Homework 3

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1.

PERMNO	date	TICKER	RET
75104	20051213	VIA	0.002017
75104	20051214	VIA	-0.004025
75104	20051215	VIA	-0.018764
75104	20051216	VIA	0.003530
75104	20051219	VIA	-0.009968
75104	20051220	VIA	-0.012437
75104	20051221	VIA	0.001499
75104	20051222	VIA	-0.003593
75104	20051223	VIA	0.001502
75104	20051227	VIA	-0.014402
75104	20051228	VIA	-0.009132
75104	20051229	VIA	-0.003994
75104	20051230	VIA	0.010487
75104	20060103	CBS	0.033120
75104	20060104	CBS	-0.003824
75104	20060105	CBS	0.013436
75104	20060106	CBS	0.028409
75104	20060109	CBS	-0.006262
75104	20060110	CBS	-0.018162
75104	20060111	CBS	-0.008305
75104	20060112	CBS	-0.009136
75104	20060113	CBS	-0.019209
75104	20060117	CBS	-0.017235
75104	20060118	CBS	0.021124
75104	20060119	CBS	-0.002342
75104	20060120	CBS	-0.023474
75104	20060123	CBS	0.035657
75104	20060124	CBS	0.040232
75104	20060125	CBS	-0.016735
75104	20060126	CBS	0.016263
75104	20060127	CBS	-0.001117
75104	20060130	CBS	0.020119
76226	20051213	VIA	0.004329
76226	20051214	VIA	-0.006322
76226	20051215	VIA	-0.018219
76226	20051216	VIA	0.002356
76226	20051219	VIA	-0.007934
76226	20051220	VIA	-0.012145
76226	20051221	VIA	0.000600
76226	20051222	VIA	-0.004195
76226	20051223	VIA	0.003310
76226	20051227	VIA	-0.015897
76226	20051228	VIA	-0.009448
76226	20051229	VIA	-0.004615
76226	20051230	VIA	0.007728
76226	20060103	CBS	0.039724
76226	20060104	CBS	-0.007634
76226	20060105	CBS	0.013846
76226	20060106	CBS	0.033005
76226	20060109	CBS	-0.007345

Picture 1

I sign in the wrds website, and upload a txt file including tickers of all the firms in the cvs file of which I need to get permno numbers. However, I found there is a problem that sometimes one permno does not only match one ticker, an example is picture 1 above. This is the reason why in SP500_additions.csv, we have 502 firms, but in my data set d, I have 559 firms.

If you only choose a couple of date and download the data of permno, you will get fewer firms; if you choose a broad range of time and download the data of permno, you will get more firms. You have to trade off, and I cannot find a solution that can remove all extra firms and keep all firms I need. And I choose to use firms from 2002-2017.

2. I download the stock returns and market returns data and name them d_ret and d_ mkt.

3.

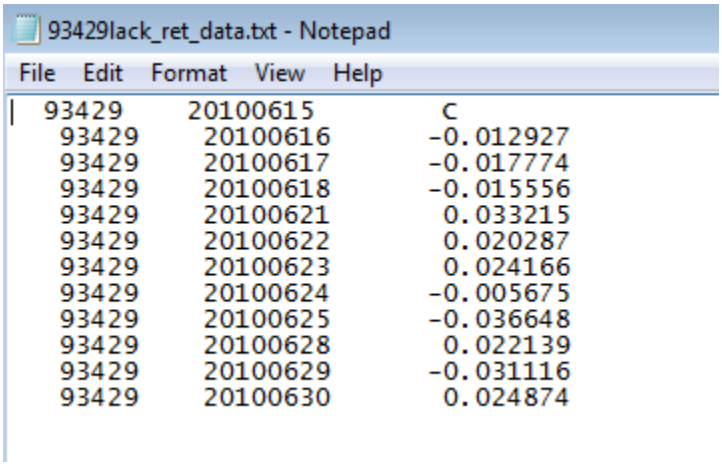
AR around effdate

Relative Day	Mean	t	# obs
-10	-.001076129	-0.86796	448
-9	-.000669415	-0.60341	448
-8	0.000744705	0.82685	448
-7	-.000862097	-0.67892	448
-6	-.000663462	-0.72995	448
-5	0.000090597	0.08803	448
-4	-.001862788	-1.80299	448
-3	0.000331265	0.48817	448
-2	0.003117686	3.32620	448
-1	0.001631525	1.99778	448
0	0.000335814	0.32011	448
1	0.003305540	3.40911	447
2	-.001595678	-1.46265	447
3	-.000978516	-0.78624	447
4	-.001573164	-1.31481	447
5	-.000694617	-0.56865	447
6	0.001323507	1.29602	447
7	-.000455572	-0.40961	447
8	0.000276146	0.30289	447
9	-.002391962	-2.71190	447
10	-.001018292	-1.20320	447

Picture 2**.**

As shown above, picture 2 is the table I get from SAS, with 1st column the relative day, 2nd column the average abnormal return, 3rd the t-statistic, and 4th the number of observations.

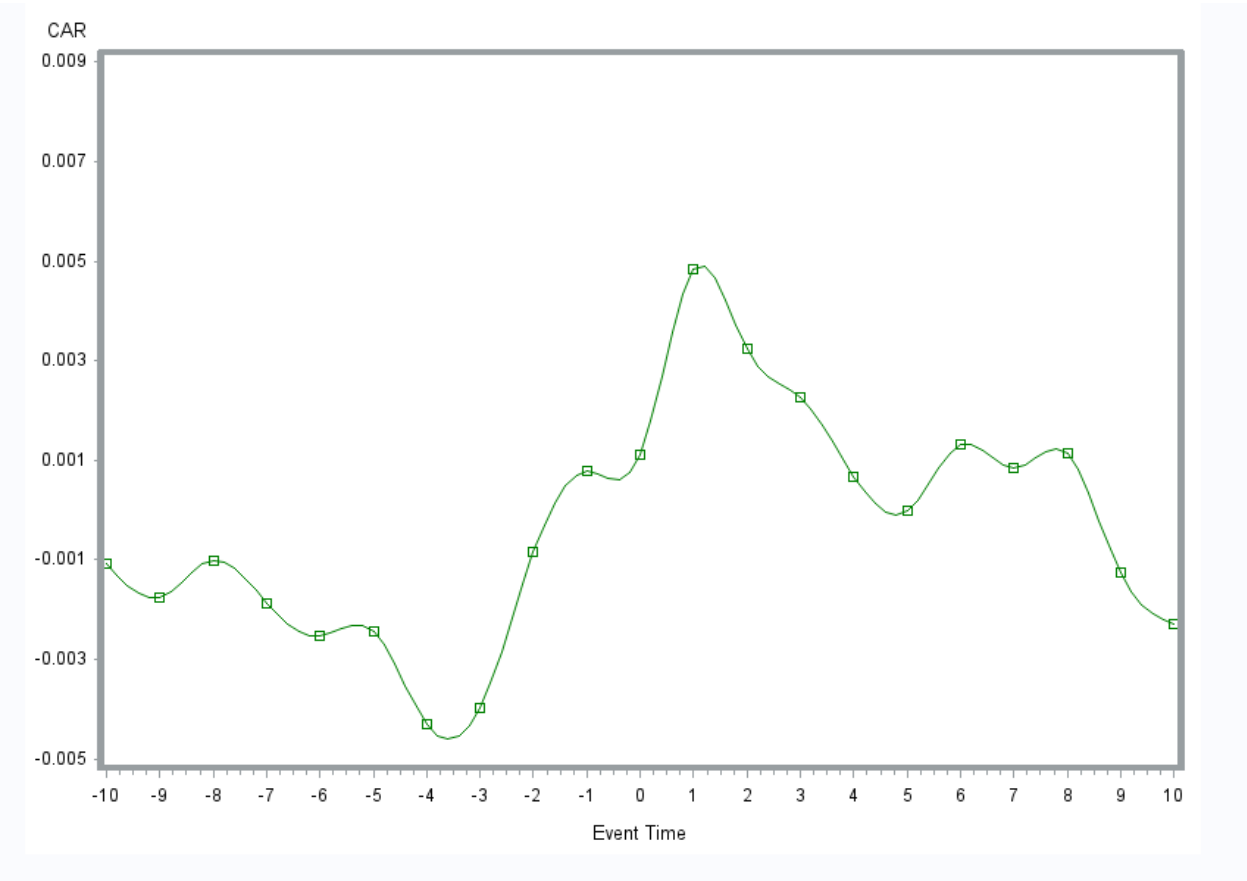
I found here we have 448 observations, but we got more than 559 firms earlier. It is because for some firms, we lack some data. Like Picture 3 showing that for the firm with Permno=93429, we cannot get the data before 20100616. So, in the very end of d3 data set, there is some blank space for n and rel_day, which makes some firms cannot be selected and added to d4 data set.



Picture 3.

The number of observations are different maybe because there is a company that misses the return value after day 0.

4.



Picture 4.

The graph of the average cumulative abnormal return around the index inclusion date is picture 4 above. Intuitively the car begins to rise in day -3, and the second round rise happens from day 0 to day 1, and then the car falls dramatically with a second round fall after day 8. Eventually, the car goes back to its origin level.

AR around effdate

Relative Day	Mean	t	# obs	p
-10	-.001076129	-0.86796	448	0.38588
-9	-.000669415	-0.60341	448	0.54654
-8	0.000744705	0.82685	448	0.40877
-7	-.000862097	-0.67892	448	0.49754
-6	-.000663462	-0.72995	448	0.46580
-5	0.000090597	0.08803	448	0.92990
-4	-.001862788	-1.80299	448	0.07206
-3	0.000331265	0.48817	448	0.62567
-2	0.003117686	3.32620	448	0.00095
-1	0.001631525	1.99778	448	0.04635
0	0.000335814	0.32011	448	0.74903
1	0.003305540	3.40911	447	0.00071
2	-.001595678	-1.46265	447	0.14427
3	-.000978516	-0.78624	447	0.43214
4	-.001573164	-1.31481	447	0.18925
5	-.000694617	-0.56865	447	0.56988
6	0.001323507	1.29602	447	0.19564
7	-.000455572	-0.40961	447	0.68229
8	0.000276146	0.30289	447	0.76211
9	-.002391962	-2.71190	447	0.00695
10	-.001018292	-1.20320	447	0.22954

Picture 5.

I noticed I can add a p-value to make picture 3 more readable, so I get another table to help me interpret the result, as picture 5.

If I set the significance level as 0.05, day -2, day -1, day 1, day 9 have significant average abnormal returns. So, 2 days before the inclusion, the firms' stock would have an average abnormal return as 0.31%; 1 day before the inclusion, the firms' stock would have an average abnormal return as 0.16%; at the first day after the inclusion, the firms' stock would have an average abnormal return as 0.33%; at the ninth day after the inclusion, the firms' stock would have an average abnormal return as -0.24%.

According to EMH, a two-day event window, CAR (0,1) is sufficient to capture whatever permanent price effect of being add to the S&P 500 will have on a security; actually, after the inclusion, we only get statistically significant positive abnormal returns on day 1. But it cannot explain the subsequent price reversal.

The positive abnormal return at day -2 is because many people in the stock market already know that the firm would be included in SP 500 very soon, and this is considered good news to that firm. At day -1, the abnormal return is also driven by this good news, but not as large as that of the day -2, maybe because more people already noticed this good news at day -2 and have already bought that stock at day -2. At day 0, the abnormal return is not significant. At day 1, the strongest abnormal return appears, I think it is mainly because many ETF and hedge funds would add this stock to their portfolio after the inclusion. At day 9, the significant fall of the abnormal return maybe come from those short term investors selling their stock, who know that the stock price would rise after the inclusion, and buy the stock before the inclusion, and sell them after the price becomes very high after the inclusion, leading to a significant negative abnormal return, which bring the car back to its day -10's initial level. Maybe it can be explained by DSSW model.

The short-run demand curve for stocks (Wurgler and Zhuravskaya[1999]) is the following expression

$$(1) \qquad EXD = \frac{-TS\left[\frac{P-P^*}{P^*}\right]}{h} + u$$

u is a measure of random excess demand shocks due to trading imbalances, noise traders and other factors. P is the current price, P* is the long-run equilibrium value.

If h is positive (the costs of risky arbitrage exists), hu/TS=(P-P*)/P*

If we consider the right-hand side is very small, and use ln(1+(P-P*)/P*) to substitute it, then

P=P*e^(hu/TS)

The current price is affected by P* and u.

Therefore,

dP/P=dP*/P*+hdu/TS=v+hdu/TS

v are random shocks to the long-rum equilibrium values and du =u-u_{-1}

$[dP/P]_0 = v_f + hdTS/TS$

Where$[dP/P]_0$ is the announcement price effect from a firm's being added to the S&P 500 Index, and (hdTS/TS) is the fraction of tradable supply of the firm's shares that are removed from the market as a result of the acquisitions of S&P 500 index mutual funds.

Thus, the increase of stock price can be separated into 2 factors, the first is the long-rum equilibrium value, the second is the trading effects.

If we assume excess demand shocks and shocks to P* are uncorrelated and TS and h are constant

The standard deviation

SDDEV(dP/P)=sqrt(σ_v^2+$h^2\sigma_{du}$/TS^2)

So, the ratio of the post to pre announce standard deviation =f(h, θ_t)= sqrt[A+$h^2\sigma'^2_{du}/\sigma^2_{du}$(1-$\theta_t$)^2]/sqrt(A+$h^2$)

Where TS$'$= (1-θ)TS

A=TS^2 σ^2_v/σ^2_{du}

A is a positive constant.

If $\sigma'^2_{du}/\sigma^2_{du}(1-\theta_t)^2 > 1$, the ratio >1. And 1) trading volume appears to rise after the addition to SP500; 2) The tradable supply of a company's shares decreases post-addition. Therefore, the excess demand shocks lead to more price volatility, leading to an increase of risk-adjusted discount rate.

$$\frac{dP*}{P*} = -\phi \frac{\sigma^{POST}}{(\sigma^{PRE} - 1)},$$

Here, - φ reflect this increase effect of price volatility. So the permanent price may change even if the firm's future cash flows keep the same. And the value is decreased.

Using all the expressions above, we got

$$\mathbf{CAR} = \left[\frac{dP}{P}\right]_0 - \phi \frac{\sigma^{POST}}{(\sigma^{PRE} - 1)} - h\theta_t + \sum_1^T v_t + \frac{hu_T}{TS}$$

$$= v_f - \phi f(h, \theta_t) + \sum_1^T v_t + \frac{hu_T}{TS},$$

Where T is the terminal date of the CAR.

This model imply that 1) the average announcement price effect is rising over time(because θ_t increases) ; 2) the average increase in price volatility also should be rising; 3) due to a rising volatility, the permanent price increase should be falling.

By Daniel Cooper(2001), his cross-sectional evidence is silent about the source of fundamental effects, and the permanent price change also includes a price decrease that is related to the increased volatility of a company's stock returns post-addition, and the trading effects appear to be consistent with the theoretical arguments first raised by De Long et al (1990).

```
***BUFN745-Financial Programming Assignment #3;
***Author Luhao Wang 116089876;
***Date 2/16;
options ls=72 nodate nonumber;
libname worklib 'C:\Users\lhwang94\Desktop\SAS\lib';
*Import SP500_additions.csv into my SAS environment;
%let additions=C:/Users/lhwang94/Desktop/SAS/lib/SP500_additions.csv;
data d0;
infile "&additions" delimiter=',' MISSOVER DSD lrecl=32767 firstobs=1 ;
informat ticker $4. ;
informat effdate anydtdte. ;
format ticker $4. ;
format effdate date9. ;
input ticker $ effdate;
run;

*Add permno to d0,and create d;
proc sql;
create table d as
select distinct
d_tp.permno,
d0.*
from
d0,worklib.d_tp
where
d_tp.ticker=d0.ticker
order by
effdate;
run;
/*check if one ticker has two permno
data dd;
set d;
proc sort data=dd;
by ticker;
data worklib.dd;
```

```
set dd;
run;
*/

*connect to wrds;
%let wrds=wrds.wharton.upenn.edu 4016;
options comamid=TCP remote=WRDS;
signon username=_prompt_;
rsubmit;

libname crspsd '/wrds/crsp/sasdata/a_stock';
libname crspix '/wrds/crsp/sasdata/a_indexes';
libname worklib './data';
*upload d;
proc upload data=d out=worklib.d_unix;
run;
*download returns;
proc sql;
create table d_ret as
select distinct
dsf.ret,
dsf.date,
d_unix.*
from
crspsd.dsf,worklib.d_unix
where
d_unix.permno=dsf.permno and
"01JAN2002"d<=dsf.date<="31DEC2017"d;
proc download data=d_ret out=worklib.d_ret;
run;
*download market return;
data d_mkt;
set crspix.dsix;
where caldt>="01JAN2002"d and
caldt<="31DEC2017"d;
keep caldt vwretd;
```

```
run;
proc download data=d_mkt out=worklib.d_mkt(rename=(caldt=date));
run;
endrsubmit;
* Merge stock and market returns, get abnormal returns;
proc sort data=worklib.d_ret out=d_ret;
by date;
proc sort data=worklib.d_mkt out=d_mkt;
by date;
data d1;
merge d_ret d_mkt;
by date;
ar=ret-vwretd;
run;
* Compute cumulative abnormal returns;
proc sql;
create table d2 as
select
d1.ar,
d1.date,
d1.permno,
d.effdate
from
d1,d
where
d1.permno=d.permno and
d.effdate-25<=d1.date<=d.effdate+25
order by
permno,effdate,date;
proc print data=d2 (obs=120);
var permno effdate date ar;
format effdate date date9.;
run;
```

```
proc means data=d2 noprint;
var permno;
by permno effdate;
output out=d2_stats
n=num_before;
where date<effdate;
run;
data d3;*some n may lost here;
merge d2 d2_stats(keep=permno effdate num_before);
by permno effdate;
label num_before="n";
if first.effdate then
rel_day=-num_before;
else
rel_day=rel_day+1;
retain rel_day;
run;
data d4;
set d3;
if -10<=rel_day<=10;
run;
data d4;
set d4;
by permno effdate;
if first.permno then
car=ar;
else
car=car+ar;
retain car;
run;
* Get averages and plot graph;
proc sort data=d4;
by rel_day;
proc means data=d4 noprint;
var car ar;
output out=d4_stats
```

```
n(car)=ncar
mean(car)=acar
n(ar)=nar
mean(ar)=aar
t(ar)=tar
probt(ar)=par;
by rel_day;
run;
proc print data=d4_stats noobs label;
title 'AR around effdate';
var rel_day aar tar nar;
label
rel_day="Relative Day"
aar="Mean"
tar="t"
nar="# obs";
symbol1
color=green interpol=spline width=1 value=square;
axis1
label=('Event Time')
order=-10 to 10 by 1
width=3;
axis2
label=('CAR')
order=-0.005 to 0.01 by 0.002
width=3;
proc gplot data=d4_stats;
plot acar*rel_day/haxis=asix1 vaxis=axis2;
run;
```