Homework 7, by Somesh Srivastava, Mar 09, 2018

Executive Summary

As part of this project, Fama-Macbeth type of regression analysis has been conducted with stock returns as dependent variable and firm-marketcap, price-normalized accruals, the earnings-price ratio, and 1/price as independent variables.

Details

For data preparation, annual data for price, market cap, Earning per share has been taken from CRSP/Compustat database. Also to calculate price normalized accruals data has been taken from annual fundamental table for account payable(AP), receivable total (rect), tax payable (txp) and accrued expense (xacc).

Price Normalized Accruals = (ap-rect+txp+xacc)/MarketCap)

Period of data is starting 1980 till 2016. Only those stocks have been filtered which have complete records in the specified period. As a first step, Time series regression has been run with Annual holding period return of stocks vs independent lagged variables viz. Market Cap, Price-normalized-accruals, earning-price ratio, 1/price for each stock. In the second steps, cross-sectional regression has been run for each year to calculate the risk premium of each factor loading(Lambda). Finally mean of each Lambda has been calculated as final estimated value of each risk premium.

From Time series regression -

Annual Stock Ret= α+β_marketcap*MarketCap+β_(price-normalized-earnings)*Price_(normalized_Eearnings) + β_(earning-price-ratio)*EearningPriceRatio+β_(price-inverse)* (1/price) + ε

From cross-sectional regression -

Annual Stock Ret= α'+β_marketcap*λ_marketcap+β_(price-normalized-earnings)*λ_(price-normalized-earnings) + β_(earning-price-ratio)*λ_(earning-price-ratio)+β_(price-inverse)*λ_(price-inverse) + ε'

.

Tables and Figures

Sample Data for One stock:

fyear	PERMNO	AnnualRet	MarketCap	price_norm_accrual	EPRatio	Price	lag_MarketCap	lag_price_norm_accrual	lag_EPRatio	lag_Price
1982	10145	-0.2110357	1141218.8	0.00034787	0.1921236	32.38	1791661.5	0.0001948	0.152336	53.50
1983	10145	0.8104779	2980339.3	0.00027648	0.1239462	55.75	1480518.0	0.0002459	0.209003	43.88
1984	10145	-0.0224920	2864500.5	0.00031000	0.1455072	34.50	1141218.8	0.0003479	0.192124	32.38
1985	10145	0.4143333	8190319.5	0.00014358	-0.0701604	46.75	2980339.3	0.0002765	0.123946	55.75
1986	10145	-0.0034831	6995874.0	0.00018983	0.0812461	40.13	2864500.5	0.0003100	0.145507	34.50
1987	10145	-0.2628861	4269450.8	0.00033892	0.1086726	28.25	8190319.5	0.0001436	-0.070160	46.75
1988	10145	0.2142041	4834245.0	0.00028877	0.0953846	32.50	6995874.0	0.0001898	0.081246	40.13
1989	10145	0.1275422	5231494.1	0.00027086	0.1017921	34.88	4269450.8	0.0003389	0.108673	28.25
1990	10145	-0.1816399	3639465.0	0.00031049	0.1240741	27.00	4834245.0	0.0002888	0.095385	32.50
1991	10145	0.7049566	6029741.3	0.00018475	-0.0455840	43.88	5231494.1	0.0002709	0.101792	34.88
1992	10145	0.4046008	8569038.5	0.00017622	0.0628099	60.50	3639465.0	0.0003105	0.124074	27.00
1993	10145	0.3277328	11192483.0	0.00013795	0.0584810	79.00	6029741.3	0.0001848	-0.045584	43.88
1994	10145	-0.1234848	9621558.0	0.00012430	0.0788235	34.00	8569038.5	0.0001762	0.062810	60.50
1995	10145	0.4230697	13435517.5	0.00009133	0.0650526	47.50	11192483.0	0.0001379	0.058481	79.00
1996	10145	0.4316193	18947667.0	0.00006829	0.0538806	67.00	9621558.0	0.0001243	0.078824	34.00
1997	10145	0.1744621	21894237.3	0.00006084	0.0520458	38.81	13435517.5	0.0000913	0.065053	47.50

1998	10145	0.1587137	24817215.6	0.00004251	0.0523554	44.31	18947667.0	0.0000683	0.053881	67.00
1999	10145	0.3183616	45528878.7	0.00002759	0.0329361	57.69	21894237.3	0.0000608	0.052046	38.81
2000	10145	-0.1666203	38083534.5	0.00001197	0.0433289	47.31	24817215.6	0.0000425	0.052355	44.31
2001	10145	-0.2709287	27502052.0	0.00005716	-0.0035482	33.82	45528878.7	0.0000276	0.032936	57.69
2002	10145	-0.2737764	19705224.0	0.00012596	-0.0112500	24.00	38083534.5	0.0000120	0.043329	47.31
2003	10145	0.4325132	28818364.9	0.00008415	0.0466647	33.43	27502052.0	0.0000572	-0.003548	33.82
2004	10145	0.0821139	30458548.9	0.00009019	0.0420785	35.41	19705224.0	0.0001260	-0.011250	24.00
2005	10145	0.0754672	31392772.8	0.00007314	0.0499329	37.25	28818364.9	0.0000841	0.046665	33.43
2006	10145	0.2416667	36938912.4	0.00005864	0.0554819	45.24	30458548.9	0.0000902	0.042079	35.41
2007	10145	0.3864151	45978628.9	0.00004474	0.0513237	61.57	31392772.8	0.0000731	0.049933	37.25
2008	10145	-0.4534744	23844002.2	0.00010447	0.1145294	32.83	36938912.4	0.0000586	0.055482	45.24
2009	10145	0.2381948	29911324.8	0.00007495	0.0727041	39.20	45978628.9	0.0000447	0.051324	61.57
2010	10145	0.3950954	41473996.7	0.00004960	0.0487208	53.16	23844002.2	0.0001045	0.114529	32.83
2011	10145	0.0483500	42039562.0	0.00005849	0.0432383	54.35	29911324.8	0.0000750	0.072704	39.20
2012	10145	0.1984656	49720620.8	0.00004803	0.0581377	63.47	41473996.7	0.0000496	0.048721	53.16
2013	10145	0.4705048	71695572.0	0.00002755	0.0538470	91.37	42039562.0	0.0000585	0.043238	54.35
2014	10145	0.1151062	78218375.2	0.00002622	0.0533427	99.92	49720620.8	0.0000480	0.058138	63.47
2015	10145	0.0584036	79820466.9	0.00002375	0.0583180	103.57	71695572.0	0.0000275	0.053847	91.37
2016	10145	0.1498829	88292181.3	0.00001978	0.0535175	115.85	78218375.2	0.0000262	0.053343	99.92

Time Series Regression Output:

PERMNO	alpha	beta1	beta2	beta3	beta4
10145	0.136747514	-1.70E-09	-75.25452949	0.98800913	0.196442535
10656	0.059838645	-4.55E-07	-2792.539481	-0.244173882	0.282147331
10866	0.356856275	-4.59E-07	108.4222691	0.320337772	0.217782414
10890	0.425826754	-1.13E-07	146.361354	-0.100391075	0.247739192
11790	0.433159201	-1.22E-06	-151.7256897	-2.869282296	0.204171002
13303	0.430157182	-3.16E-07	-851.3706477	-0.282446205	0.19115951
13901	0.527716361	-1.81E-09	609.0189532	-2.797688614	0.289125426
13928	0.098598573	-1.13E-10	789.5386756	-1.081804804	0.091103731
14198	0.127503325	-8.96E-08	2673.594301	3.293437502	0.277548051
14277	-0.039551558	1.28E-09	3634.498397	0.731181045	0.165586702
14526	0.346440752	-2.52E-07	516.7614622	-0.469886463	0.245751034
14541	0.149961323	7.99E-11	472.3228925	-0.828457906	0.096193622
14702	0.398320272	-1.32E-08	3259.647727	2.462295251	0.201063715
14816	-0.160330667	-5.66E-08	2702.302426	6.769448085	0.266273781
15203	0.193731564	-2.98E-06	1066.706498	-0.537209085	0.239583544
15721	0.254582768	-2.88E-08	1593.003997	-0.197730284	0.16365365
16126	-0.023512523	1.42E-07	-2646.523926	0.126742194	0.152118932

16600	0.133758972	-1.15E-08	1973.197211	0.168384811	0.123481653

Fama-Macbeth coefficients (Lambda's) :

λ_marketcap= 7.898767e+03
λ_(price-normalized-earnings)= -1.429522e-06
λ_(earning-price-ratio)= 1.515075e-03
λ_(price-inverse)= 3.316640e-01

Computer Code

```
## Loading required libraries

if (!require("data.table")) install.packages("data.table")
if (!require("xts")) install.packages("xts")
if (!require("ggplot2")) install.packages("ggplot2")
if (!require("plyr")) install.packages("plyr")

setwd("D:/MFE/Curriculum/Winter 2018/404-Corporate Finance and Risk Management - WELCH/Homework/HW7")


#Data collection (1980 to 2016) and cleaning

stocks <- fread("./stock_daily.CSV", header = TRUE)
stocks$date <- as.Date(as.character(stocks$date), "%Y%m%d")
stocks$RET <- as.numeric(as.character(stocks$RET))
stocks[is.na(stocks)] = 0
ticker <- data.table(PERMNO=stocks$PERMNO, TICKER=stocks$TICKER, key="PERMNO")
ticker = unique(ticker[!ticker$TICKER==""])
stocks$grossRet <- stocks$RET+1
stocks[, grossRet := lapply(.SD, prod), by=list(stocks$PERMNO, year(stocks$date)), .SDcols=c("grossRet")]
yearend <- stocks[, .(max(date)), by=year(stocks$date)]
colnames(yearend) <- c("year", "date")
stocks <- stocks[date %in% yearend$date]
stocks$AnnualRet = stocks$grossRet-1
stocks$fyear = year(stocks$date)
stocks$TICKER=ticker$TICKER[match(stocks$PERMNO, ticker$PERMNO)]


fundamental <- fread("./Fundamental_Annual.CSV", header = TRUE)
colnames(fundamental)[2] = "PERMNO"
colnames(fundamental)[20] = "Price"
mastertable <- merge(fundamental, stocks, by=c("fyear", "PERMNO"))
mastertable$EPRatio <- mastertable$epsfx/mastertable$Price
mastertable$price_norm_accrual <- mastertable[, .(price_norm_accrual = (ap-rect+txp+xacc)/(Price*SHROUT))]
mastertable <- mastertable[, .(fyear, PERMNO, AnnualRet, MarketCap = SHROUT*Price, price_norm_accrual, EPRatio, Price)]
mastertable <- mastertable[complete.cases(mastertable)]
YearData <- mastertable[, .(Count = .N), by = "PERMNO"]
YearData <- YearData[YearData$Count==37] #complete 37 year data (1980 to 2016)
mastertable <- mastertable[mastertable$PERMNO %in% YearData$PERMNO]

## regression should be dependent_var_t~independent_var_(t-2). Shifting by 2
setorder(mastertable, PERMNO, fyear)

cols = c("MarketCap", "price_norm_accrual", "EPRatio", "Price")
anscols = paste("lag", cols, sep="_")
mastertable[, (anscols) := shift(.SD, 2, NA, "lag"), .SDcol=cols, by=PERMNO]
mastertable <- mastertable[complete.cases(mastertable)]


#to find beta
regression <- mastertable[,
                          {
                            summary <- summary(lm(AnnualRet ~ lag_MarketCap + lag_price_norm_accrual + lag_EPRatio + 1/lag_Price))
                            out <- data.table(
                              alpha=summary$coefficients[1],
                              beta1=summary$coefficients[2],
                              beta2=summary$coefficients[3],
                              beta3=summary$coefficients[4],
                              beta4=summary$coefficients[5]
                              )
                            out
                          },
                          by=PERMNO]



## Fama MacBeth
YearlyLambda <- mastertable[, {
  summary <- summary(lm(AnnualRet~regression$beta1+regression$beta2+regression$beta3+regression$beta4))
  out <- data.table(
    lambda0=summary$coefficients[1],
    lambda1=summary$coefficients[2],
    lambda2=summary$coefficients[3],
    lambda3=summary$coefficients[4],
    lambda4=summary$coefficients[5])
  out
} , by=fyear]
```

```
FamaMLambda <- colMeans(YearlyLambda[, -1])
```

References

- Wharton Research Data Services (WRDS) CRSP data taken on Mar 09, 2018.