**Replicating the Three-Factor Model**

**For Jeff:**

Text with light gray color is for understanding, no need to include in the slides

Test below “Code” should be include in the slides

OUTLINE

[ after data preparation (Daria Parts)]

1. Batch regression
2. Formatting the Results (Betas and t-value)
3. To Compare with the Original Fama-French Results

Slides: Batch Regression

Recall: how our regression data look like?

In excel file “FF3”: Rf, SMB, HML, MKT-RF

In excel file “FF3\_25\_ValueWeighted”

What does (5\*5) mean?

5 groups in Market Equity (ME): Small to Big

5 groups in Book-to-Market value (BM): Low to high

[The data set structures the data as 1 column of months (YYYYDD format) plus 25 columns of portfolio monthly returns. The first return column is SMALL (market cap) LoBM (low book-to-market / “growth”). The first 5 return columns are all small cap but with increasing book-to-market ratios. The last 5 return columns are all large cap with the last column being BIG (market cap) HiBM (high book-to-market / “value”). In reporting, results are structured in a matrix with rows representing market cap and columns for book to market ratios.]

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Low | 2 | 3 | 4 | High |
| Small | SMALL LoBM | ME1 BM2 | ME1 BM3 | ME1 BM4 | SMALL HiBM |
| 2 | ME2 BM1 | ME2 BM2 | ME2 BM3 | ME2 BM4 | ME2 BM5 |
| 3 | ME3 BM1 | ME3 BM2 | ME3 BM3 | ME3 BM4 | ME3 BM5 |
| 4 | ME4 BM1 | ME4 BM2 | ME4 BM3 | ME4 BM4 | ME4 BM5 |
| Big | BIG LoBM | ME5 BM2 | ME5 BM3 | ME5 BM4 | BIG HiBM |

Using multivariate regression. To run regression on each portfolio and saves the results in a list `results`.

Code

```{r}

# batch regressing 25 portfolios

results <- list()

# Data starts from the 2nd col of P25

for (i in 1:(ncol(P25) - 1)) {

rirf <- unlist (P25[, i + 1]) - rf

y <- lm (rirf ~ rmrf + smb + hml)

results[[i]] <- summary (y)

}

```

Slides: Formatting the Results (Betas and t-value)

Code:

```{r}

betas <- vector()

std.errors <- vector()

t.values <- vector()

R.squareds <- vector()

# save all betas

for(i in 1:(ncol(P25)-1)) {

betas <- cbind(betas,results[[i]]$coefficients[,1])

std.errors <- cbind(std.errors,results[[i]]$sigma)

t.values <- cbind(t.values, results[[i]]$coefficients[,3])

R.squareds <- cbind(R.squareds, results[[i]]$adj.r.squared)

}

# resize the output to 5x5 format like Fama French paper

resize <- function(x) {

df = data.frame (matrix(x, nrow=5, byrow = TRUE))

colnames(df) = c("Low", "2", "3", "4", "High")

rownames(df) = c("Small", "2", "3", "4", "Big")

return(df)

}

```

Slides: Formatting the Results (Betas and t-value)

Resize the results to keep the same display as the Table 6 in the paper

Code:

resize <- function(x) {

return (matrix (x, nrow=5, byrow = TRUE,

dimnames = list (c("SMALL", "2", "3", "4", "BIG"), c("LOW", "2", "3", "4", "HIGH"))))

}

Code:

# resize betas

market.beta <- resize(betas[2, ])

SMB.beta <- resize(betas[3, ])

HML.beta <- resize(betas[4, ])

Slides: To Compare with the Original Fama-French Results

Directly use this

The table is a pdf file named “**FF3\_Results.pdf**”



