FamaFrench3factor

2023-04-20

stocks=read.csv("C:\\Users\\helbarmi\\Documents\\Stock\_Bond\_2004\_to\_2006.csv", header=T)  
stocks<-stocks[-(505:674),]  
attach(stocks)  
stocks\_subset= as.data.frame(cbind(GM\_AC, F\_AC, UTX\_AC, MRK\_AC))  
FF\_data<-read.table("C:\\Users\\helbarmi\\Documents\\FF\_data.txt", header=T )  
stocks\_diff=as.data.frame(100\*apply(log(stocks\_subset)-FF\_data$RF, 2, diff))  
names(stocks\_diff)=c("GM", "Ford", "UTX", "Merk")  
FF\_data=FF\_data[-1,]

# CAPM

CAPM<-lm(as.matrix(stocks\_diff)~FF\_data$Mkt.RF)  
CAPM

##   
## Call:  
## lm(formula = as.matrix(stocks\_diff) ~ FF\_data$Mkt.RF)  
##   
## Coefficients:  
## GM Ford UTX Merk   
## (Intercept) -0.21781 -0.17201 0.01182 -0.08114  
## FF\_data$Mkt.RF 1.22790 1.29803 0.90806 0.64255

summary(CAPM)

## Response GM :  
##   
## Call:  
## lm(formula = GM ~ FF\_data$Mkt.RF)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -13.7764 -0.7171 0.0108 0.8088 15.2886   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -0.21781 0.08639 -2.521 0.012 \*   
## FF\_data$Mkt.RF 1.22790 0.12481 9.838 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1.936 on 501 degrees of freedom  
## Multiple R-squared: 0.1619, Adjusted R-squared: 0.1602   
## F-statistic: 96.79 on 1 and 501 DF, p-value: < 2.2e-16  
##   
##   
## Response Ford :  
##   
## Call:  
## lm(formula = Ford ~ FF\_data$Mkt.RF)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -5.3034 -0.8626 0.0182 0.7955 9.1081   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -0.17201 0.06747 -2.55 0.0111 \*   
## FF\_data$Mkt.RF 1.29803 0.09748 13.32 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1.512 on 501 degrees of freedom  
## Multiple R-squared: 0.2614, Adjusted R-squared: 0.2599   
## F-statistic: 177.3 on 1 and 501 DF, p-value: < 2.2e-16  
##   
##   
## Response UTX :  
##   
## Call:  
## lm(formula = UTX ~ FF\_data$Mkt.RF)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -3.4071 -0.5196 -0.0012 0.5099 3.6282   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 0.01182 0.03873 0.305 0.76   
## FF\_data$Mkt.RF 0.90806 0.05595 16.230 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.8678 on 501 degrees of freedom  
## Multiple R-squared: 0.3446, Adjusted R-squared: 0.3433   
## F-statistic: 263.4 on 1 and 501 DF, p-value: < 2.2e-16  
##   
##   
## Response Merk :  
##   
## Call:  
## lm(formula = Merk ~ FF\_data$Mkt.RF)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -31.1217 -0.4808 0.0726 0.7080 12.3075   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -0.08114 0.09191 -0.883 0.378   
## FF\_data$Mkt.RF 0.64255 0.13279 4.839 1.74e-06 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.06 on 501 degrees of freedom  
## Multiple R-squared: 0.04465, Adjusted R-squared: 0.04274   
## F-statistic: 23.42 on 1 and 501 DF, p-value: 1.741e-06

# Three factor model

FF3<- lm(as.matrix(stocks\_diff)~FF\_data$Mkt.RF+FF\_data$SMB+ FF\_data$HML)  
summary(FF3)

## Response GM :  
##   
## Call:  
## lm(formula = GM ~ FF\_data$Mkt.RF + FF\_data$SMB + FF\_data$HML)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -13.7393 -0.7650 -0.0074 0.7755 14.8383   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -0.24559 0.08623 -2.848 0.00458 \*\*   
## FF\_data$Mkt.RF 1.38721 0.14825 9.357 < 2e-16 \*\*\*  
## FF\_data$SMB -0.24343 0.21493 -1.133 0.25792   
## FF\_data$HML 0.83140 0.29674 2.802 0.00528 \*\*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1.921 on 499 degrees of freedom  
## Multiple R-squared: 0.178, Adjusted R-squared: 0.1731   
## F-statistic: 36.03 on 3 and 499 DF, p-value: < 2.2e-16  
##   
##   
## Response Ford :  
##   
## Call:  
## lm(formula = Ford ~ FF\_data$Mkt.RF + FF\_data$SMB + FF\_data$HML)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -5.2886 -0.8565 -0.0177 0.8115 9.0854   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -0.18274 0.06785 -2.693 0.00731 \*\*   
## FF\_data$Mkt.RF 1.30979 0.11665 11.228 < 2e-16 \*\*\*  
## FF\_data$SMB 0.04614 0.16912 0.273 0.78508   
## FF\_data$HML 0.34978 0.23349 1.498 0.13475   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1.511 on 499 degrees of freedom  
## Multiple R-squared: 0.2648, Adjusted R-squared: 0.2603   
## F-statistic: 59.89 on 3 and 499 DF, p-value: < 2.2e-16  
##   
##   
## Response UTX :  
##   
## Call:  
## lm(formula = UTX ~ FF\_data$Mkt.RF + FF\_data$SMB + FF\_data$HML)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -3.3176 -0.5314 0.0105 0.5311 3.4567   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 0.009946 0.038762 0.257 0.7976   
## FF\_data$Mkt.RF 1.003065 0.066642 15.052 <2e-16 \*\*\*  
## FF\_data$SMB -0.253718 0.096616 -2.626 0.0089 \*\*   
## FF\_data$HML 0.007639 0.133393 0.057 0.9544   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.8635 on 499 degrees of freedom  
## Multiple R-squared: 0.3536, Adjusted R-squared: 0.3498   
## F-statistic: 91.01 on 3 and 499 DF, p-value: < 2.2e-16  
##   
##   
## Response Merk :  
##   
## Call:  
## lm(formula = Merk ~ FF\_data$Mkt.RF + FF\_data$SMB + FF\_data$HML)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -30.3838 -0.5185 0.0890 0.6913 12.1337   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -0.04453 0.09107 -0.489 0.6251   
## FF\_data$Mkt.RF 0.68034 0.15658 4.345 1.69e-05 \*\*\*  
## FF\_data$SMB -0.37685 0.22700 -1.660 0.0975 .   
## FF\_data$HML -1.23812 0.31341 -3.951 8.92e-05 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.029 on 499 degrees of freedom  
## Multiple R-squared: 0.0767, Adjusted R-squared: 0.07115   
## F-statistic: 13.82 on 3 and 499 DF, p-value: 1.142e-08

# GM

CAPM\_GM<- lm(stocks\_diff[,1]~FF\_data$Mkt.RF)  
summary(CAPM\_GM)

##   
## Call:  
## lm(formula = stocks\_diff[, 1] ~ FF\_data$Mkt.RF)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -13.7764 -0.7171 0.0108 0.8088 15.2886   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -0.21781 0.08639 -2.521 0.012 \*   
## FF\_data$Mkt.RF 1.22790 0.12481 9.838 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1.936 on 501 degrees of freedom  
## Multiple R-squared: 0.1619, Adjusted R-squared: 0.1602   
## F-statistic: 96.79 on 1 and 501 DF, p-value: < 2.2e-16

FF3\_GM <- lm(stocks\_diff[,1]~FF\_data$Mkt.RF++FF\_data$SMB+ FF\_data$HML )  
summary(FF3\_GM)

##   
## Call:  
## lm(formula = stocks\_diff[, 1] ~ FF\_data$Mkt.RF + +FF\_data$SMB +   
## FF\_data$HML)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -13.7393 -0.7650 -0.0074 0.7755 14.8383   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -0.24559 0.08623 -2.848 0.00458 \*\*   
## FF\_data$Mkt.RF 1.38721 0.14825 9.357 < 2e-16 \*\*\*  
## FF\_data$SMB -0.24343 0.21493 -1.133 0.25792   
## FF\_data$HML 0.83140 0.29674 2.802 0.00528 \*\*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1.921 on 499 degrees of freedom  
## Multiple R-squared: 0.178, Adjusted R-squared: 0.1731   
## F-statistic: 36.03 on 3 and 499 DF, p-value: < 2.2e-16

anova(CAPM\_GM, FF3\_GM)

## Analysis of Variance Table  
##   
## Model 1: stocks\_diff[, 1] ~ FF\_data$Mkt.RF  
## Model 2: stocks\_diff[, 1] ~ FF\_data$Mkt.RF + +FF\_data$SMB + FF\_data$HML  
## Res.Df RSS Df Sum of Sq F Pr(>F)   
## 1 501 1877.4   
## 2 499 1841.3 2 36.107 4.8926 0.007865 \*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

# Ford

CAPM\_Ford<- lm(stocks\_diff[,2]~FF\_data$Mkt.RF)  
summary(CAPM\_Ford)

##   
## Call:  
## lm(formula = stocks\_diff[, 2] ~ FF\_data$Mkt.RF)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -5.3034 -0.8626 0.0182 0.7955 9.1081   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -0.17201 0.06747 -2.55 0.0111 \*   
## FF\_data$Mkt.RF 1.29803 0.09748 13.32 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1.512 on 501 degrees of freedom  
## Multiple R-squared: 0.2614, Adjusted R-squared: 0.2599   
## F-statistic: 177.3 on 1 and 501 DF, p-value: < 2.2e-16

FF3\_Ford <- lm(stocks\_diff[,2]~FF\_data$Mkt.RF++FF\_data$SMB+ FF\_data$HML )  
summary(FF3\_Ford)

##   
## Call:  
## lm(formula = stocks\_diff[, 2] ~ FF\_data$Mkt.RF + +FF\_data$SMB +   
## FF\_data$HML)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -5.2886 -0.8565 -0.0177 0.8115 9.0854   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -0.18274 0.06785 -2.693 0.00731 \*\*   
## FF\_data$Mkt.RF 1.30979 0.11665 11.228 < 2e-16 \*\*\*  
## FF\_data$SMB 0.04614 0.16912 0.273 0.78508   
## FF\_data$HML 0.34978 0.23349 1.498 0.13475   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 1.511 on 499 degrees of freedom  
## Multiple R-squared: 0.2648, Adjusted R-squared: 0.2603   
## F-statistic: 59.89 on 3 and 499 DF, p-value: < 2.2e-16

anova(CAPM\_Ford, FF3\_Ford)

## Analysis of Variance Table  
##   
## Model 1: stocks\_diff[, 2] ~ FF\_data$Mkt.RF  
## Model 2: stocks\_diff[, 2] ~ FF\_data$Mkt.RF + +FF\_data$SMB + FF\_data$HML  
## Res.Df RSS Df Sum of Sq F Pr(>F)  
## 1 501 1145.1   
## 2 499 1140.0 2 5.1703 1.1316 0.3233

# UTX

CAPM\_UTX<- lm(stocks\_diff[,3]~FF\_data$Mkt.RF)  
summary(CAPM\_UTX)

##   
## Call:  
## lm(formula = stocks\_diff[, 3] ~ FF\_data$Mkt.RF)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -3.4071 -0.5196 -0.0012 0.5099 3.6282   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 0.01182 0.03873 0.305 0.76   
## FF\_data$Mkt.RF 0.90806 0.05595 16.230 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.8678 on 501 degrees of freedom  
## Multiple R-squared: 0.3446, Adjusted R-squared: 0.3433   
## F-statistic: 263.4 on 1 and 501 DF, p-value: < 2.2e-16

FF3\_UTX <- lm(stocks\_diff[,3]~FF\_data$Mkt.RF++FF\_data$SMB+ FF\_data$HML )  
summary(FF3\_UTX)

##   
## Call:  
## lm(formula = stocks\_diff[, 3] ~ FF\_data$Mkt.RF + +FF\_data$SMB +   
## FF\_data$HML)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -3.3176 -0.5314 0.0105 0.5311 3.4567   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 0.009946 0.038762 0.257 0.7976   
## FF\_data$Mkt.RF 1.003065 0.066642 15.052 <2e-16 \*\*\*  
## FF\_data$SMB -0.253718 0.096616 -2.626 0.0089 \*\*   
## FF\_data$HML 0.007639 0.133393 0.057 0.9544   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.8635 on 499 degrees of freedom  
## Multiple R-squared: 0.3536, Adjusted R-squared: 0.3498   
## F-statistic: 91.01 on 3 and 499 DF, p-value: < 2.2e-16

anova(CAPM\_UTX, FF3\_UTX)

## Analysis of Variance Table  
##   
## Model 1: stocks\_diff[, 3] ~ FF\_data$Mkt.RF  
## Model 2: stocks\_diff[, 3] ~ FF\_data$Mkt.RF + +FF\_data$SMB + FF\_data$HML  
## Res.Df RSS Df Sum of Sq F Pr(>F)   
## 1 501 377.27   
## 2 499 372.06 2 5.207 3.4918 0.03119 \*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

# Merk

CAPM\_Merk<- lm(stocks\_diff[,4]~FF\_data$Mkt.RF)  
summary(CAPM\_Merk)

##   
## Call:  
## lm(formula = stocks\_diff[, 4] ~ FF\_data$Mkt.RF)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -31.1217 -0.4808 0.0726 0.7080 12.3075   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -0.08114 0.09191 -0.883 0.378   
## FF\_data$Mkt.RF 0.64255 0.13279 4.839 1.74e-06 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.06 on 501 degrees of freedom  
## Multiple R-squared: 0.04465, Adjusted R-squared: 0.04274   
## F-statistic: 23.42 on 1 and 501 DF, p-value: 1.741e-06

FF3\_Merk <- lm(stocks\_diff[,4]~FF\_data$Mkt.RF++FF\_data$SMB+ FF\_data$HML )  
summary(FF3\_Merk)

##   
## Call:  
## lm(formula = stocks\_diff[, 4] ~ FF\_data$Mkt.RF + +FF\_data$SMB +   
## FF\_data$HML)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -30.3838 -0.5185 0.0890 0.6913 12.1337   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -0.04453 0.09107 -0.489 0.6251   
## FF\_data$Mkt.RF 0.68034 0.15658 4.345 1.69e-05 \*\*\*  
## FF\_data$SMB -0.37685 0.22700 -1.660 0.0975 .   
## FF\_data$HML -1.23812 0.31341 -3.951 8.92e-05 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 2.029 on 499 degrees of freedom  
## Multiple R-squared: 0.0767, Adjusted R-squared: 0.07115   
## F-statistic: 13.82 on 3 and 499 DF, p-value: 1.142e-08

anova(CAPM\_Merk, FF3\_Merk)

## Analysis of Variance Table  
##   
## Model 1: stocks\_diff[, 4] ~ FF\_data$Mkt.RF  
## Model 2: stocks\_diff[, 4] ~ FF\_data$Mkt.RF + +FF\_data$SMB + FF\_data$HML  
## Res.Df RSS Df Sum of Sq F Pr(>F)   
## 1 501 2125.1   
## 2 499 2053.8 2 71.286 8.6597 0.0002009 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1