**Advanced Data Analysis MTH 9797 & STA 9797**

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**Homework #2**

Due: Sun, Nov 12 by 12 midnight

Submit via Blackboard

**2.1: CAPM Regression**

Refer to Dataset: Excel\_HW02.xlsx, sheet “Prob 2.1”

See “Excel VBA\_Linear Regression.xlsm,” sheet CAPM Regression Loop for insight.

CAPM Model:

Using the CAPM Equation, compute the Beta for each of the 500 stocks.

Perform a hypothesis test to determine if the estimated Beta is statistically different from 1 for all stocks.

How many stocks have a Beta that is statistically different from 1?

**2.2: Covariance Matrix Estimation**

Refer to Dataset: Excel\_HW02.xlsx, sheet “Prob 2.2”

See “Excel VBA Calculate Risk Factor Model Example.xlsm,” for a 5-stock example.

Using Fama-French Factors and stock data provided in the Excel file compute the covariance matrix for all 500 stocks.

Fama French three factor model:

* Compute log returns for each stock, e.g.,
* Subtract the risk free rate from the calculated returns before running the regression model.
* The risk free rate for each day is included as a column in the excel sheet.

1. Calculate the Covariance Matrix using the Fama-French Factors, denote this matric as
2. Calculate the Covariance Matrix using market data, denote this matrix as
3. Compare and contrast these matrices
4. Do the covariance signs from these matrices differ? If so, what repercussions does this have on portfolio management?

**2.3: Logit Probability Model**

Refer to Dataset: Excel\_HW02.xlsx, sheet “Prob 2.3”

See “Excel VBA\_Probability Models.xlsm” for an example.

Using the logistic model from class (and shown below), compute the parameters of the probability model.

Logistic Model:

Hint:

* Transform the probability model into a linear regression model
* You will need to estimate three parameters,
* Solve using the Logit Regression
* Compare your estimated probability to the actual probability

**2.4: Linear Regression with Constraints**

Refer to Dataset: Excel\_HW02.xlsx, sheet “Prob 2.4”

Estimate the parameters for the linear regression line with form:

Subject to

Hint:

* Set-up the Lagrange Equation
* Calculate the First Order Conditions for all and
* Find the reduced form equation in matrix notation
* Solve for all and using Matrix Multiplication

**2.5 Lecture 2 Important Items**

What were the most important take-away items from lecture 2?