Econ 512
Financial Econometrics

Lab 1
The Predictability of Asset Returns

**Reading**:

1. *Modeling Financial Time Series with S-PLUS*, chapter 1 (Time series specification, manipulations, and visualization) and chapter 2 (Time series concepts).
2. *The Econometrics of Financial Markets*, chapters 1 and 2.
3. *Analysis of Financial Time Series*, chapters 1 and 2.
4. *Getting Started Guide for S-PLUS 6*

## *Starting S-PLUS and loading S+FinMetrics*

Start S-PLUS. Load the `S+FinMetrics` module. From the GUI, use **File/Load Module**, choose **FinMetrics**, **OK**. To open the command window, click on the command window button on the toolbar or use **Window/Commands Window**. To see the help file for `S+FinMetrics`, use **Help/Available Help/FinMetrics.** To get help from the command line for a particular function, e.g. `getReturns`, use

```
> ?getReturns
```

To see arguments for a functions use the `args` function: e.g.,

```
> args(getReturns)
```

You might want to create and attach a S-PLUS chapter directory to store the work for this lab. To do this from the GUI, use **File/Chapters/Attach/Create Chapter** and then specify the full path and name for the chapter directory.

You might also want create a script file for the S-PLUS commands used in this lab. To do this, use **File/New/Script File**. This opens the script editor from which you can enter and execute S-PLUS commands. To execute all commands in the script window click the run button on the toolbar. To execute a group of commands, highlight them and then either click the run button or press [F10]. To run a command in the command window, copy and paste the command from the script window to the command window.

For the lab write-up, I suggest copying and pasting the output and graphs from S-PLUS into a word processor like MS Word.

## *Exercises*

0. Browse through the *Getting Started Guide for S-PLUS 6*. This is available in a .pdf file from the Help menu: **Help/Online Manuals/Getting Started Guide**.

Answer the following questions using the `S+FinMetrics` "`timeSeries`" object `sp.raw`, which contains daily closing prices on the S&P 500 index from January 4, 1960 to October 16, 1987. The "`timeSeries`" `sp.raw`, however, doesn't have a column ID for the data which causes problems with some of the modeling functions. Unfortunately, the `colIds` function cannot be used to add a column ID to a "`timeSeries`" if one doesn't exit. The following method to add a column ID is cumbersome but will work:

```
> tmp = as.matrix(seriesData(sp.raw))
> colIds(tmp) = "sp500"
> sp.raw = timeSeries(pos=positions(sp.raw),data=tmp)
```

1. Create continuously compounded daily returns using the `S+FinMetrics` function `getReturns`:

```
> ret.sp500 = getReturns(sp.raw,type="continuous")
```

Make a time plot of the returns using `plot` and briefly comments what you see. Next, compute a histogram and qq-plot against the normal distribution. Do the returns look normal? (Note: the S-PLUS function `hist` doesn't have a method for "`timeSeries`". You have to use `hist(seriesData(nyse))`. Alternatively, you can use the `S+FinMetrics` function `histPlot`. ). Finally, compute and plot the ACF for the absolute value of returns and squared returns. Comment.

2. Use the S-PLUS function `aggregateSeries` to create monthly continuously compounded returns and repeat the above analyses for the monthly returns:

```
> retm.sp500 =
+ aggregateSeries(ret.sp500,by="months",FUN=sum)
```

**Answer the following questions using both daily and monthly returns:**

3. Compute summary statistics for the returns using the `S+FinMetrics` function `summaryStats`. Compute approximate 95% confidence intervals for population mean assuming the returns are *iid* normal. Briefly comment. Next, compute the Jarque-Bera test for normality using the `S+FinMetrics` function `normalTest`. What do you conclude?

4. Using the S-PLUS function `acf`, compute and plot the sample ACF using 20 lags. Are any of the sample autocorrelations statistically significant? Next, estimate the first lag autocorrelation using the `S+FinMetrics` function `OLS` and compute a heteroskedasticity robust standard error as follows

```
> ols.fit = OLS(sp500~tslag(sp500),data=ret.sp500)
> summary(ols.fit,correction="white")
```

What do you find? Finally, test the null hypothesis that all of the autocorrelations up to lag 20 are zero using the `S+FinMetrics` function `autocorTest`. What do you conclude?

5. Test for long memory behavior in the daily returns, absolute returns and squared returns using the `S+FinMetrics` function `rosTest`. The function `rosTest` computes Lo's modified rescaled range statistic (see CLM pages 59-64). What do you conclude?

6. The `S+FinMetrics` "`timeSeries`" stocks contains daily returns from 7/3/1962 through 12/31/91 on the five stocks AMOCO, FORD, HP, IBM and MERCK. Compute summary statistics for the returns using the `S+FinMetrics` function `summaryStats`. Briefly comment. Create histograms and normal qq-plots using the `S+FinMetrics` functions `histPlot` and `qqPlot`. Note: if you use

```
> histPlot(stocks,strip.text=colIds(stocks))
```

then a 5 panel plot will be created. Compute tests for normality and no autocorrelation using the `S+FinMetrics` functions `normalTest` and `autocorTest`. Note: you can compute test statistics for all assets at once; e.g use `normalTest(stocks, method="jb")`. Finally, using the S-PLUS function `acf`, compute and plot 4 period lead-lag cross correlations between the stocks. What patterns emerge if any?