculate the Box Q statistic to test the null

hypothesis that residuals are not autocorrelated at up to 12 lags (one statistic for each series).

Questions or issues that you should cover in the Final Project write up:

- Which stocks did you expect to have large betas before estimation?
- Do the returns look normally distributed? What do the Jarque-Bera statistics suggest?
- Is there any significant serial correlation for the returns? Do returns appear predictable using past returns?
- Are the means estimated precisely? Are the standard deviations estimated precisely?
- Compare the standard deviation of the risk-free asset to those of the risky assets. Is an assumption of a constant risk-free asset reasonable?
- Are there any negative weights on the 10 stocks in the tangency portfolio? If so, interpret them.
- How does the mean and standard deviation of market portfolio compare to the tangency portfolio and the efficient set given only the 10 risky assets?
- Do the estimated betas for the MM match your priors?
- Is the beta for the tangency portfolio close to 1?
- Are the betas for the CAPM regressions similar to those for the MM regressions?
- Can you reject the hypothesis that alpha is zero? What does this imply for the CAPM?
- Do the statistical assumptions underlying the CAPM hold?
- Based on your results, would you make any recommendations to your reader? Assume your reader is interested in investing.

Format of Final Project:

1. Introduction
    - summarize the main results
2. Data Description
    - where is it from
    - why did you pick particular stocks
    - Time plots of data
    - Histograms
3. CER Model Results
    - List of assumptions of model
    - Table of Means and Standard Deviations for 12 series
    - Table of Jarque-Bera statistics
    - Table of serial correlation results
4. Portfolio Theory Results
    - Describe the optimization problems and the procedure for calculating the Markowitz bullet
    - Plot the Markowitz bullet, the tangency portolio, the efficient set of portfolios given risky assets and a risk-free asset, and the location of the mean and standard deviation of the market portfolio (e.g., S&P500).

5. Market Model and CAPM Results
    - MM regression equation and assumptions
    - Table of Betas with confidence intervals for MM
    - CAPM regression equation and assumptions
    - Table of Alphas with confidence intervals for CAPM regressions
    - Table of Jarque-Bera stats for CAPM residuals
    - Table of White Test results
    - Table of Chow Test results
    - Table of serial correlation test results
6. Conclusion
    - Interpret results (how well do assumptions hold, what do results suggest about diversification, CAPM, etc…)
    - Any advice to the reader?
7. Bibliography
    - Feel free to quote and reference Random Walk Down Wall Street during the write up