Financial Econometrics
Problem Set
Problem set 2, 2021

Exercise 1. *The Value of a Win in the Premier League* [5]

The link between soccer results and stock market performance - Manchester United.

Consider a football club as a business concern. Its main sources of revenues are ticket sales at home games, as well as TV revenues etc. These revenues are presumably increasing in the position in the league, as more fans are interested in going to the games, as well as the likelihood of TV coverage. Each time the club wins a game, it increases the likelihood of higher future income, an increase that should be reflected in the *current economic value* of the football club. If the football club was a listed company, we would expect to see an increase in the stock price the day after a win.

Well, there are actually listed football clubs. Manchester United is listed on the New York Stock Exchange. We can use stock price data for Manchester United to ask the question: How much is a win(or loss) worth?

How to ask this? Well, we need to identify the stock return that reflects the result of a given game. Suppose games are played on Saturday. We would therefore expect to see the reaction in the stock price on the following monday. So if we collect the stock returns for Manchester United, look at returns on the day after a game, we should see that days following a win are days when returns are higher than days when they lose.

You are asked to check this. On the homepage you will find data on the UK premier league results. Manchester United shares are traded in the US.

1. Collect returns for Manchester United, and split it into three cases:
   - Wins
   - Draw
   - Loss

   Are the returns different? In expected directions?

2. An alternative way to investigate this relationships in terms of *points*. For each game, a team gets 3 points for a win, 1 for a draw, and 0 for a loss. What is the increase in value from a one point increase?

   This can be done as a regression:

   $$r_{it} = a + b\text{points}_{it} + e_{it}$$

   What is the predicted sign on b? What do you find?

3. Manchester United has recently been coached by a Norwegian. Are the above relationships different during Solskjærs reign?

The data for this exercise runs until first week of September, 2021.

Exercise 2. *Five factor* [8]

Fama and French has recently introduced their five-factor model, which leads to the regression:

$$eR_{i,t} = b^m eR_{m,t} + b^{SMB}SMB_t + b^{HML}HML_t + b^{RMW}RMW_t + b^{CMW}CMW_t + \varepsilon_{i,t}$$

You want to test whether the two "new" factors RMW and CMW makes much of a difference.

Your test assets are monthly returns for 10 US Industry portfolios, provided by Ken French, with data from 1926 to 2015. Use the equally weighted portfolios.

Perform a "Black Jensen Scholes" type of analysis.

- One analysis should be looking at adding the last two factors to the three factor model. How much does this improve the estimations.
- Another should be to look at momentum. It has been argued that the five factor model makes momentum unnecessary. Investigate that by looking at adding momentum to the three factor and five factor models.

Exercise 3. *Expusure* [5]

The concept of exchange rate exposure can be both applied to companies and to whole exchanges. Exchange rate exposure occurs when changes in exchange rates affect the value of a firm/exchange. To measure the degree of exposure one will want to find the coefficient b in the following relation

$$\Delta \text{ Value } = a + b\Delta\text{Exchange Rate}$$

To empirically investigate exposure, one will typically run regressions

$$R_{it} = a_i + \text{Other factors} + \beta_{ix} X_t + e_{it}$$

where R_{it} is the return on the asset which we want to measure exposure to, α_i is a constant, X_{it} the (change in) the exchange rate, and β_{ix} is the exposure measure.

You want to see if there are signs that currency risk affects the US stock market. To this end collect the returns on the Fama French 17 industry portfolios. Similary collect monthly changes in the JPY and EUR. Using data 1990-2017 for the JPY, and for the EUR 2000–2017, investigate how many of the industries show sign of exchange rate exposure. In the specification of the "other factors," use both a single market index (CAPM) and the Fama French 3 factor model.

Financial Econometrics

Solutions

Problem set 2, 2021

Exercise 1. *The Value of a Win in the Premier League* [5]

Collect returns for Manchester United, and split it into three cases:

- Wins
- Draw
- Loss

We then map this into the return for the stock on the Exchange. We look at the return on the day this news is reflected in the stock. For weekend games, this is monday. For games during the week, this actually the same day, since the closing time on the NYSE is after the game has been played. (New York is five hours behind London). Table 1 shows the results

Table 1 Man U Returns depending on game result

The table shows the average return (in percent) for ManU stock returns in New York on closing time for day when game result is known to the market.

An alternative way to investigate this relationships in terms of *points*. For each game, a team gets 3 points for a win, 1 for a draw, and 0 for a loss. What is the increase in value from a one point increase? This can be done as a regression:

$$r_{it} = a + b\text{points}_{it} + e_{it}$$

The results of this are shown in table 2

Table 2 Regression of stock returns on the number of points won by Man U

Results of running the regression $r_{it} = a + b\text{points}_{it} + e_{it}$ on the stock returns of ManU.

Savvy finance students may now raise their hand and question that particular formulation. What about the market return? Well, this is probably a low-beta stock, but let us include the market in the regression, in addition to the points. Table 3 shows the results. Including the market does not change our inference that a positive point results in an increase in the stock value.

Table 3 Regression of stock returns on the number of points won by Man U and stock market return

Results of running the regression $r_{it} = a + b\text{points}_{it} + b^m r_{mt} + \varepsilon_{it}$ on the stock returns of ManU.

Exercise 2. *Five factor* [8]

Read in data, show how it is done for the factors. Note that the French data needs some editing to get into R.

```
library(zoo)
datadir <- "/home/bernt/data/2016/french_data/"
filename <- paste(datadir,"F-F_Research_Data_Factors.csv",sep="")

FF <- read.table(filename,
                 header=TRUE,
                 skip=3,
                 na.strings=c("-99.99","-999"),
```

```
                 sep=",")
head(FF)
dates <- as.yearmon(as.character(FF[,1]),format="%Y%m")
FF <- zoo(coredata(FF), order.by=dates)
RMRF <- FF$Mkt.RF/100
SMB  <- FF$SMB/100
HML  <- FF$HML/100
RF   <- FF$RF/100
RM   <- RF + RMRF

                                        # note that returns are now actual returns, not percentage r
filename <- paste0(datadir,"F-F_Momentum_Factor.csv")
FF  <- read.table(filename,
                  sep=",",
                  header=TRUE,
                  na.strings=c("-99.99","-999"),
                  skip=13)
dates <- as.yearmon(as.character(FF[,1]),format="%Y%m")
head(dates)

WML <- zoo(coredata(FF[,2]), order.by=dates)
WML <- WML/100;
head(WML)
```

Now, show the estimation of the three factor model. The following is the complete program.

```
library(stargazer)
Sys.setlocale(category = "LC_ALL", locale = "C")
outdir <- "../../results/2016_04_bjs/"
source ("../2016_04_read_data/read_industries.R")
source ("../2016_04_read_data/read_pricing_factors.R")

eRi <- FF10IndusEW-RF
eRm <- RMRF
data <- merge.zoo(eRi,eRm,SMB,HML, all=FALSE)
stargazer(data,summary=TRUE)
eRi <- as.matrix(data[,1:10])
eRm <- as.matrix(data[,11])
SMB <- as.matrix(data[,12])
HML <- as.matrix(data[,13])
names(data)
reg <- lm(eRi~eRm+SMB+HML)
summary(reg)
reg1 <- lm(eRi[,1]~eRm+SMB+HML)
reg2 <- lm(eRi[,2]~eRm+SMB+HML)
reg3 <- lm(eRi[,3]~eRm+SMB+HML)
reg4 <- lm(eRi[,4]~eRm+SMB+HML)
reg5 <- lm(eRi[,5]~eRm+SMB+HML)
reg6 <- lm(eRi[,6]~eRm+SMB+HML)
reg7 <- lm(eRi[,7]~eRm+SMB+HML)
reg8 <- lm(eRi[,8]~eRm+SMB+HML)
reg9 <- lm(eRi[,9]~eRm+SMB+HML)
reg10 <- lm(eRi[,10]~eRm+SMB+HML)
cnames <- names(FF10IndusEW)
filename <- paste0(outdir,"bjs_10_industries_3_factors.tex")
stargazer(reg1,reg2,reg3,reg4,reg5,reg6,reg7,reg8,reg9,reg10,
```

```
omit.stat=c("f","rsq","ser"),
float=FALSE,
dep.var.labels=cnames,
out=filename)
```

The results are shown as tables summarizing the various estimations.

First, 3 factors vs 5 factors

	Dependent variable:									
	NoDur	Durbl	Manuf	Enrgy	HiTec	Telcm	Shops	Hlth	Utils	Other
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
eRm	0.866***	1.170***	1.097***	0.980***	1.247***	0.966***	0.947***	0.939***	0.822***	0.963***
	(0.012)	(0.018)	(0.011)	(0.031)	(0.020)	(0.024)	(0.016)	(0.021)	(0.024)	(0.013)
SMB	0.720***	1.012***	0.763***	0.602***	1.010***	0.549***	0.888***	0.777***	0.129***	0.832***
	(0.020)	(0.029)	(0.018)	(0.051)	(0.032)	(0.039)	(0.027)	(0.034)	(0.039)	(0.022)
HML	0.346***	0.397***	0.402***	0.515***	−0.184***	−0.218***	0.204***	−0.257***	0.510***	0.683***
	(0.017)	(0.026)	(0.016)	(0.045)	(0.029)	(0.035)	(0.024)	(0.030)	(0.035)	(0.019)
Constant	0.0004	−0.002**	−0.0001	0.001	0.002*	0.003**	0.0003	0.004***	0.001	−0.001
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	1,074	1,074	1,074	1,074	1,074	1,074	1,074	1,074	1,074	1,074
Adjusted R^2	0.910	0.893	0.947	0.643	0.866	0.696	0.867	0.772	0.650	0.924
Note:										*p<0.1; **p<0.05; ***p<0.01

	Dependent variable:									
	NoDur	Durbl	Manuf	Enrgy	HiTec	Telcm	Shops	Hlth	Utils	Other
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
eRm	0.912***	1.109***	1.038***	1.048***	1.055***	1.040***	0.984***	0.937***	0.628***	0.910***
	(0.020)	(0.027)	(0.018)	(0.060)	(0.031)	(0.037)	(0.024)	(0.032)	(0.024)	(0.018)
SMB	0.824***	1.028***	0.860***	0.545***	1.198***	0.610***	0.980***	0.963***	0.005	0.815***
	(0.028)	(0.038)	(0.025)	(0.083)	(0.043)	(0.051)	(0.034)	(0.044)	(0.034)	(0.026)
HML	0.387***	0.489***	0.391***	0.537***	−0.260***	0.045	0.317***	−0.444***	0.382***	0.469***
	(0.040)	(0.053)	(0.035)	(0.116)	(0.060)	(0.072)	(0.048)	(0.062)	(0.048)	(0.036)
RMW	0.213***	0.108*	0.074**	−0.116	−0.627***	−0.778***	0.190***	−0.419***	0.009	0.136***
	(0.042)	(0.055)	(0.037)	(0.123)	(0.064)	(0.076)	(0.050)	(0.065)	(0.050)	(0.038)
CMA	−0.027	−0.139*	−0.071	−0.128	−0.408***	−0.454***	−0.120*	0.131	0.163**	−0.159***
	(0.059)	(0.079)	(0.053)	(0.175)	(0.091)	(0.108)	(0.072)	(0.093)	(0.072)	(0.054)
Constant	−0.002*	−0.004***	−0.001	−0.00001	0.005***	0.006***	−0.001	0.006***	0.001	−0.0004
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	630	630	630	630	630	630	630	630	630	630
Adjusted R^2	0.866	0.852	0.912	0.447	0.871	0.763	0.852	0.813	0.552	0.891
Note:										*p<0.1; **p<0.05; ***p<0.01

See that the new factors are significant in many cases

Then, look at adding momentum to the 3 and five factor models

	Dependent variable:									
	NoDur	Durbl	Manuf	Enrgy	HiTec	Telcm	Shops	Hlth	Utils	Other
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
eRm	0.837***	1.137***	1.069***	0.977***	1.214***	0.924***	0.915***	0.927***	0.817***	0.934***
	(0.012)	(0.018)	(0.011)	(0.032)	(0.020)	(0.024)	(0.016)	(0.021)	(0.025)	(0.013)
SMB	0.716***	1.006***	0.758***	0.600***	1.004***	0.540***	0.881***	0.776***	0.129***	0.826***
	(0.019)	(0.028)	(0.017)	(0.051)	(0.032)	(0.038)	(0.026)	(0.034)	(0.039)	(0.021)
HML	0.284***	0.332***	0.345***	0.506***	−0.254***	−0.308***	0.136***	−0.283***	0.505***	0.621***
	(0.018)	(0.027)	(0.016)	(0.049)	(0.030)	(0.036)	(0.025)	(0.032)	(0.037)	(0.020)
WML	−0.133***	−0.146***	−0.125***	−0.017	−0.150***	−0.193***	−0.146***	−0.054**	−0.017	−0.133***
	(0.014)	(0.021)	(0.013)	(0.037)	(0.023)	(0.028)	(0.019)	(0.025)	(0.029)	(0.015)
Constant	0.002***	−0.001	0.001**	0.001	0.003***	0.005***	0.002**	0.005***	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068
Adjusted R^2	0.917	0.899	0.951	0.643	0.871	0.708	0.874	0.773	0.650	0.929
Note:										*p<0.1; **p<0.05; ***p<0.01

	Dependent variable:									
	NoDur	Durbl	Manuf	Enrgy	HiTec	Telcm	Shops	Hlth	Utils	Other
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
eRm	0.885***	1.078***	1.016***	1.050***	1.028***	1.004***	0.947***	0.923***	0.630***	0.895***
	(0.019)	(0.025)	(0.017)	(0.060)	(0.030)	(0.035)	(0.022)	(0.032)	(0.025)	(0.018)
SMB	0.836***	1.043***	0.871***	0.544***	1.211***	0.627***	0.998***	0.970***	0.004	0.823***
	(0.026)	(0.035)	(0.023)	(0.084)	(0.042)	(0.049)	(0.030)	(0.044)	(0.034)	(0.025)
HML	0.283***	0.363***	0.302***	0.546***	−0.366***	−0.099	0.173***	−0.499***	0.390***	0.408***
	(0.038)	(0.051)	(0.034)	(0.120)	(0.060)	(0.071)	(0.044)	(0.063)	(0.050)	(0.036)
RMW	0.264***	0.170***	0.118***	−0.121	−0.575***	−0.707***	0.261***	−0.391***	0.005	0.166***
	(0.039)	(0.052)	(0.035)	(0.124)	(0.062)	(0.073)	(0.045)	(0.065)	(0.051)	(0.037)
CMA	0.058	−0.036	0.001	−0.136	−0.322***	−0.336***	−0.002	0.177*	0.157**	−0.109**
	(0.055)	(0.074)	(0.050)	(0.177)	(0.088)	(0.104)	(0.064)	(0.093)	(0.073)	(0.052)
WML	−0.195***	−0.236***	−0.167***	0.017	−0.198***	−0.272***	−0.271***	−0.104***	0.014	−0.113***
	(0.018)	(0.024)	(0.016)	(0.057)	(0.029)	(0.034)	(0.021)	(0.030)	(0.024)	(0.017)
Constant	−0.0001	−0.002*	0.0004	−0.0001	0.007***	0.008***	0.001	0.006***	0.001	0.0004
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	630	630	630	630	630	630	630	630	630	630
Adjusted R^2	0.887	0.872	0.925	0.447	0.880	0.785	0.883	0.816	0.551	0.898

Note: *p<0.1; **p<0.05; ***p<0.01

In both cases momentum is signficiant in a lot of cases. Hard to argue that momentum is subsumed by the new factors with these results.

Exercise 3. *Expusure* [5]

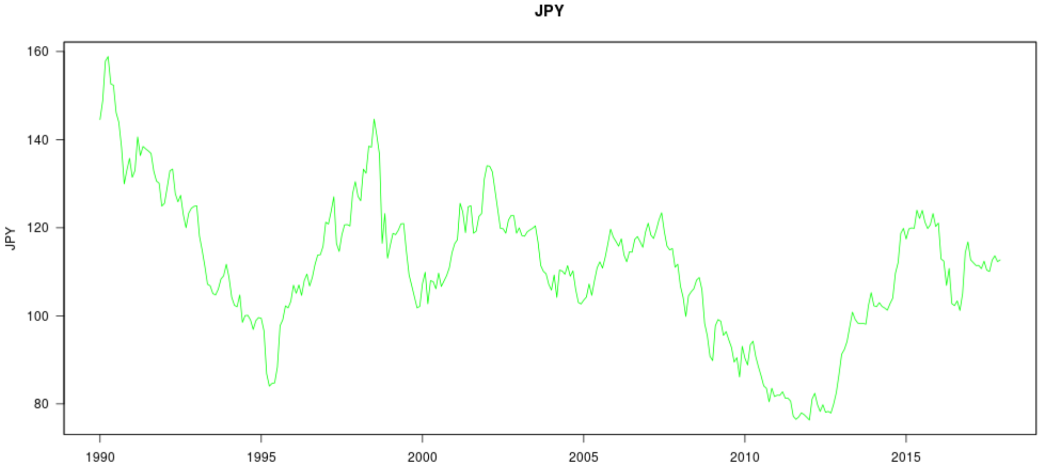
Here we have to make some choices. The French industry indices come in both VW and EW flavours. I have no strong priors about this choice, but I took the EW indices for illustrative purposes. The frequency which is most sensible is monthly returns.

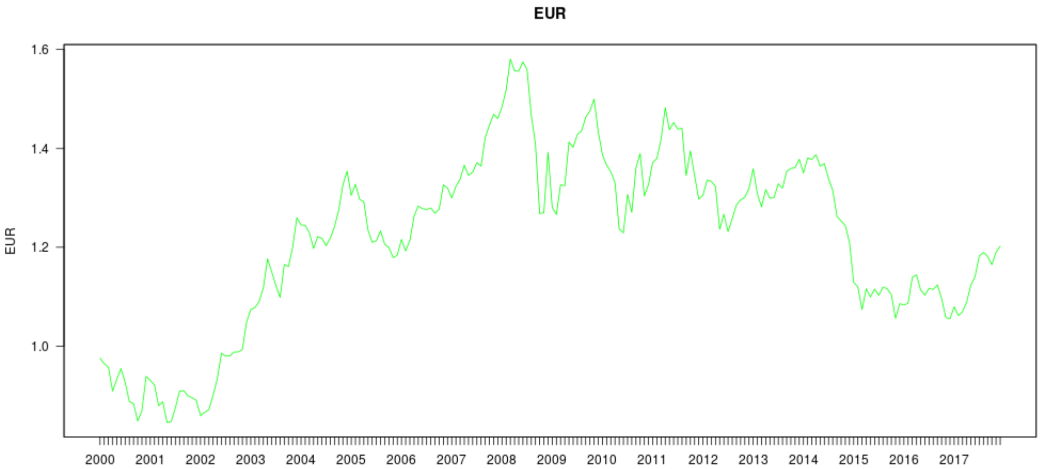
We first input the data. Show the currency stuff, the French data should be known

```
> library(quantmod)
Loading required package: TTR
Version 0.4-0 included new data defaults. See ?getSymbols.
>
> outdir <- "../../results/2018_02_exposure_us_industries/"
> source ("~/data/2018/french_us_data/read_industries.R")
> source ("~/data/2018/french_us_data/read_pricing_factors.R")
>
> getSymbols("DEXUSEU",src="FRED")
[1] "DEXUSEU"
> EUR <- na.omit(as.xts(DEXUSEU))
> names(EUR) <- "EUR"
> mEUR <- EUR[endpoints(EUR,on="months")]
>                                         # use xts aligned by yearmon
> mEUR <- xts(coredata(mEUR),
+              order.by=as.yearmon(index(mEUR)))
> names(mEUR) <- "mEUR"
> head(mEUR)
           mEUR
Jan 1999 1.1371
Feb 1999 1.0995
Mar 1999 1.0808
Apr 1999 1.0564
May 1999 1.0422
Jun 1999 1.0310

> dEUR <- diff(log(mEUR))
names(dEUR)<-"dEUR"
```

Plot the resulting currency series





Do the exposure analysis, first by only using the market as the relevant factor in addition to the currency. Note that we use the excess return in both the dependent and explanatory variables. This is typical, it gets rid of variation related to the *level* of interest rates.

Preparing data

```
> Ri <-  FF17IndusEW
> eRi <- FF17IndusEW - RF
> data <- merge(dEUR,RMRF,eRi,all=FALSE)
> head(data)
                 dEUR    RMRF    Food   Mines     Oil   Clths   Durbl   Chems
Jan 2000 -0.031575731 -0.0474  0.0106 -0.0149  0.0892 -0.0042  0.0460 -0.0188
Feb 2000 -0.011752713  0.0245  0.0602  0.0828  0.0412 -0.0137  0.0644  0.0204
Mar 2000 -0.007181173  0.0520  0.0344 -0.0430  0.1624  0.0440  0.0017  0.1091
Apr 2000 -0.051986200 -0.0640 -0.0364 -0.0541 -0.0364 -0.0284 -0.0532 -0.0654
May 2000  0.025955738 -0.0442  0.0192 -0.0521  0.1604 -0.0770 -0.0888 -0.0378
...
```

Doing regressions

```
> eri <- data[,3:19]
> deur <- data$dEUR
> rmrf <- data$RMRF
```

```
> reg <- lm(eri~rmrf+deur)
> reg1 <- lm(eri$Food~rmrf+deur)
> reg2 <- lm(eri$Mines~rmrf+deur)
...
> stargazer(reg1,reg2,reg3,reg4,reg5,reg6,
+           no.space=TRUE,
+           float=FALSE,
+           intercept.top=TRUE,
+           intercept.bottom=FALSE,
+           omit.stat=c("rsq","f","ser")
+           )
```

Table 4 Exchange Rate Exposure vs EUR

	Dependent variable:					
	Food	Mines	Oil	Clths	Durbl	Chems
Constant	0.009***	0.006	0.006	0.005	0.001	0.004
	(0.002)	(0.005)	(0.005)	(0.003)	(0.003)	(0.003)
rmrf	0.707***	1.089***	1.162***	1.127***	1.238***	1.261***
	(0.048)	(0.123)	(0.127)	(0.076)	(0.067)	(0.063)
deur	0.107	0.815***	0.608***	−0.065	−0.092	0.144
	(0.073)	(0.185)	(0.191)	(0.114)	(0.101)	(0.095)
Observations	205	205	205	205	205	205
Adjusted R^2	0.553	0.397	0.375	0.539	0.642	0.694
Note:						*p<0.1; **p<0.05; ***p<0.01

	Dependent variable:					
	Cnsum	Cnstr	Steel	FabPr	Machn	Cars
Constant	0.009**	0.003	0.001	0.008***	0.004	0.002
	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)
rmrf	1.187***	1.306***	1.493***	1.058***	1.575***	1.483***
	(0.081)	(0.068)	(0.089)	(0.060)	(0.075)	(0.077)
deur	−0.072	−0.052	0.282**	0.110	−0.199*	−0.014
	(0.121)	(0.102)	(0.134)	(0.090)	(0.113)	(0.116)
Observations	205	205	205	205	205	205
Adjusted R^2	0.533	0.665	0.624	0.638	0.696	0.668
Note:						*p<0.1; **p<0.05; ***p<0.01

	Dependent variable:				
	Trans	Utils	Rtail	Finan	Other
Constant	0.006**	0.007***	0.003	0.005***	0.003
	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)
rmrf	1.182***	0.457***	1.202***	0.753***	1.413***
	(0.062)	(0.051)	(0.072)	(0.048)	(0.072)
deur	−0.100	0.108	−0.165	0.063	−0.169
	(0.093)	(0.077)	(0.108)	(0.073)	(0.108)
Observations	205	205	205	205	205
Adjusted R^2	0.657	0.321	0.588	0.577	0.668
Note:					*p<0.1; **p<0.05; ***p<0.01

Now, do the analysis versus the JPY:

Table 5 Exchange Rate Exposure vs EUR

	Dependent variable:					
	Food	Mines	Oil	Clths	Durbl	Chems
Constant	0.003**	0.0002	0.002	−0.0003	−0.001	0.001
	(0.002)	(0.004)	(0.004)	(0.003)	(0.002)	(0.002)
rmrf	0.705***	1.033***	1.044***	1.011***	1.074***	1.123***
	(0.038)	(0.094)	(0.094)	(0.059)	(0.054)	(0.049)
djpy	0.018	−0.221*	−0.089	0.195**	0.174**	−0.018
	(0.052)	(0.128)	(0.129)	(0.080)	(0.074)	(0.067)
Observations	325	325	325	325	325	325
Adjusted R^2	0.512	0.272	0.270	0.489	0.557	0.618
Note:				*p<0.1; **p<0.05; ***p<0.01		

>

stargazer(reg7,reg8,reg9,reg10,reg11,reg12, + model.numbers=FALSE, + no.space=TRUE, + float=FALSE, + intercept.top=TRUE, + intercept.bottom=FALSE, + omit.stat=c("rsq","f","ser") +)

	Dependent variable:					
	Cnsum	Cnstr	Steel	FabPr	Machn	Cars
Constant	0.006**	0.00002	−0.002	0.004*	0.003	−0.001
	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)
rmrf	1.151***	1.127***	1.353***	0.998***	1.401***	1.233***
	(0.064)	(0.056)	(0.070)	(0.050)	(0.060)	(0.061)
djpy	0.129	0.199***	0.090	0.069	0.048	0.142*
	(0.088)	(0.076)	(0.096)	(0.069)	(0.083)	(0.083)
Observations	325	325	325	325	325	325
Adjusted R^2	0.504	0.565	0.538	0.549	0.626	0.565
Note:				*p<0.1; **p<0.05; ***p<0.01		

>

stargazer(reg13,reg14,reg15,reg16,reg17, + model.numbers=FALSE, + no.space=TRUE, + float=FALSE, + intercept.top=TRUE, + intercept.bottom=FALSE, + omit.stat=c("rsq","f","ser") +)

	Dependent variable:				
	Trans	Utils	Rtail	Finan	Other
Constant	0.002	0.005***	−0.0002	0.005***	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
rmrf	1.049***	0.433***	1.076***	0.738***	1.280***
	(0.047)	(0.038)	(0.056)	(0.039)	(0.057)
djpy	0.086	−0.026	0.211***	0.179***	0.098
	(0.064)	(0.052)	(0.076)	(0.053)	(0.077)
Observations	325	325	325	325	325
Adjusted R^2	0.608	0.286	0.546	0.542	0.616
Note:			*p<0.1; **p<0.05; ***p<0.01		

With both EUR and JPY we find significant exposure coefficients, and more of them than one would expect by pure chance. (1 in 20 at a 5% level). You may want to think about which industries the US has competitive exposure to Japan and Europe(Germany).

Let us also look at results when adding the other two FF factors.

EUR

```
> data <- merge(dEUR,RMRF,SMB,HML,eRi,all=FALSE)
> eri <- data[,5:21]
> deur <- data$dEUR
> rmrf <- data$RMRF
> hml <- data$HML
> smb <- data$SMB
> reg1 <- lm(eri$Food~rmrf+smb+hml+deur)
> reg2 <- lm(eri$Mines~rmrf+smb+hml+deur)
...
```

Table 6 Exchange Rate Exposure against the JPY, additional factors

Panel A

	Dependent variable:					
	Food	Mines	Oil	Clths	Durbl	Chems
Constant	0.006***	0.002	0.002	0.001	−0.002	0.001
	(0.002)	(0.005)	(0.005)	(0.003)	(0.002)	(0.002)
rmrf	0.652***	0.974***	1.103***	1.048***	1.129***	1.209***
	(0.045)	(0.120)	(0.126)	(0.069)	(0.058)	(0.058)
smb	0.351***	0.703***	0.469***	0.540***	0.645***	0.395***
	(0.058)	(0.155)	(0.162)	(0.089)	(0.075)	(0.074)
hml	0.328***	0.561***	0.690***	0.596***	0.452***	0.531***
	(0.059)	(0.158)	(0.165)	(0.090)	(0.077)	(0.076)
deur	0.087	0.784***	0.555***	−0.105	−0.115	0.105
	(0.065)	(0.175)	(0.183)	(0.100)	(0.085)	(0.084)
Observations	205	205	205	205	205	205
Adjusted R^2	0.644	0.462	0.428	0.646	0.748	0.763
Note:						*p<0.1; **p<0.05; ***p<0.01

>

stargazer(reg7,reg8,reg9,reg10,reg11,reg12, + model.numbers=FALSE, + no.space=TRUE, + float=FALSE, + intercept.top=TRUE, + intercept.bottom=FALSE, + omit.stat=c("rsq","f","ser") +)

	Dependent variable:					
	Cnsum	Cnstr	Steel	FabPr	Machn	Cars
Constant	0.007***	−0.001	−0.003	0.005**	0.002	−0.002
	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)
rmrf	0.984***	1.209***	1.394***	0.963***	1.373***	1.402***
	(0.063)	(0.052)	(0.083)	(0.053)	(0.055)	(0.070)
smb	0.920***	0.669***	0.641***	0.558***	0.919***	0.548***
	(0.081)	(0.067)	(0.107)	(0.069)	(0.071)	(0.090)
hml	−0.163*	0.736***	0.597***	0.367***	−0.155**	0.593***
	(0.083)	(0.068)	(0.109)	(0.070)	(0.072)	(0.092)
deur	−0.023	−0.102	0.245**	0.094	−0.150*	−0.054
	(0.092)	(0.076)	(0.121)	(0.078)	(0.080)	(0.102)
Observations	205	205	205	205	205	205
Adjusted R^2	0.736	0.816	0.698	0.734	0.848	0.743
Note:						*p<0.1; **p<0.05; ***p<0.01

>

stargazer(reg13,reg14,reg15,reg16,reg17, + model.numbers=FALSE, + no.space=TRUE, + float=FALSE, + intercept.top=TRUE, + intercept.bottom=FALSE, + omit.stat=c("rsq","f","ser") +)

	Dependent variable:				
	Trans	Utils	Rtail	Finan	Other
Constant	0.002	0.006***	−0.0001	0.002	0.001
	(0.002)	(0.002)	(0.003)	(0.001)	(0.002)
rmrf	1.105***	0.482***	1.108***	0.712***	1.223***
	(0.051)	(0.050)	(0.066)	(0.034)	(0.053)
smb	0.541***	−0.033	0.573***	0.379***	0.847***
	(0.066)	(0.065)	(0.086)	(0.044)	(0.068)
hml	0.614***	0.312***	0.450***	0.653***	−0.220***
	(0.067)	(0.066)	(0.087)	(0.045)	(0.069)
deur	−0.142*	0.076	−0.190*	0.011	−0.116
	(0.074)	(0.073)	(0.097)	(0.050)	(0.077)
Observations	205	205	205	205	205
Adjusted R^2	0.783	0.392	0.676	0.803	0.834
Note:					*p<0.1; **p<0.05; ***p<0.01

So when we add the two Fama French factors SMB and HML there is less evidence of currency exposure for US industries against the JPY, but *more* against the EUR. But the FF factors may not be sensible in a currency exposure setting (discuss...). Are we doing asset pricing, or are we investigating currency exposure in itself? They may also be some econometric issues in the formulation. (See **?**).

Table 7 Exchange Rate Exposure against the JPY, additional factors

Panel A

	Dependent variable:					
	Food	Mines	Oil	Clths	Durbl	Chems
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.002	−0.003	−0.001	−0.003	−0.003*	−0.001
	(0.001)	(0.004)	(0.004)	(0.002)	(0.002)	(0.002)
rmrf	0.675***	0.983***	1.039***	0.968***	1.001***	1.104***
	(0.034)	(0.088)	(0.091)	(0.051)	(0.044)	(0.041)
smb	0.450***	0.845***	0.644***	0.711***	0.806***	0.569***
	(0.046)	(0.121)	(0.124)	(0.069)	(0.060)	(0.056)
hml	0.369***	0.731***	0.829***	0.606***	0.498***	0.610***
	(0.049)	(0.128)	(0.131)	(0.073)	(0.063)	(0.060)
djpy	−0.061	−0.373***	−0.234*	0.067	0.049	−0.133**
	(0.045)	(0.119)	(0.122)	(0.068)	(0.059)	(0.056)
Observations	325	325	325	325	325	325
Adjusted R^2	0.645	0.391	0.371	0.641	0.727	0.745
Note:						*p<0.1; **p<0.05; ***p<0.01

	Dependent variable:					
	Cnsum	Cnstr	Steel	FabPr	Machn	Cars
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.006***	−0.003*	−0.004*	0.002	0.002	−0.004*
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
rmrf	0.964***	1.089***	1.305***	0.940***	1.215***	1.202***
	(0.050)	(0.042)	(0.060)	(0.042)	(0.042)	(0.051)
smb	0.980***	0.816***	0.846***	0.708***	1.070***	0.731***
	(0.068)	(0.057)	(0.082)	(0.057)	(0.058)	(0.070)
hml	−0.180**	0.789***	0.743***	0.489***	−0.048	0.734***
	(0.072)	(0.060)	(0.088)	(0.061)	(0.061)	(0.074)
djpy	0.059	0.043	−0.063	−0.046	−0.043	−0.0001
	(0.066)	(0.056)	(0.081)	(0.056)	(0.057)	(0.069)
Observations	325	325	325	325	325	325
Adjusted R^2	0.722	0.774	0.677	0.708	0.828	0.711
Note:						*p<0.1; **p<0.05; ***p<0.01

	Dependent variable:				
	Trans	Utils	Rtail	Finan	Other
	(1)	(2)	(3)	(4)	(5)
Constant	−0.0003	0.004**	−0.002	0.002**	0.001
	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
rmrf	1.020***	0.478***	1.012***	0.751***	1.097***
	(0.036)	(0.036)	(0.049)	(0.027)	(0.039)
smb	0.658***	0.004	0.697***	0.451***	0.986***
	(0.049)	(0.049)	(0.067)	(0.037)	(0.053)
hml	0.648***	0.366***	0.422***	0.704***	−0.142**
	(0.053)	(0.053)	(0.071)	(0.039)	(0.056)
djpy	−0.041	−0.064	0.104	0.065*	0.024
	(0.049)	(0.049)	(0.066)	(0.036)	(0.052)
Observations	325	325	325	325	325
Adjusted R^2	0.782	0.382	0.667	0.790	0.829
Note:					*p<0.1; **p<0.05; ***p<0.01