Financial Econometrics Rauli Susmel
FINA 4397

**Homework 1** (Due September 14)

Instructions: Send your solved homework, along with the code, to my TA, Yousaf, Hammad. His email address is: hyousaf@CougarNet.UH.EDU.

**1.1** (**Calculating moments**). Download the data PPP dataset (**ppp_m.csv**) from my homepage. Or just use the following line to create the data matrix PPP_da:

```
PPP_da <- read.csv("http://www.bauer.uh.edu/rsusmel/4397/ppp_m.csv", head=TRUE,sep=",")
```

Compute the log returns for the DKK/USD (DKK_USD in the PPP dataset) and the SGD/USD (SGD_USD in the PPP dataset).

a. Report the mean, standard deviation, skewness, and kurtosis of the log returns for both series.
b. Plot the histogram for the SGD/USD log returns series.

**1.2** (**Testing Normality**). Using the Jarque-Bera test, test if the data is normal for the log returns of the two currencies in question 1.1, DKK/USD and SGD/USD.

**1. 3** (**Testing and Confidence Intervals**). An investment bank assumes that its monthly trading desk returns follow a Normal distribution with mean = .02 (2%) and SD = 0.15 (15%). They estimated these values using N=100 observations.

a. Using the log return approximation, derive the quarterly mean and standard deviation.
b. Build a 98% confidence interval for the sample mean.
c. Build a 98% confidence interval for the variance (and SD) using the chi-square distribution.
d. Test $H_0$: $\mu = 0\%$ against $H_1$: $\mu \neq 0\%$, at the 5% level.

**1.4** (**Practice Linear Algebra**). Use R.

a. Using runif, create two (non-singular) 3x3 matrices, **A** and **B.** (Check determinants are different from 0.) Calculate **A** * **B**, and **B** * **A**. Is matrix multiplication commutative?
b. Calculate **A** + **B**¸ and **A** – **B**.
c. Using seq, create a 3x1 vector, **v**. Calculate **A** * **v**.
d. Calculate **v’** * **A**.
e. Calculate **v’** * **v** (should be a scalar –i.e., a number).
f. Using c(), create a 3x1 vector **w**. Divide element by element **v**/**w**.

**1.5** (**Practice Regression with Linear Algebra**). Use R.

a. Using runif and rnorm and binding them, create a 6x2 matrix **D**. Calculate **C** = **D’** * **D** (should be a 2x2 matrix).
b. Invert **C**.
c. Extract the diagonal elements of **C**.
d. Create a 6x1 vector **f**. Calculate **b** = $\mathbf{C}^{-1}$ * **D’** * **f** (OLS formula for (**A1**): $\mathbf{f} = \mathbf{D}\boldsymbol{\beta} + \boldsymbol{\varepsilon}$)
e. Compute **f_hat** = **D** * **b** (f_hat = fitted values)
f. Compute **e** = **f** - **f_hat** (e = estimated error or residual)
g. Compute RSS = **e’** * **e** (should be a number, the Residual SS)
h. Compute sigma2 = RSS/(6-2) (simga2 is the estimated $\sigma^2$)
i. Compute Var_b = sigma2 * $\mathbf{C}^{-1}$ (should be a 2x2 matrix,.the Var[b|X])
j. Compute SE_b = sqrt(diag(Var_b)) (should be a 2x1 vector, the SE[b|X])

Note: In part 1.5.i, R will treat sigma2 as 1x1 vector. To make R understand is a scalar use as.numeric(sigma2) => Var_b <- as.numeric(sigma2) * solve(**C**).

**1.6** (**Regression**). Download the data **Stocks_FX_1973.csv** from my homepage.
Or just use the following line to create the data matrix FX_da:

```
FX_da <- read.csv("http://www.bauer.uh.edu/rsusmel/4397/Stocks_FX_1973.csv", head=TRUE,sep=",")
```

Regress PFE excess returns (PFE: Pfizer) against market excess returns (Mkt_RF) and a constant. This is a CAPM estimation. (Check class example for IBM.)
a. Plot PFE excess returns against market excess returns
b. Report the regression.
c. Test the CAPM –i.e., the constant is equal to zero.
d. Test if Pfizer's beta is greater than 1 (against different or less than1) at the 5% level (You need to do a one-sided C.I. for the $H_0$).
e. Suppose the market excess returns are equal to 0.005. Predict the excess returns for PFE.

**1.7** (**Regression**). An analyst tells you that shares in ARLO have no systematic risk, in other words that the returns on its shares are completely unrelated to movements in the market. The value of beta and its standard error are calculated to be 0.92 and 0.26, respectively. The model is estimated over seventy quarters.
a. Write down the null and alternative hypotheses.
b. Test this null hypothesis against a two-sided alternative at the 5% level.