

Master Thesis - Working R Code

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Hypothesis A1: Listed shipping companies with a high level of green investments will outperform the market

#Load green and non-green portfolios

```
Port <- read.table("Port1_16.csv",header=TRUE,sep=",")
```

#Load factors for factor models

```
FamaFrench5 <- read.table("ff5.csv",header=TRUE,sep=",")
```

```
FamaFrench3 <- read.table("ff3.csv",header=TRUE,sep=",")
```

```
Mom <- read.table("mom.csv",header=TRUE,sep=",")
```

#Load alternative market benchmark

```
SI <- read.table("SI_16.csv",header=TRUE,sep=",")
```

#Retrieve Fama French 5 factors

```
rmrf <- FamaFrench5[,2] #market premium is the same for all factor models
```

```
smb5 <- FamaFrench5[,3]
```

```
hml5 <- FamaFrench5[,4]
```

```
rmw5 <- FamaFrench5[,5]
```

```
cma5 <- FamaFrench5[,6]
```

#Retrieve Carhart 4 factors

```
smb3 <- FamaFrench3[,3]
```

```
hml3 <- FamaFrench3[,4]
```

```
mom <- Mom[,2]
```

#Risk-free rate

```
rf <- FamaFrench3[,5]
```

#Retrieve the portfolios

```
Gport <- Port[,2]
```

```
NGport <- Port[,3]
```

```
Diffport <- Port[,4]
```

#Alternative market benchmark: Solactive Global Shipping index

```

SOLindex          <- SI[,3]

#Excess returns for the portfolios
Gport.excess     <- Gport - rf
NGport.excess    <- NGport - rf
Diffport.excess  <- Diffport - rf

SOLindex.excess  <- SOLindex - rf

MeanGI           <- mean(Gport.excess)
MeanNGI          <- mean(NGport.excess)
MeanDiff         <- mean(Diffport.excess)

MaxGI            <- max(Gport.excess)
MaxNGI           <- max(NGport.excess)
MaxDiff          <- max(Diffport.excess)

MinGI            <- min(Gport.excess)
MinNGI           <- min(NGport.excess)
MinDiff          <- min(Diffport.excess)

StdGI            <- sd(Gport.excess)
StdNGI           <- sd(NGport.excess)
StdDiff          <- sd(Diffport.excess)

SR_GI            <- MeanGI/StdGI
SR_NGI           <- MeanNGI/StdNGI
SR_Diff          <- MeanDiff/StdDiff

#Log Returns
log              <- sign(Gport.excess) * log(abs(Gport.excess))
logNG            <- sign(NGport.excess) * log(abs(NGport.excess))
logDiff          <- sign(Diffport.excess) * log(abs(Diffport.excess))

logSOL           <- sign(SOLindex.excess) * log(abs(SOLindex.excess))
logrmrf          <- sign(rmrf) * log(abs(rmrf))

#Log returns for fama french 5
logsm5           <- sign(smb5) * log(abs(smb5))
loghml5          <- sign(hml5) * log(abs(hml5))
logrmw5          <- sign(rmw5) * log(abs(rmw5))
logcma5          <- sign(cma5) * log(abs(cma5))

#Log returns for carhart 4
logsm3           <- sign(smb3) * log(abs(smb3))
loghml3          <- sign(hml3) * log(abs(hml3))
logmom           <- sign(mom) * log(abs(mom))

#Regressions on FF market factor
mktc_G           <- lm(logG ~ logrmrf + logsm3 + loghml3 + logmom)
mktc_NG          <- lm(logNG ~ logrmrf + logsm3 + loghml3 + logmom)

```

```

mktc_Diff      <- lm(logDiff ~ logrmrf + logsmb3 + loghml3 + logmom)
mktff_G       <- lm(logG ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5)
mktff_NG      <- lm(logNG ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5)
mktff_Diff    <- lm(logDiff ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5)

#Regression Cahart 5
mktc5_G       <- lm(logG ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5 + logmom)
mktc5_NG      <- lm(logNG ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5 + logmom)
mktc5_Diff    <- lm(logDiff ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5 + logmom)

SOLc5_G       <- lm(logG ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5 + logmom)
SOLc5_NG      <- lm(logNG ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5 + logmom)
SOLc5_Diff    <- lm(logDiff ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5 + logmom)

#Regressions on shipping market benchmark
SOLc_G        <- lm(logG ~ logSOL + logsmb3 + loghml3 + logmom)
SOLc_NG       <- lm(logNG ~ logSOL + logsmb3 + loghml3 + logmom)
SOLc_Diff     <- lm(logDiff ~ logSOL + logsmb3 + loghml3 + logmom)
SOLff_G       <- lm(logG ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5)
SOLff_NG      <- lm(logNG ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5)
SOLff_Diff    <- lm(logDiff ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5)
SOLc5_Diff    <- lm(logDiff ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5 + logmom)

#Show regression results - the Shipping index
print(summary(SOLc_G))

##
## Call:
## lm(formula = logG ~ logSOL + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q    Max
## -2.93121 -0.67798 -0.09822  0.54337  2.77413
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.03555   0.14274   0.249  0.804
## logSOL       0.85250   0.08964   9.511 4.08e-14 ***
## logsmb3     -0.04602   0.13831  -0.333  0.740
## loghml3     -0.05035   0.14219  -0.354  0.724
## logmom       0.06737   0.12395   0.544  0.589
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.186 on 68 degrees of freedom
## Multiple R-squared:  0.5957, Adjusted R-squared:  0.572
## F-statistic: 25.05 on 4 and 68 DF, p-value: 8.992e-13

print(summary(SOLc_NG))

```

```

##
## Call:
## lm(formula = logNG ~ logSOL + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -2.7440 -1.0531 -0.0275  1.0482  3.1912
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.4051   0.1777  -2.280  0.0258 *
## logSOL      0.5898   0.1116   5.285 1.44e-06 ***
## logsmb3     -0.1525   0.1722  -0.886  0.3789
## loghml3     0.2145   0.1770   1.212  0.2297
## logmom      -0.2716   0.1543  -1.760  0.0829 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.476 on 68 degrees of freedom
## Multiple R-squared:  0.4209, Adjusted R-squared:  0.3868
## F-statistic: 12.35 on 4 and 68 DF, p-value: 1.316e-07

print(summary(SOLc_Diff))

##
## Call:
## lm(formula = logDiff ~ logSOL + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.5598 -1.0121  0.3452  1.2330  2.8005
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) 0.529682  0.194366   2.725 0.00816 **
## logSOL      0.257715  0.122060   2.111 0.03842 *
## logsmb3     -0.009469  0.188333  -0.050 0.96005
## loghml3     -0.321747  0.193617  -1.662 0.10116
## logmom      0.190527  0.168787   1.129 0.26295
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.614 on 68 degrees of freedom
## Multiple R-squared:  0.1073, Adjusted R-squared:  0.05479
## F-statistic: 2.043 on 4 and 68 DF, p-value: 0.09801

print(summary(SOLff_G))

##
## Call:
## lm(formula = logG ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5)
##
## Residuals:
##   Min     1Q   Median     3Q      Max

```

```

## -3.12455 -0.67943 -0.08987 0.60901 2.81813
##
## Coefficients:
##      Estimate Std. Error t value Pr(>|t|)
## (Intercept) 0.04868  0.13958  0.349  0.728
## logSOL      0.83379  0.08787  9.489 5.13e-14 ***
## logsmb5     0.20009  0.12584  1.590  0.117
## loghml5    -0.08074  0.14809 -0.545  0.587
## logrmw5     0.06052  0.11976  0.505  0.615
## logcma5     0.05165  0.14261  0.362  0.718
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.174 on 67 degrees of freedom
## Multiple R-squared:  0.6097, Adjusted R-squared:  0.5805
## F-statistic: 20.93 on 5 and 67 DF,  p-value: 1.549e-12

print(summary(SOLff_NG))

##
## Call:
## lm(formula = logNG ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.6573 -0.9841 -0.3170  0.9090  3.7672
##
## Coefficients:
##      Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.33488  0.17690 -1.893  0.0627 .
## logSOL      0.56689  0.11136  5.090 3.11e-06 ***
## logsmb5     0.04594  0.15948  0.288  0.7742
## loghml5     0.36236  0.18768  1.931  0.0578 .
## logrmw5    -0.27142  0.15178 -1.788  0.0783 .
## logcma5    -0.14040  0.18074 -0.777  0.4400
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.487 on 67 degrees of freedom
## Multiple R-squared:  0.4206, Adjusted R-squared:  0.3773
## F-statistic: 9.726 on 5 and 67 DF,  p-value: 5.129e-07

print(summary(SOLff_Diff))

##
## Call:
## lm(formula = logDiff ~ logSOL + logsmb5 + loghml5 + logrmw5 +
##      logcma5)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -3.4311 -1.2478  0.4435  1.0614  3.3720
##
## Coefficients:

```

```

##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) 0.52038  0.18834  2.763 0.00739 **
## logSOL      0.22865  0.11856  1.929 0.05803 .
## logsmb5     0.08027  0.16980  0.473 0.63795
## loghml5    -0.30046  0.19982 -1.504 0.13737
## logrmw5     0.34335  0.16160  2.125 0.03730 *
## logcma5    -0.08330  0.19243 -0.433 0.66649
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.584 on 67 degrees of freedom
## Multiple R-squared:  0.1537, Adjusted R-squared:  0.09049
## F-statistic: 2.433 on 5 and 67 DF,  p-value: 0.04363

#Show regression results - Carhart 5
print(summary(mktc5_G))

##
## Call:
## lm(formula = logG ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5 +
##     logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.4095 -1.1181  0.2813  0.9010  3.1481
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) 0.06561  0.19111  0.343  0.732
## logrmrf     0.67764  0.15151  4.472 3.12e-05 ***
## logsmb5     0.22529  0.17068  1.320  0.191
## loghml5     0.30232  0.20222  1.495  0.140
## logrmw5    -0.03747  0.16261 -0.230  0.818
## logcma5    -0.22881  0.18765 -1.219  0.227
## logmom     -0.01934  0.16749 -0.115  0.908
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.578 on 66 degrees of freedom
## Multiple R-squared:  0.3047, Adjusted R-squared:  0.2414
## F-statistic: 4.82 on 6 and 66 DF,  p-value: 0.0003915

print(summary(mktc5_NG))

##
## Call:
## lm(formula = logNG ~ logrmrf + logsmb5 + loghml5 + logrmw5 +
##     logcma5 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -2.7058 -1.0374 -0.3177  1.2884  3.0014
##
## Coefficients:

```

```
##      Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.36600  0.19473 -1.880 0.06459 .
## logrmrf     0.44614  0.15438  2.890 0.00521 **
## logsmb5     0.09734  0.17390  0.560 0.57754
## loghml5     0.49681  0.20604  2.411 0.01869 *
## logrmw5    -0.30533  0.16568 -1.843 0.06985 .
## logcma5    -0.31224  0.19120 -1.633 0.10722
## logmom     -0.29432  0.17066 -1.725 0.08927 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.608 on 66 degrees of freedom
## Multiple R-squared:  0.3328, Adjusted R-squared:  0.2722
## F-statistic: 5.488 on 6 and 66 DF,  p-value: 0.0001174
```

```
print(summary(mktc5_Diff))
```

```
##
## Call:
## lm(formula = logDiff ~ logrmrf + logsmb5 + loghml5 + logrmw5 +
##   logcma5 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.1947 -1.1671  0.3929  1.1265  3.7903
##
## Coefficients:
##      Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.56341  0.19716  2.858  0.0057 **
## logrmrf      0.12149  0.15631  0.777  0.4398
## logsmb5      0.07783  0.17608  0.442  0.6599
## loghml5     -0.13318  0.20862 -0.638  0.5254
## logrmw5      0.30758  0.16775  1.834  0.0712 .
## logcma5     -0.16921  0.19359 -0.874  0.3853
## logmom       0.11612  0.17279  0.672  0.5039
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.628 on 66 degrees of freedom
## Multiple R-squared:  0.1187, Adjusted R-squared:  0.03857
## F-statistic: 1.481 on 6 and 66 DF,  p-value: 0.1982
```

```
print(summary(SOLc5_G))
```

```
##
## Call:
## lm(formula = logG ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5 +
##   logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.0925 -0.6921 -0.1166  0.5869  2.8920
##
## Coefficients:
```

```

##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) 0.05350  0.14159  0.378  0.707
## logSOL      0.83779  0.08962  9.348 1.05e-13 ***
## logsmb5     0.19560  0.12772  1.531  0.130
## loghml5    -0.06705  0.15689 -0.427  0.670
## logrmw5     0.05681  0.12131  0.468  0.641
## logcma5     0.05066  0.14364  0.353  0.725
## logmom      0.03509  0.12506  0.281  0.780
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.182 on 66 degrees of freedom
## Multiple R-squared:  0.6101, Adjusted R-squared:  0.5747
## F-statistic: 17.22 on 6 and 66 DF,  p-value: 7.272e-12

print(summary(SOLc5_NG))

##
## Call:
## lm(formula = logNG ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5 +
##     logmom)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.7496 -0.8605 -0.1681  0.8324  3.6629
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.37082  0.17582 -2.109  0.0387 *
## logSOL      0.53706  0.11128  4.826 8.59e-06 ***
## logsmb5     0.07948  0.15859  0.501  0.6179
## loghml5     0.26029  0.19481  1.336  0.1861
## logrmw5    -0.24377  0.15063 -1.618  0.1104
## logcma5    -0.13308  0.17836 -0.746  0.4583
## logmom     -0.26171  0.15528 -1.685  0.0966 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.467 on 66 degrees of freedom
## Multiple R-squared:  0.4445, Adjusted R-squared:  0.394
## F-statistic: 8.801 on 6 and 66 DF,  p-value: 4.759e-07

print(summary(SOLc5_Diff))

##
## Call:
## lm(formula = logDiff ~ logSOL + logsmb5 + loghml5 + logrmw5 +
##     logcma5 + logmom)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -3.4939 -1.1476  0.4006  1.0760  3.4481
##
## Coefficients:

```



```

##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) 0.54057  0.19007  2.844 0.00592 **
## logSOL      0.24541  0.12030  2.040 0.04536 *
## logsmb5     0.06143  0.17145  0.358 0.72129
## loghml5    -0.24312  0.21060 -1.154 0.25250
## logrmw5     0.32781  0.16285  2.013 0.04820 *
## logcma5    -0.08741  0.19282 -0.453 0.65179
## logmom      0.14701  0.16787  0.876 0.38437
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.586 on 66 degrees of freedom
## Multiple R-squared:  0.1634, Adjusted R-squared:  0.08732
## F-statistic: 2.148 on 6 and 66 DF,  p-value: 0.05932

#Show regressions results - FF market factor
print(summary(mktc_G))

##
## Call:
## lm(formula = logG ~ logrmrf + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.1370 -1.0360  0.1114  1.1536  3.3634
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) 0.05804  0.19430  0.299  0.766
## logrmrf     0.67866  0.15392  4.409 3.78e-05 ***
## logsmb3     0.12585  0.18358  0.686  0.495
## loghml3     0.22826  0.18682  1.222  0.226
## logmom     -0.01102  0.16671 -0.066  0.947
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.596 on 68 degrees of freedom
## Multiple R-squared:  0.2674, Adjusted R-squared:  0.2244
## F-statistic: 6.207 on 4 and 68 DF,  p-value: 0.0002562

print(summary(mktc_NG))

##
## Call:
## lm(formula = logNG ~ logrmrf + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -2.7333 -1.2952 -0.2298  1.1954  3.0365
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.38092  0.20270 -1.879  0.0645 .
## logrmrf     0.43665  0.16058  2.719  0.0083 **

```

```

## logsmb3  -0.02745  0.19152 -0.143  0.8865
## loghml3   0.40809  0.19490  2.094  0.0400 *
## logmom   -0.33160  0.17392 -1.907  0.0608 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.665 on 68 degrees of freedom
## Multiple R-squared:  0.2632, Adjusted R-squared:  0.2198
## F-statistic: 6.072 on 4 and 68 DF,  p-value: 0.0003079

print(summary(mktc_Diff))

##
## Call:
## lm(formula = logDiff ~ logrmrf + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.297 -1.226  0.335  1.284  3.254
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.55167   0.20163   2.736 0.00792 **
## logrmrf      0.14754   0.15972   0.924 0.35891
## logsmb3      0.05328   0.19051   0.280 0.78056
## loghml3     -0.23610   0.19387  -1.218 0.22748
## logmom       0.15667   0.17300   0.906 0.36833
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.656 on 68 degrees of freedom
## Multiple R-squared:  0.06057,  Adjusted R-squared:  0.005305
## F-statistic: 1.096 on 4 and 68 DF,  p-value: 0.3657

print(summary(mktff_G))

##
## Call:
## lm(formula = logG ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.3947 -1.1163  0.2519  0.8807  3.1465
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.06796   0.18862   0.360  0.720
## logrmrf      0.68071   0.14806   4.598 1.95e-05 ***
## logsmb5      0.22277   0.16803   1.326  0.189
## loghml5      0.31075   0.18716   1.660  0.102
## logrmw5     -0.03987   0.16008  -0.249  0.804
## logcma5     -0.23008   0.18595  -1.237  0.220
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

##
## Residual standard error: 1.567 on 67 degrees of freedom
## Multiple R-squared:  0.3045, Adjusted R-squared:  0.2526
## F-statistic: 5.867 on 5 and 67 DF,  p-value: 0.0001486

print(summary(mktff_NG))

##
## Call:
## lm(formula = logNG ~ logrmrf + logsmb5 + loghml5 + logrmw5 +
##     logcma5)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -2.6321 -1.2173 -0.2776  1.2944  3.0353
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.33027   0.19645  -1.681  0.09739 .
## logrmrf      0.49287   0.15421   3.196  0.00213 **
## logsmb5      0.05904   0.17500   0.337  0.73689
## loghml5      0.62520   0.19493   3.207  0.00206 **
## logrmw5     -0.34190   0.16673  -2.051  0.04422 *
## logcma5     -0.33158   0.19367  -1.712  0.09150 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.632 on 67 degrees of freedom
## Multiple R-squared:  0.3028, Adjusted R-squared:  0.2507
## F-statistic: 5.819 on 5 and 67 DF,  p-value: 0.0001605

print(summary(mktff_Diff))

##
## Call:
## lm(formula = logDiff ~ logrmrf + logsmb5 + loghml5 + logrmw5 +
##     logcma5)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.2373 -1.1566  0.4256  1.1523  3.6972
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.54932   0.19524   2.814  0.00642 **
## logrmrf      0.10305   0.15325   0.672  0.50363
## logsmb5      0.09294   0.17392   0.534  0.59485
## loghml5     -0.18384   0.19372  -0.949  0.34604
## logrmw5      0.32200   0.16569   1.943  0.05617 .
## logcma5     -0.16158   0.19246  -0.840  0.40416
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.622 on 67 degrees of freedom

```

```
## Multiple R-squared: 0.1127, Adjusted R-squared: 0.04644
## F-statistic: 1.701 on 5 and 67 DF, p-value: 0.1464
```

Hypothesis A2: Listed shipping companies with a high level of green investments will outperform non-green peers

#Load green and non-green portfolios

```
Sector <- read.table("Sector.csv",header=TRUE,sep=",")
```

#Load factors for factor models

```
FamaFrench5 <- read.table("ff5.csv",header=TRUE,sep=",")
FamaFrench3 <- read.table("ff3.csv",header=TRUE,sep=",")
Mom <- read.table("mom.csv",header=TRUE,sep=",")
```

#Load alternative market benchmark

```
SI <- read.table("SI_16.csv",header=TRUE,sep=",")
```

#Retrieve Fama French 5 factors

```
rmrf <- FamaFrench5[,2] #market premium is the same for all factor models
smb5 <- FamaFrench5[,3]
hml5 <- FamaFrench5[,4]
rmw5 <- FamaFrench5[,5]
cma5 <- FamaFrench5[,6]
```

#Retrieve Carhart 4 factors

```
smb3 <- FamaFrench3[,3]
hml3 <- FamaFrench3[,4]
mom <- Mom[,2]
```

#Risk-free rate

```
rf <- FamaFrench3[,5]
```

#Retrieve the portfolios

```
G_T <- Sector[,2]
G_DB <- Sector[,3]
NG_T <- Sector[,4]
NG_DB <- Sector[,5]
Diff_T <- Sector[,6]
Diff_DB <- Sector[,7]
```

#Alternative market benchmark: Solactive Global Shipping index

```
SOLindex <- SI[,3]
```

#Excess returns for the portfolios

```
G_T.excess <- G_T - rf
G_DB.excess <- G_DB - rf
NG_T.excess <- NG_T - rf
NG_DB.excess <- NG_DB - rf
Diff_T.excess <- Diff_T - rf
Diff_DB.excess <- Diff_DB - rf
```

```

SOLindex.excess      <- SOLindex - rf

MeanG_T              <- mean(G_T.excess)
MeanNG_T             <- mean(NG_T.excess)
MeanDiff_T           <- mean(Diff_T.excess)

MaxG_T               <- max(G_T.excess)
MaxNG_T              <- max(NG_T.excess)
MaxDiff_T            <- max(Diff_T.excess)

MinG_T               <- min(G_T.excess)
MinNG_T              <- min(NG_T.excess)
Min_T                <- min(Diff_T.excess)

StdG_T               <- sd(G_T.excess)
StdNG_T              <- sd(NG_T.excess)
StdDiff_T            <- sd(Diff_T.excess)

SR_G_T               <- MeanG_T/StdG_T
SR_NG_T              <- MeanNG_T/StdNG_T
SR_Diff_T            <- MeanDiff_T/StdDiff_T

MeanG_DB             <- mean(G_DB.excess)
MeanNG_DB            <- mean(NG_DB.excess)
MeanDiff_DB          <- mean(Diff_DB.excess)

MaxG_DB              <- max(G_DB.excess)
MaxNG_DB             <- max(NG_DB.excess)
MaxDiff_DB           <- max(Diff_DB.excess)

MinG_DB              <- min(G_DB.excess)
MinNG_DB             <- min(NG_DB.excess)
MinDiff_DB           <- min(Diff_DB.excess)

StdG_DB              <- sd(G_DB.excess)
StdNG_DB             <- sd(NG_DB.excess)
StdDiff_DB           <- sd(Diff_DB.excess)

SR_G_DB              <- MeanG_DB/StdG_DB
SR_NG_DB             <- MeanNG_DB/StdNG_DB
SR_Diff_DB           <- MeanDiff_DB/StdDiff_DB

#Log Returns
logG_T               <- sign(G_T.excess) * log(abs(G_T.excess))
logNG_T              <- sign(NG_T.excess) * log(abs(NG_T.excess))
logDiff_T            <- sign(Diff_T.excess) * log(abs(Diff_T.excess))

logG_DB              <- sign(G_DB.excess) * log(abs(G_DB.excess))
logNG_DB             <- sign(NG_DB.excess) * log(abs(NG_DB.excess))
logDiff_DB           <- sign(Diff_DB.excess) * log(abs(Diff_DB.excess))

logSOL               <- sign(SOLindex.excess) * log(abs(SOLindex.excess))

```

```

logrmrf          <- sign(rmrf) * log(abs(rmrf))

#Log returns for fama french 5
logsmb5         <- sign(smb5) * log(abs(smb5))
loghml5         <- sign(hml5) * log(abs(hml5))
logrmw5         <- sign(rmw5) * log(abs(rmw5))
logcma5         <- sign(cma5) * log(abs(cma5))

#Log returns for carhart 4
logsmb3         <- sign(smb3) * log(abs(smb3))
loghml3         <- sign(hml3) * log(abs(hml3))
logmom          <- sign(mom) * log(abs(mom))

#Regressions on FF market factor
mktc_GT         <- lm(logG_T ~ logrmrf + logsmb3 + loghml3 + logmom)
mktc_NGT        <- lm(logNG_T ~ logrmrf + logsmb3 + loghml3 + logmom)
mktc_DiffT      <- lm(logDiff_T ~ logrmrf + logsmb3 + loghml3 + logmom)
mktff_GT        <- lm(logG_T ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5)
mktff_NGT       <- lm(logNG_T ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5)
mktff_DiffT     <- lm(logDiff_T ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5)

mktc_GDB        <- lm(logG_DB ~ logrmrf + logsmb3 + loghml3 + logmom)
mktc_NGDB       <- lm(logNG_DB ~ logrmrf + logsmb3 + loghml3 + logmom)
mktc_DiffDB     <- lm(logDiff_DB ~ logrmrf + logsmb3 + loghml3 + logmom)
mktff_GDB       <- lm(logG_DB ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5)
mktff_NGDB      <- lm(logNG_DB ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5)
mktff_DiffDB    <- lm(logDiff_DB ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5)

#Regressions on alternative market benchmark
SOLc_GT         <- lm(logG_T ~ logSOL + logsmb3 + loghml3 + logmom)
SOLc_NGT        <- lm(logNG_T ~ logSOL + logsmb3 + loghml3 + logmom)
SOLc_DiffT      <- lm(logDiff_T ~ logSOL + logsmb3 + loghml3 + logmom)
SOLff_GT        <- lm(logG_T ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5)
SOLff_NGT       <- lm(logNG_T ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5)
SOLff_DiffT     <- lm(logDiff_T ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5)

SOLc_GDB        <- lm(logG_DB ~ logSOL + logsmb3 + loghml3 + logmom)
SOLc_NGDB       <- lm(logNG_DB ~ logSOL + logsmb3 + loghml3 + logmom)
SOLc_DiffDB     <- lm(logDiff_DB ~ logSOL + logsmb3 + loghml3 + logmom)
SOLff_GDB       <- lm(logG_DB ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5)
SOLff_NGDB      <- lm(logNG_DB ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5)
SOLff_DiffDB    <- lm(logDiff_DB ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5)

#Show regressions results - FF market factor
print(summary(mktc_GT))

##
## Call:
## lm(formula = logG_T ~ logrmrf + logsmb3 + loghml3 + logmom)
##
## Residuals:
##      Min       1Q   Median       3Q      Max

```

```

## -2.58147 -1.38400 -0.03612 1.43294 3.06188
##
## Coefficients:
##      Estimate Std. Error t value Pr(>|t|)
## (Intercept) 0.009662 0.194059 0.050 0.96044
## logrmrf    0.417702 0.153728 2.717 0.00834 **
## logsmb3    0.188938 0.183354 1.030 0.30645
## loghml3    0.243249 0.186588 1.304 0.19674
## logmom     -0.046988 0.166500 -0.282 0.77864
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.594 on 68 degrees of freedom
## Multiple R-squared: 0.1603, Adjusted R-squared: 0.1109
## F-statistic: 3.245 on 4 and 68 DF, p-value: 0.01698

print(summary(mktc_NGT))

##
## Call:
## lm(formula = logNG_T ~ logrmrf + logsmb3 + loghml3 + logmom)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.52254 -1.42759 -0.07118  1.01997  3.13624
##
## Coefficients:
##      Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.4972   0.1943 -2.559 0.0127 *
## logrmrf     0.3206   0.1539  2.083 0.0410 *
## logsmb3     0.1300   0.1836  0.708 0.4813
## loghml3     0.4052   0.1868  2.169 0.0336 *
## logmom     -0.3442   0.1667 -2.065 0.0428 *
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.596 on 68 degrees of freedom
## Multiple R-squared: 0.2508, Adjusted R-squared: 0.2067
## F-statistic: 5.691 on 4 and 68 DF, p-value: 0.0005191

print(summary(mktc_DiffT))

##
## Call:
## lm(formula = logDiff_T ~ logrmrf + logsmb3 + loghml3 + logmom)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -3.6092 -0.8779  0.3244  1.1185  2.5607
##
## Coefficients:
##      Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.6525   0.1853  3.521 0.000773 ***
## logrmrf     0.1095   0.1468  0.746 0.458320

```

```

## logsmb3    0.1823    0.1751    1.041 0.301489
## loghml3   -0.2037    0.1782   -1.143 0.256920
## logmom     0.2144    0.1590    1.348 0.181974
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.522 on 68 degrees of freedom
## Multiple R-squared:  0.09181, Adjusted R-squared:  0.03839
## F-statistic: 1.719 on 4 and 68 DF, p-value: 0.156

print(summary(mktff_GT))

##
## Call:
## lm(formula = logG_T ~ logrmrf + logsmb5 + loghml5 + logrmw5 +
##     logcma5)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -2.8836 -1.2364 -0.0461  1.1042  3.2895
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.004167   0.190228  -0.022  0.98259
## logrmrf      0.448441   0.149318   3.003  0.00375 **
## logsmb5      0.016739   0.169457   0.099  0.92161
## loghml5      0.357290   0.188754   1.893  0.06269 .
## logrmw5     -0.105684   0.161441  -0.655  0.51495
## logcma5     -0.310605   0.187527  -1.656  0.10233
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.58 on 67 degrees of freedom
## Multiple R-squared:  0.1871, Adjusted R-squared:  0.1265
## F-statistic: 3.085 on 5 and 67 DF, p-value: 0.01448

print(summary(mktff_NGT))

##
## Call:
## lm(formula = logNG_T ~ logrmrf + logsmb5 + loghml5 + logrmw5 +
##     logcma5)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -2.8054 -1.1750 -0.0737  1.1562  3.2508
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.48836   0.18836  -2.593  0.01168 *
## logrmrf      0.41633   0.14785   2.816  0.00638 **
## logsmb5     -0.01873   0.16779  -0.112  0.91146
## loghml5      0.47346   0.18690   2.533  0.01365 *
## logrmw5     -0.46802   0.15986  -2.928  0.00466 **

```



```

## logcma5  -0.03097  0.18569 -0.167  0.86804
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.564 on 67 degrees of freedom
## Multiple R-squared:  0.2908, Adjusted R-squared:  0.2379
## F-statistic: 5.494 on 5 and 67 DF,  p-value: 0.0002688

print(summary(mktff_DiffT))

##
## Call:
## lm(formula = logDiff_T ~ logrmrf + logsmb5 + loghml5 + logrmw5 +
##     logcma5)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.3523 -0.8970  0.2547  0.9297  2.3458
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.63089   0.17423   3.621 0.000565 ***
## logrmrf      0.06367   0.13676   0.466 0.643027
## logsmb5      0.09222   0.15521   0.594 0.554416
## loghml5     -0.14213   0.17288  -0.822 0.413921
## logrmw5      0.45907   0.14787   3.105 0.002791 **
## logcma5     -0.20623   0.17176  -1.201 0.234089
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.447 on 67 degrees of freedom
## Multiple R-squared:  0.1915, Adjusted R-squared:  0.1311
## F-statistic: 3.174 on 5 and 67 DF,  p-value: 0.01246

print(summary(mktc_GDB))

##
## Call:
## lm(formula = logG_DB ~ logrmrf + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.4729 -1.4647  0.1339  1.2940  4.0283
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.05729   0.21717   0.264 0.792744
## logrmrf      0.69666   0.17203   4.050 0.000134 ***
## logsmb3      0.04956   0.20519   0.242 0.809877
## loghml3      0.33623   0.20881   1.610 0.111976
## logmom       0.06839   0.18633   0.367 0.714743
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##

```

```

## Residual standard error: 1.784 on 68 degrees of freedom
## Multiple R-squared: 0.2355, Adjusted R-squared: 0.1905
## F-statistic: 5.237 on 4 and 68 DF, p-value: 0.0009753

print(summary(mktc_NGDB))

##
## Call:
## lm(formula = logNG_DB ~ logrmrf + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q    Max
## -3.0779 -1.7074 -0.0786  1.6236  3.5549
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.15383   0.23966  -0.642  0.5231
## logrmrf      0.40914   0.18985   2.155  0.0347 *
## logsmb3      0.04379   0.22644   0.193  0.8472
## loghml3      0.33023   0.23043   1.433  0.1564
## logmom      -0.26620   0.20563  -1.295  0.1998
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.969 on 68 degrees of freedom
## Multiple R-squared: 0.1597, Adjusted R-squared: 0.1103
## F-statistic: 3.232 on 4 and 68 DF, p-value: 0.01732

print(summary(mktc_DiffDB))

##
## Call:
## lm(formula = logDiff_DB ~ logrmrf + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q    Max
## -5.1558 -1.7745  0.3401  1.4599  3.1349
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.200895  0.230479  0.872  0.386
## logrmrf      0.211148  0.182578  1.156  0.252
## logsmb3     -0.006122  0.217765 -0.028  0.978
## loghml3      0.061151  0.221606  0.276  0.783
## logmom       0.296598  0.197748  1.500  0.138
##
## Residual standard error: 1.893 on 68 degrees of freedom
## Multiple R-squared: 0.04495, Adjusted R-squared: -0.01122
## F-statistic: 0.8002 on 4 and 68 DF, p-value: 0.5293

print(summary(mktff_GDB))

##
## Call:

```

```

## lm(formula = logG_DB ~ logrmrf + logsmb5 + loghml5 + logrmw5 +
##   logcma5)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.7063 -1.1321  0.3361  1.2129  3.7254
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.06709   0.20941   0.320 0.749666
## logrmrf      0.67774   0.16437   4.123 0.000105 ***
## logsmb5      0.17962   0.18654   0.963 0.339072
## loghml5      0.44265   0.20779   2.130 0.036819 *
## logrmw5     -0.03342   0.17772  -0.188 0.851396
## logcma5     -0.35967   0.20644  -1.742 0.086044 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.739 on 67 degrees of freedom
## Multiple R-squared:  0.2839, Adjusted R-squared:  0.2304
## F-statistic: 5.312 on 5 and 67 DF,  p-value: 0.0003598

print(summary(mktff_NGDB))

##
## Call:
## lm(formula = logNG_DB ~ logrmrf + logsmb5 + loghml5 + logrmw5 +
##   logcma5)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -2.7988 -1.5693 -0.1352  1.3191  3.4683
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.09888   0.23145  -0.427  0.6706
## logrmrf      0.44652   0.18168   2.458  0.0166 *
## logsmb5      0.28374   0.20618   1.376  0.1733
## loghml5      0.51267   0.22966   2.232  0.0289 *
## logrmw5     -0.26015   0.19643  -1.324  0.1899
## logcma5     -0.28943   0.22817  -1.269  0.2090
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.922 on 67 degrees of freedom
## Multiple R-squared:  0.2105, Adjusted R-squared:  0.1516
## F-statistic: 3.573 on 5 and 67 DF,  p-value: 0.00635

print(summary(mktff_DiffDB))

##
## Call:
## lm(formula = logDiff_DB ~ logrmrf + logsmb5 + loghml5 + logrmw5 +
##   logcma5)

```

```
##
## Residuals:
##   Min    1Q  Median    3Q   Max
## -5.4224 -1.6281  0.6406  1.6035  2.5550
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.16096   0.23292   0.691   0.492
## logrmrf      0.16602   0.18283   0.908   0.367
## logsmb5     -0.05440   0.20749  -0.262   0.794
## loghml5     -0.02036   0.23112  -0.088   0.930
## logrmw5      0.05572   0.19768   0.282   0.779
## logcma5     -0.09039   0.22962  -0.394   0.695
##
## Residual standard error: 1.935 on 67 degrees of freedom
## Multiple R-squared:  0.01734, Adjusted R-squared: -0.05599
## F-statistic: 0.2365 on 5 and 67 DF, p-value: 0.945
```

#Show regression results - the Shipping index

```
print(summary(SOLc_GT))
```

```
##
## Call:
## lm(formula = logG_T ~ logSOL + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min    1Q  Median    3Q   Max
## -2.3910 -0.9224 -0.1567  0.9290  2.6507
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.03454   0.15785  -0.219   0.827
## logSOL       0.65317   0.09913  6.589 7.74e-09 ***
## logsmb3      0.03809   0.15295   0.249   0.804
## loghml3      0.02727   0.15724   0.173   0.863
## logmom       0.03111   0.13708   0.227   0.821
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.311 on 68 degrees of freedom
## Multiple R-squared:  0.4319, Adjusted R-squared:  0.3984
## F-statistic: 12.92 on 4 and 68 DF, p-value: 7.028e-08
```

```
print(summary(SOLc_NGT))
```

```
##
## Call:
## lm(formula = logNG_T ~ logSOL + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min    1Q  Median    3Q   Max
## -2.6181 -1.3330  0.0110  0.8432  3.2769
##
## Coefficients:
```

```

##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.50952  0.18171  -2.804 0.006572 **
## logSOL      0.40974  0.11411  3.591 0.000618 ***
## logsmb3     0.04635  0.17607  0.263 0.793167
## loghml3     0.27120  0.18101  1.498 0.138690
## logmom      -0.30557  0.15780  -1.936 0.056965 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.509 on 68 degrees of freedom
## Multiple R-squared:  0.33, Adjusted R-squared:  0.2906
## F-statistic: 8.374 on 4 and 68 DF,  p-value: 1.489e-05

print(summary(SOLc_DiffT))

##
## Call:
## lm(formula = logDiff_T ~ logSOL + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q    Max
## -3.6849 -1.1005  0.3202  1.1230  2.5974
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.6365   0.1803   3.530 0.000751 ***
## logSOL       0.1899   0.1133   1.677 0.098157 .
## logsmb3     0.1362   0.1747   0.780 0.438329
## loghml3     -0.2668   0.1796  -1.485 0.142073
## logmom       0.2392   0.1566   1.528 0.131222
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.498 on 68 degrees of freedom
## Multiple R-squared:  0.1207, Adjusted R-squared:  0.06902
## F-statistic: 2.334 on 4 and 68 DF,  p-value: 0.06427

print(summary(SOLff_GT))

##
## Call:
## lm(formula = logG_T ~ logSOL + logsmb5 + loghml5 + logrmw5 +
##   logcma5)
##
## Residuals:
##   Min     1Q   Median     3Q    Max
## -2.3351 -0.9632 -0.1367  0.9985  2.6809
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.040231  0.156756  -0.257  0.798
## logSOL       0.641243  0.098682   6.498 1.19e-08 ***
## logsmb5     -0.006495  0.141324  -0.046  0.963
## loghml5     0.047891  0.166312  0.288  0.774

```

```

## logrmw5 -0.034033 0.134498 -0.253 0.801
## logcma5 -0.093020 0.160161 -0.581 0.563
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.318 on 67 degrees of freedom
## Multiple R-squared: 0.4343, Adjusted R-squared: 0.392
## F-statistic: 10.29 on 5 and 67 DF, p-value: 2.407e-07

print(summary(SOLff_NGT))

##
## Call:
## lm(formula = logNG_T ~ logSOL + logsmb5 + loghml5 + logrmw5 +
## logcma5)
##
## Residuals:
## Min 1Q Median 3Q Max
## -3.4783 -1.1430 -0.0070 0.9708 2.9731
##
## Coefficients:
## Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.4866 0.1757 -2.770 0.007237 **
## logSOL 0.4568 0.1106 4.131 0.000103 ***
## logsmb5 -0.0278 0.1584 -0.176 0.861163
## loghml5 0.2638 0.1864 1.415 0.161556
## logrmw5 -0.4098 0.1507 -2.719 0.008327 **
## logcma5 0.1228 0.1795 0.684 0.496050
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.477 on 67 degrees of freedom
## Multiple R-squared: 0.3678, Adjusted R-squared: 0.3207
## F-statistic: 7.797 on 5 and 67 DF, p-value: 7.869e-06

print(summary(SOLff_DiffT))

##
## Call:
## lm(formula = logDiff_T ~ logSOL + logsmb5 + loghml5 + logrmw5 +
## logcma5)
##
## Residuals:
## Min 1Q Median 3Q Max
## -3.6263 -0.8202 0.2866 0.9823 2.0605
##
## Coefficients:
## Estimate Std. Error t value Pr(>|t|)
## (Intercept) 0.6055 0.1691 3.579 0.000646 ***
## logSOL 0.1710 0.1065 1.606 0.112980
## logsmb5 0.0817 0.1525 0.536 0.593890
## loghml5 -0.2308 0.1795 -1.286 0.202776
## logrmw5 0.4740 0.1451 3.266 0.001720 **
## logcma5 -0.1475 0.1728 -0.854 0.396376

```

```

## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.422 on 67 degrees of freedom
## Multiple R-squared:  0.2189, Adjusted R-squared:  0.1606
## F-statistic: 3.756 on 5 and 67 DF,  p-value: 0.004663

print(summary(SOLc_GDB))

##
## Call:
## lm(formula = logG_DB ~ logSOL + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.1483 -0.8929 -0.1125  0.7285  3.6430
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.03134   0.16700   0.188  0.852
## logSOL       0.88723   0.10487   8.460 3.2e-12 ***
## logsmb3     -0.13112   0.16182  -0.810  0.421
## loghml3      0.04603   0.16636   0.277  0.783
## logmom       0.15167   0.14502   1.046  0.299
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.387 on 68 degrees of freedom
## Multiple R-squared:  0.5377, Adjusted R-squared:  0.5105
## F-statistic: 19.77 on 4 and 68 DF,  p-value: 7.803e-11

print(summary(SOLc_NGDB))

##
## Call:
## lm(formula = logNG_DB ~ logSOL + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.3087 -1.4278  0.2313  1.3471  3.1990
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.18938   0.21509  -0.880  0.382
## logSOL       0.60700   0.13508   4.494 2.79e-05 ***
## logsmb3     -0.09247   0.20842  -0.444  0.659
## loghml3      0.13003   0.21426   0.607  0.546
## logmom      -0.19732   0.18679  -1.056  0.295
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.787 on 68 degrees of freedom
## Multiple R-squared:  0.3079, Adjusted R-squared:  0.2672
## F-statistic: 7.562 on 4 and 68 DF,  p-value: 4.224e-05

```

```

print(summary(SOLc_DiffDB))

##
## Call:
## lm(formula = logDiff_DB ~ logSOL + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -5.2211 -1.6506  0.4154  1.4276  2.7159
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.24487   0.22995   1.065   0.291
## logSOL       0.04953   0.14441   0.343   0.733
## logsmb3     0.01606   0.22281   0.072   0.943
## loghml3     0.04919   0.22906   0.215   0.831
## logmom      0.27088   0.19969   1.357   0.179
##
## Residual standard error: 1.91 on 68 degrees of freedom
## Multiple R-squared:  0.02785, Adjusted R-squared: -0.02933
## F-statistic: 0.4871 on 4 and 68 DF, p-value: 0.7452

```

```

print(summary(SOLff_GDB))

##
## Call:
## lm(formula = logG_DB ~ logSOL + logsmb5 + loghml5 + logrmw5 +
##   logcma5)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.4390 -0.8671 -0.1355  0.8060  3.5642
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.04749   0.16609   0.286   0.776
## logSOL       0.83174   0.10456   7.955 2.91e-11 ***
## logsmb5     0.15689   0.14974   1.048   0.299
## loghml5     0.05198   0.17622   0.295   0.769
## logrmw5     0.06662   0.14251   0.468   0.642
## logcma5    -0.07862   0.16970  -0.463   0.645
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.397 on 67 degrees of freedom
## Multiple R-squared:  0.5383, Adjusted R-squared:  0.5038
## F-statistic: 15.62 on 5 and 67 DF, p-value: 3.611e-10

```

```

print(summary(SOLff_NGDB))

##
## Call:
## lm(formula = logNG_DB ~ logSOL + logsmb5 + loghml5 + logrmw5 +
##   logcma5)

```



```

##
## Residuals:
##   Min    1Q  Median    3Q   Max
## -3.0460 -1.0701 -0.1039  1.4654  3.4303
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.11946   0.21069  -0.567   0.573
## logSOL      0.57815   0.13263   4.359 4.6e-05 ***
## logsmb5     0.26605   0.18995   1.401   0.166
## loghml5     0.23839   0.22353   1.066   0.290
## logrmw5    -0.19243   0.18077  -1.064   0.291
## logcma5    -0.09377   0.21527  -0.436   0.665
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.772 on 67 degrees of freedom
## Multiple R-squared:  0.3295, Adjusted R-squared:  0.2794
## F-statistic: 6.584 on 5 and 67 DF, p-value: 4.868e-05

print(summary(SOLff_DiffDB))

##
## Call:
## lm(formula = logDiff_DB ~ logSOL + logsmb5 + loghml5 + logrmw5 +
##   logcma5)
##
## Residuals:
##   Min    1Q  Median    3Q   Max
## -5.4264 -1.5883  0.6004  1.6435  2.7721
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.204325  0.231468   0.883   0.381
## logSOL       0.014150  0.145715   0.097   0.923
## logsmb5     -0.042864  0.208681  -0.205   0.838
## loghml5     -0.009891  0.245579  -0.040   0.968
## logrmw5     0.068853  0.198602   0.347   0.730
## logcma5    -0.087494  0.236495  -0.370   0.713
##
## Residual standard error: 1.946 on 67 degrees of freedom
## Multiple R-squared:  0.00539, Adjusted R-squared: -0.06883
## F-statistic: 0.07262 on 5 and 67 DF, p-value: 0.9961

```

Hypothesis B1: Listed shipping companies that publish sustainability reports outperform the market

#Load SR and non-SR portfolios

```
Port <- read.table("Port2_16.csv",header=TRUE,sep=",")
```

#Load factors for factor models

```
FamaFrench5 <- read.table("ff5.csv",header=TRUE,sep=",")
```

```
FamaFrench3 <- read.table("ff3.csv",header=TRUE,sep=",")
```

```
Mom <- read.table("mom.csv",header=TRUE,sep=",")
```

```

#Load alternative market benchmark
SI          <- read.table("SI_16.csv",header=TRUE,sep=",")

#Retrieve Fama French 5 factors
rmrf        <- FamaFrench5[,2] #market premium is the same for all factor models
smb5        <- FamaFrench5[,3]
hml5        <- FamaFrench5[,4]
rmw5        <- FamaFrench5[,5]
cma5        <- FamaFrench5[,6]

#Retrieve Carhart 4 factors
smb3        <- FamaFrench3[,3]
hml3        <- FamaFrench3[,4]
mom         <- Mom[,2]

#Risk-free rate
rf          <- FamaFrench3[,5]

#Retrieve the portfolios
SRport     <- Port[,2]
NSRport    <- Port[,3]
Diffport   <- Port[,4]

#Alternative market benchmark: Solactive Global Shipping index
SOLindex   <- SI[,3]

#Excess returns for the portfolios
SRport.excess <- SRport - rf
NSRport.excess<- NSRport - rf
Diffport.excess <- Diffport - rf

SOLindex.excess<- SOLindex - rf

#Descriptive Statistics
MeanSR      <- mean(SRport.excess)
MeanNSR     <- mean(NSRport.excess)
MeanDiff    <- mean(Diffport.excess)

MaxSR <- max(SRport.excess)
MaxNSR <- max(NSRport.excess)
MaxDiff <- max(Diffport.excess)

MinSR      <- min(SRport.excess)
MinNSR     <- min(NSRport.excess)
MinDiff    <- min(Diffport.excess)

StdSR      <- sd(SRport.excess)
StdNSR     <- sd(NSRport.excess)
StdDiff    <- sd(Diffport.excess)

SR_SR <- MeanSR/StdSR
SR_NSR <- MeanNSR/StdNSR

```

```
SR_Diff <- MeanDiff/StdDiff
```

#Log Returns

```
logSR      <- sign(SRport.excess) * log(abs(SRport.excess))  
logNSR     <- sign(NSRport.excess) * log(abs(NSRport.excess))  
logDiff    <- sign(Diffport.excess) * log(abs(Diffport.excess))
```

```
logSOL     <- sign(SOLindex.excess) * log(abs(SOLindex.excess))  
logrmrf    <- sign(rmrf) * log(abs(rmrf))
```

#Log returns for fama french 5

```
logsmb5    <- sign(smb5) * log(abs(smb5))  
loghml5    <- sign(hml5) * log(abs(hml5))  
logrmw5    <- sign(rmw5) * log(abs(rmw5))  
logcma5    <- sign(cma5) * log(abs(cma5))
```

#Log returns for carhart 4

```
logsmb3    <- sign(smb3) * log(abs(smb3))  
loghml3    <- sign(hml3) * log(abs(hml3))  
logmom     <- sign(mom) * log(abs(mom))
```

#Regressions on FF market factor

```
mktc_SR    <- lm(logSR ~ logrmrf + logsmb3 + loghml3 + logmom)  
mktc_NSR   <- lm(logNSR ~ logrmrf + logsmb3 + loghml3 + logmom)  
mktc_Diff  <- lm(logDiff ~ logrmrf + logsmb3 + loghml3 + logmom)  
mktff_SR   <- lm(logSR ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5)  
mktff_NSR  <- lm(logNSR ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5)  
mktff_Diff <- lm(logDiff ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5)
```

#Regressions on Carhart 5

```
mktc5_SR   <- lm(logSR ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5 + logmom)  
mktc5_NSR  <- lm(logNSR ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5 + logmom)  
mktc5_Diff <- lm(logDiff ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5 + logmom)  
  
SOLc5_SR   <- lm(logSR ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5 + logmom)  
SOLc5_NSR  <- lm(logNSR ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5 + logmom)  
SOLc5_Diff <- lm(logDiff ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5 + logmom)
```

#Regressions on alternative market benchmark

```
SOLc_SR    <- lm(logSR ~ logSOL + logsmb3 + loghml3 + logmom)  
SOLc_NSR   <- lm(logNSR ~ logSOL + logsmb3 + loghml3 + logmom)  
SOLc_Diff  <- lm(logDiff ~ logSOL + logsmb3 + loghml3 + logmom)  
SOLff_SR   <- lm(logSR ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5)  
SOLff_NSR  <- lm(logNSR ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5)  
SOLff_Diff <- lm(logDiff ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5)
```

#Show regression results - the Shipping index

```
print(summary(SOLc_SR))
```

```
##
## Call:
## lm(formula = logSR ~ logSOL + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -2.93407 -0.73697 -0.05685  0.79379  2.58740
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.091204  0.150208  0.607  0.546
## logSOL       0.721605  0.094330  7.650 9.47e-11 ***
## logsmb3     -0.012462  0.145546  0.086  0.932
## loghml3     -0.004571  0.149630  0.031  0.976
## logmom      -0.108584  0.130440 -0.832  0.408
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.248 on 68 degrees of freedom
## Multiple R-squared:  0.5206, Adjusted R-squared:  0.4924
## F-statistic: 18.46 on 4 and 68 DF, p-value: 2.612e-10
```

```
print(summary(SOLc_NSR))
```

```
##
## Call:
## lm(formula = logNSR ~ logSOL + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -2.6063 -1.1225 -0.1036  1.0004  3.6308
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.45227  0.18525 -2.441  0.0172 *
## logSOL       0.61889  0.11634  5.320 1.25e-06 ***
## logsmb3     -0.08714  0.17950 -0.485  0.6289
## loghml3     -0.22201  0.18454 -1.203  0.2331
## logmom      -0.21356  0.16087 -1.328  0.1888
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.539 on 68 degrees of freedom
## Multiple R-squared:  0.4063, Adjusted R-squared:  0.3714
## F-statistic: 11.63 on 4 and 68 DF, p-value: 2.967e-07
```

```
print(summary(SOLc_Diff))
```

```
##
## Call:
## lm(formula = logDiff ~ logSOL + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
```

```

## -3.6144 -1.6280 0.3928 1.1857 2.4501
##
## Coefficients:
##      Estimate Std. Error t value Pr(>|t|)
## (Intercept) 0.41718  0.19432  2.147 0.0354 *
## logSOL      0.07399  0.12203  0.606 0.5463
## logsmb3     0.14025  0.18829  0.745 0.4589
## loghml3     -0.34397  0.19357 -1.777 0.0800 .
## logmom      0.04443  0.16874  0.263 0.7931
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.614 on 68 degrees of freedom
## Multiple R-squared:  0.0691, Adjusted R-squared:  0.01434
## F-statistic: 1.262 on 4 and 68 DF,  p-value: 0.2935

print(summary(SOLff_SR))

##
## Call:
## lm(formula = logSR ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -3.06008 -0.73488 -0.07613  0.74495  2.97230
##
## Coefficients:
##      Estimate Std. Error t value Pr(>|t|)
## (Intercept) 0.12005  0.14694  0.817  0.417
## logSOL      0.72540  0.09250  7.842 4.63e-11 ***
## logsmb5     0.20239  0.13247  1.528  0.131
## loghml5     0.01108  0.15589  0.071  0.944
## logrmw5     -0.10470  0.12607 -0.830  0.409
## logcma5     0.05117  0.15013  0.341  0.734
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.236 on 67 degrees of freedom
## Multiple R-squared:  0.5368, Adjusted R-squared:  0.5022
## F-statistic: 15.53 on 5 and 67 DF,  p-value: 4.012e-10

print(summary(SOLff_NSR))

##
## Call:
## lm(formula = logNSR ~ logSOL + logsmb5 + loghml5 + logrmw5 +
##     logcma5)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.6390 -1.0684 -0.1863  0.8437  3.6358
##
## Coefficients:
##      Estimate Std. Error t value Pr(>|t|)

```

```

## (Intercept) -0.3853  0.1807 -2.133  0.0366 *
## logSOL      0.5915  0.1137  5.201 2.04e-06 ***
## logsmb5    0.2117  0.1629  1.300  0.1981
## loghml5    0.3369  0.1917  1.758  0.0834 .
## logrmw5    -0.2441  0.1550 -1.575  0.1200
## logcma5    -0.1163  0.1846 -0.630  0.5308
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.519 on 67 degrees of freedom
## Multiple R-squared:  0.4299, Adjusted R-squared:  0.3873
## F-statistic: 10.1 on 5 and 67 DF, p-value: 3.073e-07

print(summary(SOLff_Diff))

##
## Call:
## lm(formula = logDiff ~ logSOL + logsmb5 + loghml5 + logrmw5 +
##     logcma5)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.466 -1.427  0.255  1.151  2.856
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.38857   0.18817   2.065  0.0428 *
## logSOL       0.08583   0.11845   0.725  0.4712
## logsmb5     -0.17493   0.16964  -1.031  0.3062
## loghml5     -0.26056   0.19964  -1.305  0.1963
## logrmw5      0.27131   0.16145   1.680  0.0975 .
## logcma5     -0.16876   0.19225  -0.878  0.3832
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.582 on 67 degrees of freedom
## Multiple R-squared:  0.1186, Adjusted R-squared:  0.05285
## F-statistic: 1.803 on 5 and 67 DF, p-value: 0.1241

#Show regressions results - FF market factor
print(summary(mktc_SR))

##
## Call:
## lm(formula = logSR ~ logrmrf + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -2.9596 -1.1358  0.2018  1.1961  2.8664
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.1144   0.1887   0.606  0.546454
## logrmrf      0.5587   0.1495   3.738  0.000383 ***

```

```

## logsmb3    0.1609    0.1783    0.902 0.370061
## loghml3    0.2408    0.1814    1.327 0.188932
## logmom     -0.1777    0.1619   -1.098 0.276257
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.55 on 68 degrees of freedom
## Multiple R-squared:  0.26, Adjusted R-squared:  0.2164
## F-statistic: 5.972 on 4 and 68 DF, p-value: 0.0003526

print(summary(mktc_NSR))

##
## Call:
## lm(formula = logNSR ~ logrmrf + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -2.7722 -1.3793 -0.3851  1.6255  3.2839
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.41829   0.21319  -1.962  0.0539 .
## logrmrf      0.42573   0.16889   2.521  0.0141 *
## logsmb3      0.05018   0.20143   0.249  0.8040
## loghml3      0.42592   0.20499   2.078  0.0415 *
## logmom      -0.28228   0.18292  -1.543  0.1274
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.751 on 68 degrees of freedom
## Multiple R-squared:  0.231, Adjusted R-squared:  0.1858
## F-statistic: 5.108 on 4 and 68 DF, p-value: 0.001169

print(summary(mktc_Diff))

##
## Call:
## lm(formula = logDiff ~ logrmrf + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.5566 -1.5495  0.3414  1.2916  2.4187
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.38711   0.19509   1.984  0.0513 .
## logrmrf      0.18033   0.15454   1.167  0.2473
## logsmb3      0.13241   0.18433   0.718  0.4750
## loghml3     -0.32278   0.18758  -1.721  0.0898 .
## logmom       0.05903   0.16738   0.353  0.7254
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##

```

```

## Residual standard error: 1.602 on 68 degrees of freedom
## Multiple R-squared: 0.08244, Adjusted R-squared: 0.02847
## F-statistic: 1.527 on 4 and 68 DF, p-value: 0.204

print(summary(mktff_SR))

##
## Call:
## lm(formula = logSR ~ logrmrf + logsmb5 + loghml5 + logrmw5 +
##   logcma5)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.3072 -1.0862  0.2211  1.1165  2.8270
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.1348   0.1837   0.734  0.4656
## logrmrf      0.5994   0.1442  4.158 9.34e-05 ***
## logsmb5      0.2216   0.1636  1.354  0.1802
## loghml5      0.3509   0.1823  1.925  0.0584 .
## logrmw5     -0.1926   0.1559 -1.235  0.2210
## logcma5     -0.1938   0.1811 -1.071  0.2882
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.526 on 67 degrees of freedom
## Multiple R-squared: 0.2937, Adjusted R-squared: 0.241
## F-statistic: 5.573 on 5 and 67 DF, p-value: 0.0002369

print(summary(mktff_NSR))

##
## Call:
## lm(formula = logNSR ~ logrmrf + logsmb5 + loghml5 + logrmw5 +
##   logcma5)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -2.5335 -1.3939 -0.3141  1.3078  3.1664
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.3687   0.2038 -1.809  0.07499 .
## logrmrf      0.4726   0.1600  2.954  0.00433 **
## logsmb5      0.2286   0.1816  1.259  0.21240
## loghml5      0.6158   0.2023  3.045  0.00333 **
## logrmw5     -0.3146   0.1730 -1.819  0.07344 .
## logcma5     -0.3163   0.2009 -1.574  0.12016
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.693 on 67 degrees of freedom

```



```

## Multiple R-squared: 0.2919, Adjusted R-squared: 0.239
## F-statistic: 5.523 on 5 and 67 DF, p-value: 0.0002565

print(summary(mktff_Diff))

##
## Call:
## lm(formula = logDiff ~ logrmrf + logsmb5 + loghml5 + logrmw5 +
##   logcma5)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.4357 -1.2979  0.3876  1.0784  2.7763
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.3593   0.1892   1.899  0.0618 .
## logrmrf      0.1807   0.1485   1.217  0.2280
## logsmb5     -0.1811   0.1685  -1.075  0.2863
## loghml5     -0.2325   0.1877  -1.239  0.2198
## logrmw5      0.2528   0.1605   1.575  0.1201
## logcma5     -0.1964   0.1865  -1.053  0.2960
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.571 on 67 degrees of freedom
## Multiple R-squared:  0.1309, Adjusted R-squared:  0.06606
## F-statistic: 2.019 on 5 and 67 DF, p-value: 0.08715

```

#Show regressions results - FF market factor

```

print(summary(mkctc5_SR))

##
## Call:
## lm(formula = logSR ~ logrmrf + logsmb5 + loghml5 + logrmw5 +
##   logcma5 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.4384 -0.9155  0.1629  0.9982  2.7388
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.1140   0.1846   0.618  0.53884
## logrmrf      0.5722   0.1463   3.911  0.00022 ***
## logsmb5      0.2438   0.1648   1.479  0.14380
## loghml5      0.2762   0.1953   1.414  0.16192
## logrmw5     -0.1713   0.1570  -1.091  0.27927
## logcma5     -0.1826   0.1812  -1.008  0.31731
## logmom      -0.1711   0.1617  -1.058  0.29394
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.524 on 66 degrees of freedom

```

```

## Multiple R-squared: 0.3055, Adjusted R-squared: 0.2424
## F-statistic: 4.839 on 6 and 66 DF, p-value: 0.0003778

print(summary(mkctc5_NSR))

##
## Call:
## lm(formula = logNSR ~ logrmrf + logsmb5 + loghml5 + logrmw5 +
##   logcma5 + logmom)
##
## Residuals:
##   Min    1Q  Median    3Q   Max
## -2.5997 -1.2488 -0.4431  1.2523  3.4299
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.4007    0.2032  -1.972  0.05276 .
## logrmrf      0.4306    0.1611   2.673  0.00945 **
## logsmb5      0.2630    0.1815   1.449  0.15195
## loghml5      0.5004    0.2150   2.328  0.02300 *
## logrmw5     -0.2818    0.1729  -1.630  0.10790
## logcma5     -0.2989    0.1995  -1.498  0.13879
## logmom      -0.2644    0.1781  -1.485  0.14240
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.678 on 66 degrees of freedom
## Multiple R-squared: 0.3148, Adjusted R-squared: 0.2525
## F-statistic: 5.053 on 6 and 66 DF, p-value: 0.0002562

print(summary(mkctc5_Diff))

##
## Call:
## lm(formula = logDiff ~ logrmrf + logsmb5 + loghml5 + logrmw5 +
##   logcma5 + logmom)
##
## Residuals:
##   Min    1Q  Median    3Q   Max
## -3.4131 -1.3259  0.3842  1.0867  2.7117
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.36674    0.19148   1.915  0.0598 .
## logrmrf      0.19044    0.15181   1.254  0.2141
## logsmb5     -0.18913    0.17101  -1.106  0.2728
## loghml5     -0.20569    0.20261  -1.015  0.3137
## logrmw5      0.24515    0.16293   1.505  0.1372
## logcma5     -0.20045    0.18802  -1.066  0.2902
## logmom       0.06148    0.16782   0.366  0.7153
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.581 on 66 degrees of freedom

```

```

## Multiple R-squared: 0.1327, Adjusted R-squared: 0.05384
## F-statistic: 1.683 on 6 and 66 DF, p-value: 0.1391

print(summary(SOLc5_SR))

##
## Call:
## lm(formula = logSR ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5 +
##   logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.1737 -0.7029 -0.0849  0.8067  2.7105
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.10297   0.14814   0.695  0.489
## logSOL       0.71123   0.09376   7.586 1.46e-10 ***
## logsmb5     0.21833   0.13362   1.634  0.107
## loghml5    -0.03741   0.16414  -0.228  0.820
## logrmw5    -0.09157   0.12692  -0.721  0.473
## logcma5     0.05465   0.15028   0.364  0.717
## logmom     -0.12433   0.13084  -0.950  0.345
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.236 on 66 degrees of freedom
## Multiple R-squared:  0.543, Adjusted R-squared:  0.5015
## F-statistic: 13.07 on 6 and 66 DF, p-value: 1.103e-09

print(summary(SOLc5_NSR))

##
## Call:
## lm(formula = logNSR ~ logSOL + logsmb5 + loghml5 + logrmw5 +
##   logcma5 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -2.6440 -1.0774 -0.1140  0.8738  3.5363
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.4158   0.1807  -2.301  0.0246 *
## logSOL       0.5662   0.1144   4.950 5.42e-06 ***
## logsmb5     0.2402   0.1630   1.473  0.1454
## loghml5     0.2502   0.2003   1.249  0.2160
## logrmw5    -0.2207   0.1549  -1.425  0.1589
## logcma5    -0.1101   0.1834  -0.600  0.5503
## logmom     -0.2223   0.1596  -1.392  0.1685
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.509 on 66 degrees of freedom

```

```

## Multiple R-squared: 0.4461, Adjusted R-squared: 0.3958
## F-statistic: 8.861 on 6 and 66 DF, p-value: 4.337e-07

print(summary(SOLc5_Diff))

##
## Call:
## lm(formula = logDiff ~ logSOL + logsmb5 + loghml5 + logrmw5 +
##   logcma5 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.4526 -1.4621  0.2741  1.1744  2.8081
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.39471   0.19089   2.068  0.0426 *
## logSOL       0.09093   0.12082   0.753  0.4544
## logsmb5     -0.18066   0.17219  -1.049  0.2979
## loghml5     -0.24312   0.21152  -1.149  0.2545
## logrmw5      0.26658   0.16355   1.630  0.1079
## logcma5     -0.17001   0.19366  -0.878  0.3832
## logmom       0.04471   0.16860   0.265  0.7917
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.593 on 66 degrees of freedom
## Multiple R-squared:  0.1196, Adjusted R-squared:  0.03952
## F-statistic: 1.494 on 6 and 66 DF, p-value: 0.194

```

Hypothesis B2: Listed shipping companies that publish sustainability reports outperform non-green peers

#Load SR and non-SR portfolios

```
Sector <- read.table("Sector.csv",header=TRUE,sep=",")
```

#Load factors for factor models

```
FamaFrench5 <- read.table("ff5.csv",header=TRUE,sep=",")
FamaFrench3 <- read.table("ff3.csv",header=TRUE,sep=",")
Mom <- read.table("mom.csv",header=TRUE,sep=",")
```

#Load alternative market benchmark

```
SI <- read.table("SI_16.csv",header=TRUE,sep=",")
```

#Retrieve Fama French 5 factors

```
rmrf <- FamaFrench5[,2] #market premium is the same for all factor models
smb5 <- FamaFrench5[,3]
hml5 <- FamaFrench5[,4]
rmw5 <- FamaFrench5[,5]
cma5 <- FamaFrench5[,6]
```

#Retrieve Carhart 4 factors

```
smb3 <- FamaFrench3[,3]
hml3 <- FamaFrench3[,4]
```

```

mom                <- Mom[,2]

#Risk-free rate
rf                <- FamaFrench3[,5]

#Retrieve the portfolios
SR_T              <- Sector[,8]
SR_DB             <- Sector[,9]
NSR_T             <- Sector[,10]
NSR_DB            <- Sector[,11]
Diff_T            <- Sector[,12]
Diff_DB           <- Sector[,13]

#Alternative market benchmark: Solactive Global Shipping index
SOLindex          <- SI[,3]

#Excess returns for the portfolios
SR_T.excess       <- SR_T - rf
SR_DB.excess      <- SR_DB - rf
NSR_T.excess      <- NSR_T - rf
NSR_DB.excess     <- NSR_DB - rf
Diff_T.excess     <- Diff_T - rf
Diff_DB.excess    <- Diff_DB - rf

SOLindex.excess  <- SOLindex - rf

meanRMRF          <- mean(rmrf)
meanSOL           <- mean(SOLindex.excess)

maxRMRF           <- max(rmrf)
maxSOL            <- max(SOLindex.excess)

minRMRF           <- min(rmrf)
minSOL            <- min(SOLindex.excess)

stdRMRF           <- sd(rmrf)
stdSOL            <- sd(SOLindex.excess)

srRMRF            <- meanRMRF/stdRMRF
srSOL             <- meanSOL/stdSOL

#Descriptive statistics
MeanSR_T          <- mean(SR_T.excess)
MeanNSR_T         <- mean(NSR_T.excess)
MeanDiff_T        <- mean(Diff_T.excess)

MaxSR_T           <- max(SR_T.excess)
MaxNSR_T          <- max(NSR_T.excess)
MaxDiff_T         <- max(Diff_T.excess)

MinSR_T           <- min(SR_T.excess)

```

```

MinNSR_T      <- min(NSR_T.excess)
Min_T         <- min(Diff_T.excess)

StdSR_T       <- sd(SR_T.excess)
StdNSR_T      <- sd(NSR_T.excess)
StdDiff_T     <- sd(Diff_T.excess)

SR_SR_T       <- MeanSR_T/StdSR_T
SR_NSR_T      <- MeanNSR_T/StdNSR_T
SR_Diff_T     <- MeanDiff_T/StdDiff_T

MeanSR_DB     <- mean(SR_DB.excess)
MeanNSR_DB    <- mean(NSR_DB.excess)
MeanDiff_DB   <- mean(Diff_DB.excess)

MaxSR_DB      <- max(SR_DB.excess)
MaxNSR_DB     <- max(NSR_DB.excess)
MaxDiff_DB    <- max(Diff_DB.excess)

MinSR_DB      <- min(SR_DB.excess)
MinNSR_DB     <- min(NSR_DB.excess)
MinDiff_DB    <- min(Diff_DB.excess)

StdSR_DB      <- sd(SR_DB.excess)
StdNSR_DB     <- sd(NSR_DB.excess)
StdDiff_DB    <- sd(Diff_DB.excess)

SR_SR_DB      <- MeanSR_DB/StdSR_DB
SR_NSR_DB     <- MeanNSR_DB/StdNSR_DB
SR_Diff_DB    <- MeanDiff_DB/StdDiff_DB

#Log Returns
logSR_T       <- sign(SR_T.excess) * log(abs(SR_T.excess))
logNSR_T      <- sign(NSR_T.excess) * log(abs(NSR_T.excess))
logDiff_T     <- sign(Diff_T.excess) * log(abs(Diff_T.excess))

logSR_DB      <- sign(SR_DB.excess) * log(abs(SR_DB.excess))
logNSR_DB     <- sign(NSR_DB.excess) * log(abs(NSR_DB.excess))
logDiff_DB    <- sign(Diff_DB.excess) * log(abs(Diff_DB.excess))

logSOL        <- sign(SOLindex.excess) * log(abs(SOLindex.excess))
logrmrf       <- sign(rmrf) * log(abs(rmrf))

#Log returns for fama french 5
logsm5        <- sign(smb5) * log(abs(smb5))
loghml5       <- sign(hml5) * log(abs(hml5))
logrmw5       <- sign(rmw5) * log(abs(rmw5))
logcma5       <- sign(cma5) * log(abs(cma5))

```

#Log returns for carhart 4

```
logsmb3      <- sign(smb3) * log(abs(smb3))
loghml3      <- sign(hml3) * log(abs(hml3))
logmom       <- sign(mom) * log(abs(mom))
```

#Regressions on FF market factor

```
mktc_SRT     <- lm(logSR_T ~ logrmrf + logsmb3 + loghml3 + logmom)
mktc_NSRT    <- lm(logNSR_T ~ logrmrf + logsmb3 + loghml3 + logmom)
mktc_DiffT   <- lm(logDiff_T ~ logrmrf + logsmb3 + loghml3 + logmom)
mktff_SRT    <- lm(logSR_T ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5)
mktff_NSRT   <- lm(logNSR_T ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5)
mktff_DiffT  <- lm(logDiff_T ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5)
```

```
mktc_SRDB    <- lm(logSR_DB ~ logrmrf + logsmb3 + loghml3 + logmom)
mktc_NSRDB   <- lm(logNSR_DB ~ logrmrf + logsmb3 + loghml3 + logmom)
mktc_DiffDB  <- lm(logDiff_DB ~ logrmrf + logsmb3 + loghml3 + logmom)
mktff_SRDB   <- lm(logSR_DB ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5)
mktff_NSRDB  <- lm(logNSR_DB ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5)
mktff_DiffDB <- lm(logDiff_DB ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5)
```

#Regressions on alternative market benchmark

```
SOLc_SRT     <- lm(logSR_T ~ logSOL + logsmb3 + loghml3 + logmom)
SOLc_NSRT    <- lm(logNSR_T ~ logSOL + logsmb3 + loghml3 + logmom)
SOLc_DiffT   <- lm(logDiff_T ~ logSOL + logsmb3 + loghml3 + logmom)
SOLff_SRT    <- lm(logSR_T ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5)
SOLff_NSRT   <- lm(logNSR_T ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5)
SOLff_DiffT  <- lm(logDiff_T ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5)
```

```
SOLc_SRDB    <- lm(logSR_DB ~ logSOL + logsmb3 + loghml3 + logmom)
SOLc_NSRDB   <- lm(logNSR_DB ~ logSOL + logsmb3 + loghml3 + logmom)
SOLc_DiffDB  <- lm(logDiff_DB ~ logSOL + logsmb3 + loghml3 + logmom)
SOLff_SRDB   <- lm(logSR_DB ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5)
SOLff_NSRDB  <- lm(logNSR_DB ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5)
SOLff_DiffDB <- lm(logDiff_DB ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5)
```

#Regressions on Carhart 5

```
mktc5_SRDB   <- lm(logSR_DB ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5)
mktc5_NSRDB  <- lm(logNSR_DB ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5)
mktc5_DiffDB <- lm(logDiff_DB ~ logrmrf + logsmb5 + loghml5 + logrmw5 + logcma5)
```

```
SOLc5_SRDB   <- lm(logSR_DB ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5)
SOLc5_NSRDB  <- lm(logNSR_DB ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5)
SOLc5_DiffDB <- lm(logDiff_DB ~ logSOL + logsmb5 + loghml5 + logrmw5 + logcma5)
```

#Show regressions results - FF market factor

```
print(summary(mktc_SRT))
## lm(formula = logSR_T ~ logrmrf + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q    Max
## -3.13997 -1.32315  0.01099  1.26468  3.14422
##
```

```

## Coefficients:
##      Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.01933  0.18883 -0.102  0.9188
## logrmrf     0.28452  0.14958  1.902  0.0614 .
## logsmb3     0.07445  0.17841  0.417  0.6778
## loghml3     0.20991  0.18156  1.156  0.2517
## logmom     -0.22164  0.16201 -1.368  0.1758
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.551 on 68 degrees of freedom
## Multiple R-squared:  0.1385, Adjusted R-squared:  0.08784
## F-statistic: 2.733 on 4 and 68 DF,  p-value: 0.03589

print(summary(mktc_NSRT))

##
## Call:
## lm(formula = logNSR_T ~ logrmrf + logsmb3 + loghml3 + logmom)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.5839 -1.4517 -0.5278  1.7578  4.0063
##
## Coefficients:
##      Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.6058   0.2236  -2.710  0.00852 **
## logrmrf     0.2830   0.1771   1.598  0.11466
## logsmb3    -0.0197   0.2112  -0.093  0.92597
## loghml3     0.4711   0.2150   2.192  0.03183 *
## logmom    -0.1707   0.1918  -0.890  0.37660
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.836 on 68 degrees of freedom
## Multiple R-squared:  0.1543, Adjusted R-squared:  0.1045
## F-statistic: 3.101 on 4 and 68 DF,  p-value: 0.02096

print(summary(mktc_DiffT))

##
## Call:
## lm(formula = logDiff_T ~ logrmrf + logsmb3 + loghml3 + logmom)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -3.4290 -1.0198  0.5932  1.1518  2.0157
##
## Coefficients:
##      Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.698730  0.195144  3.581 0.000638 ***
## logrmrf    -0.003089  0.154586 -0.020 0.984118
## logsmb3     0.215952  0.184379  1.171 0.245589
## loghml3    -0.382501  0.187630 -2.039 0.045382 *

```



```

## logmom   -0.038358  0.167430 -0.229 0.819480
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.603 on 68 degrees of freedom
## Multiple R-squared:  0.08398, Adjusted R-squared:  0.0301
## F-statistic: 1.559 on 4 and 68 DF, p-value: 0.1953

print(summary(mktff_SRT))

##
## Call:
## lm(formula = logSR_T ~ logrmrf + logsmb5 + loghml5 + logrmw5 +
##   logcma5)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -2.97381 -1.37174 -0.04121  1.27099  3.10695
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.002701  0.187630  -0.014  0.9886
## logrmrf      0.336148  0.147279   2.282  0.0256 *
## logsmb5      0.040008  0.167143   0.239  0.8116
## loghml5      0.291051  0.186177   1.563  0.1227
## logrmw5     -0.227393  0.159237  -1.428  0.1579
## logcma5     -0.077381  0.184966  -0.418  0.6770
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.558 on 67 degrees of freedom
## Multiple R-squared:  0.1431, Adjusted R-squared:  0.07915
## F-statistic: 2.238 on 5 and 67 DF, p-value: 0.06052

print(summary(mktff_NSRT))

##
## Call:
## lm(formula = logNSR_T ~ logrmrf + logsmb5 + loghml5 + logrmw5 +
##   logcma5)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -2.6783 -1.4427 -0.4391  1.1545  4.2625
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.577414  0.212622  -2.716  0.00841 **
## logrmrf      0.319319  0.166896   1.913  0.05999 .
## logsmb5      0.213980  0.189406   1.130  0.26261
## loghml5      0.466236  0.210975   2.210  0.03053 *
## logrmw5     -0.441989  0.180447  -2.449  0.01693 *
## logcma5      0.001338  0.209603   0.006  0.99493
## ---

```

```

## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.766 on 67 degrees of freedom
## Multiple R-squared:  0.2293, Adjusted R-squared:  0.1718
## F-statistic: 3.987 on 5 and 67 DF,  p-value: 0.003165

print(summary(mktff_DiffT))

##
## Call:
## lm(formula = logDiff_T ~ logrmrf + logsmb5 + loghml5 + logrmw5 +
##   logcma5)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.4488 -0.8390  0.4524  1.1303  2.5804
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.66167   0.18823   3.515 0.000793 ***
## logrmrf      0.02977   0.14775   0.202 0.840905
## logsmb5     -0.29243   0.16768  -1.744 0.085747 .
## loghml5     -0.25042   0.18677  -1.341 0.184518
## logrmw5      0.22962   0.15975   1.437 0.155252
## logcma5     -0.22016   0.18556  -1.186 0.239636
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.563 on 67 degrees of freedom
## Multiple R-squared:  0.1414, Adjusted R-squared:  0.07733
## F-statistic: 2.207 on 5 and 67 DF,  p-value: 0.06373

print(summary(mktc_SRDB))

##
## Call:
## lm(formula = logSR_DB ~ logrmrf + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.6345 -1.5370  0.0425  1.2810  3.7891
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.11687   0.22140   0.528 0.59932
## logrmrf      0.67800   0.17539   3.866 0.00025 ***
## logsmb3      0.10421   0.20919   0.498 0.61999
## loghml3      0.29612   0.21288   1.391 0.16875
## logmom       0.08997   0.18996   0.474 0.63727
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.819 on 68 degrees of freedom

```

```

## Multiple R-squared: 0.2165, Adjusted R-squared: 0.1704
## F-statistic: 4.697 on 4 and 68 DF, p-value: 0.002089

print(summary(mktc_NSRDB))

##
## Call:
## lm(formula = logNSR_DB ~ logrmrf + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.1083 -1.6885 -0.4546  1.8238  3.6557
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.23599   0.24096  -0.979  0.3309
## logrmrf      0.39694   0.19088   2.079  0.0413 *
## logsmb3      0.04771   0.22767   0.210  0.8347
## loghml3      0.33924   0.23169   1.464  0.1477
## logmom      -0.27121   0.20674  -1.312  0.1940
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.979 on 68 degrees of freedom
## Multiple R-squared:  0.1583, Adjusted R-squared:  0.1087
## F-statistic: 3.196 on 4 and 68 DF, p-value: 0.01824

print(summary(mktc_DiffDB))

##
## Call:
## lm(formula = logDiff_DB ~ logrmrf + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.9920 -1.8678  0.3357  1.4993  3.1372
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.46836   0.23176   2.021  0.0472 *
## logrmrf      0.18912   0.18359   1.030  0.3066
## logsmb3      0.05152   0.21897   0.235  0.8147
## loghml3     -0.11603   0.22283  -0.521  0.6043
## logmom       0.30433   0.19884   1.531  0.1305
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.904 on 68 degrees of freedom
## Multiple R-squared:  0.06198, Adjusted R-squared:  0.006805
## F-statistic: 1.123 on 4 and 68 DF, p-value: 0.3528

print(summary(mktff_SRDB))

```

```
##
## Call:
## lm(formula = logSR_DB ~ logrmrf + logsmb5 + loghml5 + logrmw5 +
##   logcma5)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -4.2802 -1.1999  0.1509  1.1772  3.4414
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.1187    0.2151   0.552 0.583008
## logrmrf      0.6631    0.1688   3.927 0.000205 ***
## logsmb5      0.2927    0.1916   1.527 0.131348
## loghml5      0.3054    0.2134   1.431 0.157140
## logrmw5     -0.1019    0.1826  -0.558 0.578450
## logcma5     -0.1807    0.2120  -0.852 0.397135
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.787 on 67 degrees of freedom
## Multiple R-squared:  0.2549, Adjusted R-squared:  0.1993
## F-statistic: 4.585 on 5 and 67 DF, p-value: 0.001174
```

```
print(summary(mktff_NSRDB))
```

```
##
## Call:
## lm(formula = logNSR_DB ~ logrmrf + logsmb5 + loghml5 + logrmw5 +
##   logcma5)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -2.7737 -1.5945 -0.1922  1.6878  3.2574
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.1942    0.2321  -0.836  0.4059
## logrmrf      0.4475    0.1822   2.456  0.0166 *
## logsmb5      0.1672    0.2068   0.809  0.4216
## loghml5      0.5255    0.2303   2.282  0.0257 *
## logrmw5     -0.3478    0.1970  -1.766  0.0820 .
## logcma5     -0.3341    0.2288  -1.460  0.1489
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.928 on 67 degrees of freedom
## Multiple R-squared:  0.2131, Adjusted R-squared:  0.1544
## F-statistic: 3.63 on 5 and 67 DF, p-value: 0.005766
```

```
print(summary(mktff_DiffDB))
```

```
##
## Call:
```

```

## lm(formula = logDiff_DB ~ logrmrf + logsmb5 + loghml5 + logrmw5 +
##   logcma5)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.9559 -1.4675  0.4453  1.4009  2.9168
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.4198   0.2320   1.809  0.0749 .
## logrmrf      0.1436   0.1821   0.788  0.4332
## logsmb5     -0.1170   0.2067  -0.566  0.5731
## loghml5     -0.1811   0.2302  -0.787  0.4342
## logrmw5      0.2289   0.1969   1.163  0.2491
## logcma5     -0.0714   0.2287  -0.312  0.7559
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.927 on 67 degrees of freedom
## Multiple R-squared:  0.05289, Adjusted R-squared: -0.01779
## F-statistic: 0.7483 on 5 and 67 DF, p-value: 0.5902

```

#Show regression results - the Shipping index
print(summary(SOLc_SRT))

```

##
## Call:
## lm(formula = logSR_T ~ logSOL + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.5104 -0.9094 -0.1145  0.9800  3.0696
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.06046   0.16647  -0.363   0.718
## logSOL       0.49158   0.10454   4.702 1.3e-05 ***
## logsmb3     -0.04467   0.16130  -0.277   0.783
## loghml3      0.04662   0.16583   0.281   0.779
## logmom      -0.15761   0.14456  -1.090   0.279
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.383 on 68 degrees of freedom
## Multiple R-squared:  0.3153, Adjusted R-squared:  0.275
## F-statistic: 7.829 on 4 and 68 DF, p-value: 2.989e-05

```

print(summary(SOLc_NSRT))

```

##
## Call:
## lm(formula = logNSR_T ~ logSOL + logsmb3 + loghml3 + logmom)
##
## Residuals:

```

```

##   Min   1Q  Median   3Q   Max
## -2.6661 -1.3180 -0.4822  1.1893  3.9230
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.6448   0.2051  -3.144 0.002473 **
## logSOL       0.4812   0.1288   3.736 0.000386 ***
## logsmb3     -0.1355   0.1988  -0.682 0.497851
## loghml3      0.3114   0.2043   1.524 0.132160
## logmom      -0.1088   0.1781  -0.611 0.543285
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.704 on 68 degrees of freedom
## Multiple R-squared:  0.2719, Adjusted R-squared:  0.2291
## F-statistic: 6.349 on 4 and 68 DF,  p-value: 0.0002111

print(summary(SOLc_DiffT))

##
## Call:
## lm(formula = logDiff_T ~ logSOL + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min     1Q  Median     3Q    Max
## -3.3306 -0.9714  0.5435  1.1307  2.0250
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.7229   0.1919   3.767 0.000347 ***
## logSOL      -0.1058   0.1205  -0.878 0.382839
## logsmb3     0.2525   0.1859   1.358 0.178949
## loghml3     -0.3459   0.1911  -1.810 0.074774 .
## logmom     -0.0624   0.1666  -0.374 0.709208
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.594 on 68 degrees of freedom
## Multiple R-squared:  0.09425,  Adjusted R-squared:  0.04097
## F-statistic: 1.769 on 4 and 68 DF,  p-value: 0.1452

print(summary(SOLff_SRT))

##
## Call:
## lm(formula = logSR_T ~ logSOL + logsmb5 + loghml5 + logrmw5 +
##   logcma5)
##
## Residuals:
##   Min     1Q  Median     3Q    Max
## -3.5654 -0.9449 -0.2119  1.0065  2.9326
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)

```

```

## (Intercept) -0.03709  0.16504 -0.225  0.823
## logSOL      0.50961  0.10390  4.905 6.26e-06 ***
## logsmb5    0.01998  0.14879  0.134  0.894
## loghml5    0.04292  0.17510  0.245  0.807
## logrmw5    -0.17195  0.14161 -1.214  0.229
## logcma5    0.09579  0.16862  0.568  0.572
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.388 on 67 degrees of freedom
## Multiple R-squared:  0.3205, Adjusted R-squared:  0.2698
## F-statistic:  6.32 on 5 and 67 DF, p-value: 7.32e-05

print(summary(SOLff_NSRT))

##
## Call:
## lm(formula = logNSR_T ~ logSOL + logsmb5 + loghml5 + logrmw5 +
##     logcma5)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -2.5102 -1.3074 -0.2315  1.1925  4.0791
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.6067    0.1954  -3.106 0.002783 **
## logSOL       0.4709    0.1230   3.829 0.000286 ***
## logsmb5     0.1961    0.1761   1.114 0.269409
## loghml5     0.2379    0.2073   1.148 0.255105
## logrmw5    -0.3901    0.1676  -2.327 0.022978 *
## logcma5     0.1612    0.1996   0.808 0.422053
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.643 on 67 degrees of freedom
## Multiple R-squared:  0.3331, Adjusted R-squared:  0.2834
## F-statistic:  6.694 on 5 and 67 DF, p-value: 4.112e-05

print(summary(SOLff_DiffT))

##
## Call:
## lm(formula = logDiff_T ~ logSOL + logsmb5 + loghml5 + logrmw5 +
##     logcma5)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.3022 -0.9571  0.4505  1.1579  2.4682
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.68807    0.18548   3.710 0.000424 ***
## logSOL      -0.07077    0.11676  -0.606 0.546477

```

```

## logsmb5  -0.28375  0.16722  -1.697 0.094356 .
## loghml5  -0.20750  0.19678  -1.054 0.295466
## logrmw5   0.22758  0.15914  1.430 0.157341
## logcma5  -0.24514  0.18950  -1.294 0.200251
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.56 on 67 degrees of freedom
## Multiple R-squared:  0.1456, Adjusted R-squared:  0.0818
## F-statistic: 2.283 on 5 and 67 DF,  p-value: 0.05611

print(summary(SOLc_SRDB))

##
## Call:
## lm(formula = logSR_DB ~ logSOL + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.1960 -1.0311 -0.0918  1.0505  3.7067
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.09961   0.18112   0.550  0.584
## logSOL       0.82963   0.11374  7.294 4.18e-10 ***
## logsmb3     -0.05977   0.17550  -0.341  0.734
## loghml3      0.02542   0.18042   0.141  0.888
## logmom       0.16317   0.15728   1.037  0.303
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.504 on 68 degrees of freedom
## Multiple R-squared:  0.4638, Adjusted R-squared:  0.4323
## F-statistic: 14.7 on 4 and 68 DF,  p-value: 1.051e-08

print(summary(SOLc_NSRDB))

##
## Call:
## lm(formula = logNSR_DB ~ logSOL + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.3872 -1.3424 -0.0569  1.3395  3.3269
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.27929   0.21394  -1.306  0.196
## logSOL       0.62620   0.13435  4.661 1.52e-05 ***
## logsmb3     -0.09757   0.20730  -0.471  0.639
## loghml3      0.13209   0.21311   0.620  0.537
## logmom      -0.19572   0.18578  -1.053  0.296
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```



```

##
## Residual standard error: 1.777 on 68 degrees of freedom
## Multiple R-squared: 0.3215, Adjusted R-squared: 0.2816
## F-statistic: 8.055 on 4 and 68 DF, p-value: 2.236e-05

print(summary(SOLc_DiffDB))

##
## Call:
## lm(formula = logDiff_DB ~ logSOL + logsmb3 + loghml3 + logmom)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -4.1745 -1.8565  0.4262  1.3896  2.9896
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.47348   0.22805   2.076  0.0417 *
## logSOL       0.18937   0.14321   1.322  0.1905
## logsmb3     0.02053   0.22097   0.093  0.9262
## loghml3    -0.17698   0.22717  -0.779  0.4387
## logmom      0.31498   0.19804   1.591  0.1164
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.894 on 68 degrees of freedom
## Multiple R-squared: 0.07123, Adjusted R-squared: 0.01659
## F-statistic: 1.304 on 4 and 68 DF, p-value: 0.2775

print(summary(SOLff_SRDB))

##
## Call:
## lm(formula = logSR_DB ~ logSOL + logsmb5 + loghml5 + logrmw5 +
##   logcma5)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -4.0003 -1.0444 -0.2689  1.0526  3.6969
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.103942  0.177923   0.584  0.5611
## logSOL       0.796264  0.112007   7.109 9.66e-10 ***
## logsmb5     0.272036  0.160408   1.696  0.0945 .
## loghml5    -0.067046  0.188770  -0.355  0.7236
## logrmw5    -0.005095  0.152660  -0.033  0.9735
## logcma5     0.088179  0.181788   0.485  0.6292
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.496 on 67 degrees of freedom
## Multiple R-squared: 0.4775, Adjusted R-squared: 0.4385
## F-statistic: 12.25 on 5 and 67 DF, p-value: 1.915e-08

```

```
print(summary(SOLff_NSRDB))
```

```
##  
## Call:  
## lm(formula = logNSR_DB ~ logSOL + logsmb5 + loghml5 + logrmw5 +  
##   logcma5)  
##  
## Residuals:  
##   Min    1Q  Median    3Q   Max  
## -3.1149 -1.1852 -0.1184  1.4031  3.4747  
##  
## Coefficients:  
##           Estimate Std. Error t value Pr(>|t|)  
## (Intercept) -0.2191    0.2095  -1.046  0.299  
## logSOL      0.5964    0.1319  4.522 2.57e-05 ***  
## logsmb5     0.1479    0.1889   0.783  0.436  
## loghml5     0.2411    0.2223   1.084  0.282  
## logrmw5    -0.2790    0.1798  -1.552  0.125  
## logcma5    -0.1321    0.2141  -0.617  0.539  
## ---  
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1  
##  
## Residual standard error: 1.762 on 67 degrees of freedom  
## Multiple R-squared:  0.3428, Adjusted R-squared:  0.2938  
## F-statistic: 6.991 on 5 and 67 DF,  p-value: 2.618e-05
```

```
print(summary(SOLff_DiffDB))
```

```
##  
## Call:  
## lm(formula = logDiff_DB ~ logSOL + logsmb5 + loghml5 + logrmw5 +  
##   logcma5)  
##  
## Residuals:  
##   Min    1Q  Median    3Q   Max  
## -4.0814 -1.5364  0.3394  1.3940  3.3746  
##  
## Coefficients:  
##           Estimate Std. Error t value Pr(>|t|)  
## (Intercept)  0.41686    0.22782   1.830  0.0717 .  
## logSOL      0.17143    0.14342   1.195  0.2362  
## logsmb5    -0.12142    0.20539  -0.591  0.5564  
## loghml5    -0.26120    0.24171  -1.081  0.2837  
## logrmw5     0.24986    0.19547   1.278  0.2056  
## logcma5    -0.01352    0.23277  -0.058  0.9539  
## ---  
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1  
##  
## Residual standard error: 1.916 on 67 degrees of freedom  
## Multiple R-squared:  0.06406, Adjusted R-squared: -0.005784  
## F-statistic: 0.9172 on 5 and 67 DF,  p-value: 0.4754
```

```
#Show regression results - Carhart 5
```

```
print(summary(mkctc5_SRDB))
```

```
##
## Call:
## lm(formula = logSR_DB ~ logrmrf + logsmb5 + loghml5 + logrmw5 +
##   logcma5)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -4.2802 -1.1999  0.1509  1.1772  3.4414
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.1187    0.2151   0.552 0.583008
## logrmrf      0.6631    0.1688   3.927 0.000205 ***
## logsmb5      0.2927    0.1916   1.527 0.131348
## loghml5      0.3054    0.2134   1.431 0.157140
## logrmw5     -0.1019    0.1826  -0.558 0.578450
## logcma5     -0.1807    0.2120  -0.852 0.397135
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.787 on 67 degrees of freedom
## Multiple R-squared:  0.2549, Adjusted R-squared:  0.1993
## F-statistic: 4.585 on 5 and 67 DF, p-value: 0.001174
```

```
print(summary(mktc5_SRDB))
```

```
##
## Call:
## lm(formula = logSR_DB ~ logrmrf + logsmb5 + loghml5 + logrmw5 +
##   logcma5)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -4.2802 -1.1999  0.1509  1.1772  3.4414
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.1187    0.2151   0.552 0.583008
## logrmrf      0.6631    0.1688   3.927 0.000205 ***
## logsmb5      0.2927    0.1916   1.527 0.131348
## loghml5      0.3054    0.2134   1.431 0.157140
## logrmw5     -0.1019    0.1826  -0.558 0.578450
## logcma5     -0.1807    0.2120  -0.852 0.397135
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.787 on 67 degrees of freedom
## Multiple R-squared:  0.2549, Adjusted R-squared:  0.1993
## F-statistic: 4.585 on 5 and 67 DF, p-value: 0.001174
```

```
print(summary(mktc5_DiffDB))
```

```
##
## Call:
```

```

## lm(formula = logDiff_DB ~ logrmrf + logsmb5 + loghml5 + logrmw5 +
##   logcma5)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -3.9559 -1.4675  0.4453  1.4009  2.9168
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.4198    0.2320   1.809  0.0749 .
## logrmrf      0.1436    0.1821   0.788  0.4332
## logsmb5     -0.1170    0.2067  -0.566  0.5731
## loghml5     -0.1811    0.2302  -0.787  0.4342
## logrmw5      0.2289    0.1969   1.163  0.2491
## logcma5     -0.0714    0.2287  -0.312  0.7559
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.927 on 67 degrees of freedom
## Multiple R-squared:  0.05289, Adjusted R-squared: -0.01779
## F-statistic: 0.7483 on 5 and 67 DF, p-value: 0.5902

print(summary(SOLc5_SRDB))

##
## Call:
## lm(formula = logSR_DB ~ logSOL + logsmb5 + loghml5 + logrmw5 +
##   logcma5)
##
## Residuals:
##   Min     1Q   Median     3Q      Max
## -4.0003 -1.0444 -0.2689  1.0526  3.6969
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.103942  0.177923   0.584  0.5611
## logSOL       0.796264  0.112007   7.109 9.66e-10 ***
## logsmb5      0.272036  0.160408   1.696  0.0945 .
## loghml5     -0.067046  0.188770  -0.355  0.7236
## logrmw5     -0.005095  0.152660  -0.033  0.9735
## logcma5      0.088179  0.181788   0.485  0.6292
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.496 on 67 degrees of freedom
## Multiple R-squared:  0.4775, Adjusted R-squared:  0.4385
## F-statistic: 12.25 on 5 and 67 DF, p-value: 1.915e-08

print(summary(SOLc5_NSRDB))

##
## Call:
## lm(formula = logNSR_DB ~ logSOL + logsmb5 + loghml5 + logrmw5 +
##   logcma5)

```

```

##
## Residuals:
##   Min    1Q  Median    3Q   Max
## -3.1149 -1.1852 -0.1184  1.4031  3.4747
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.2191    0.2095  -1.046   0.299
## logSQL      0.5964    0.1319   4.522 2.57e-05 ***
## logsmb5     0.1479    0.1889   0.783   0.436
## loghml5     0.2411    0.2223   1.084   0.282
## logrmw5    -0.2790    0.1798  -1.552   0.125
## logcma5    -0.1321    0.2141  -0.617   0.539
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.762 on 67 degrees of freedom
## Multiple R-squared:  0.3428, Adjusted R-squared:  0.2938
## F-statistic: 6.991 on 5 and 67 DF, p-value: 2.618e-05

print(summary(SOLc5_DiffDB))

##
## Call:
## lm(formula = logDiff_DB ~ logSQL + logsmb5 + loghml5 + logrmw5 +
##     logcma5)
##
## Residuals:
##   Min    1Q  Median    3Q   Max
## -4.0814 -1.5364  0.3394  1.3940  3.3746
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.41686    0.22782   1.830  0.0717 .
## logSQL      0.17143    0.14342   1.195  0.2362
## logsmb5    -0.12142    0.20539  -0.591  0.5564
## loghml5    -0.26120    0.24171  -1.081  0.2837
## logrmw5     0.24986    0.19547   1.278  0.2056
## logcma5    -0.01352    0.23277  -0.058  0.9539
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.916 on 67 degrees of freedom
## Multiple R-squared:  0.06406, Adjusted R-squared: -0.005784
## F-statistic: 0.9172 on 5 and 67 DF, p-value: 0.4754

```