```
1
2    /*
3    Proc options option=cpucount;
4    Run;
5    */
6    options cpuCount = actual;
7    options msglevel=i fullstimer;
8    options threads;
9
10   /********************************************************************
11   * Load the COMP_CRSP merged dataset---downloaded from WRDS CRSP
12   * Date: Mar 21,2024
13   * Location: C:\Users\lihon\Downloads\merge_back\crsp_comp_ccm.sas7bdat
14   * "Crsp_comp_ccm","12.8MB","Table","","20Mar2024:20:56:29"
15   * Variables: GVKEY DATADATE FYEAR
16               LPERMCO LPERMNO CONSOL INDFMT DATAFMT POPSRC CURCD COSTAT
17   */
18
19   data Crsp_comp_ccm;
20   set "C:\Users\lihon\Downloads\merge_back\crsp_comp_ccm_v1.sas7bdat";
21   run;
```

NOTE: There were 329697 observations read from the data set
      C:\Users\lihon\Downloads\merge_back\crsp_comp_ccm_v1.sas7bdat.
NOTE: The data set WORK.CRSP_COMP_CCM has 329697 observations and 11 variables.
NOTE: DATA statement used (Total process time):
      real time   1.01 seconds
      user cpu time   0.01 seconds
      system cpu time   0.04 seconds
      memory   1461.25k
      OS Memory   10988.00k
      Timestamp   06/01/2024 11:59:17 AM

```
22
23   /*
24   * Load the data to work directory, keep variables needed for event study merge;
25   * Load assignment.dta *
26   * April 1, 2024
27   */
28   PROC IMPORT OUT= WORK.assignment
29              DATAFILE= "D:\Research\patent\data\uspto\2022\assignment.dta"
30              DBMS=STATA REPLACE;
31
32   RUN;
```

NOTE: VARCHAR data type is not supported by the V9 engine. Variable cname has been
      converted to CHAR data type.
NOTE: VARCHAR data type is not supported by the V9 engine. Variable caddress_1 has bee
      converted to CHAR data type.
NOTE: VARCHAR data type is not supported by the V9 engine. Variable caddress_2 has bee
      converted to CHAR data type.
NOTE: VARCHAR data type is not supported by the V9 engine. Variable caddress_3 has bee
      converted to CHAR data type.
NOTE: VARCHAR data type is not supported by the V9 engine. Variable caddress_4 has bee
      converted to CHAR data type.
NOTE: VARCHAR data type is not supported by the V9 engine. Variable convey_text has
      been converted to CHAR data type.
NOTE: The import data set has 10046764 observations and 14 variables.
NOTE: WORK.ASSIGNMENT data set was successfully created.
NOTE: PROCEDURE IMPORT used (Total process time):
      real time   1:04.20
      user cpu time   33.73 seconds
      system cpu time   24.48 seconds
      memory   302800.37k
      OS Memory   356320.00k
      Timestamp   06/01/2024 12:00:22 PM
      Step Count   2 Switch Count 0


```
33   %importStata(infile="C:\Users\lihon\Downloads\merge_back\or_ee_trans_tax_state_co
     -
     180
33 ! try.dta",
```
WARNING: Apparent invocation of macro IMPORTSTATA not resolved.
ERROR 180-322: Statement is not valid or it is used out of proper order.

```
34              outfile=or_ee_trans_tax)

35   %macro contents(table);
36   Title "Varibales in table &table";
37   proc contents data= &table;
38   ods select variables;
39   run;
40   %mend contents;
41
```

```
42   %macro varList(table);
43   Title "Varibale list in table &table";
44   proc contents data= &table short varnum;
45   run;
46   %mend varList;

47
48   %macro unique_values(table, var_name1, var_name2);
49   Title "The count of total values and  unique variable &var_name1 and &var_name2
49 ! values from table &table";
50   proc sql;
51   select count(*) ,'total' as total from &table
52   union
53   select count(distinct &var_name1) as gvkey_N, "&var_name1" as uniq1 from  &table
54   union
55   select count(distinct &var_name2) as conm_N, "&var_name2" as unique_2 from &table
56   quit;
57   run;
58   %mend unique_values;
59   **************************************************************************;
60   * importStaat *;
61   * Load stata file to SAS WORK lib *;
62   *
63   * ;
64   **************************************************************************;
65   %macro importStata(infile=, outfile=);
66   PROC IMPORT OUT= WORK.&outfile
67               DATAFILE= &infile
68               DBMS=STATA REPLACE;
69   RUN;
70   %mend importStata;

71
72   %macro print30(infile, obs=30);
73   proc print data=&infile (obs=&obs);
74   run;
75   %mend print30;

76   %importStata(infile="C:\Users\lihon\Downloads\merge_back\or_ee_trans_tax_state_co
76 ! try.dta",
77               outfile=or_ee_trans_tax)
```

NOTE: VARCHAR data type is not supported by the V9 engine. Variable ee_name has been
      converted to CHAR data type.
NOTE: VARCHAR data type is not supported by the V9 engine. Variable ee_state has been
      converted to CHAR data type.
NOTE: VARCHAR data type is not supported by the V9 engine. Variable ee_country has bee
      converted to CHAR data type.
NOTE: VARCHAR data type is not supported by the V9 engine. Variable or_name has been
      converted to CHAR data type.
NOTE: VARCHAR data type is not supported by the V9 engine. Variable ee_gvkey has been
      converted to CHAR data type.
NOTE: VARCHAR data type is not supported by the V9 engine. Variable or_gvkey has been
      converted to CHAR data type.
NOTE: VARCHAR data type is not supported by the V9 engine. Variable or_state has been
      converted to CHAR data type.

NOTE: VARCHAR data type is not supported by the V9 engine. Variable or_fic has been
      converted to CHAR data type.
NOTE: VARCHAR data type is not supported by the V9 engine. Variable or_naics has been
      converted to CHAR data type.
NOTE: VARCHAR data type is not supported by the V9 engine. Variable ee_state2 has been
      converted to CHAR data type.
NOTE: VARCHAR data type is not supported by the V9 engine. Variable or_country has bee
      converted to CHAR data type.
NOTE: The import data set has 200806 observations and 28 variables.
NOTE: WORK.OR_EE_TRANS_TAX data set was successfully created.
NOTE: PROCEDURE IMPORT used (Total process time):
      real time   1.48 seconds
      user cpu time   0.50 seconds
      system cpu time   0.43 seconds
      memory   1150.90k
      OS Memory   13532.00k
      Timestamp   06/01/2024 12:02:11 PM
      Step Count   3 Switch Count 0

78   data or_ee_trans_tax;
79   /*set "C:\Users\lihon\Downloads\merge_back\or_ee_trans_tax.sas7bdat"(keep
80   =rf_id ee_name or_name exec_dt or_gvkey relation);*/
81   set or_ee_trans_tax(
82   keep=rf_id ee_name or_name exec_dt or_gvkey relation
82 ! deciles_for foreign_tran);
83   exec_year = year(exec_dt);
84   run;

NOTE: Missing values were generated as a result of performing an operation on missing
      values.
      Each place is given by: (Number of times) at (Line):(Column).
      87 at 83:35
NOTE: There were 200806 observations read from the data set WORK.OR_EE_TRANS_TAX.
NOTE: The data set WORK.OR_EE_TRANS_TAX has 200806 observations and 9 variables.
NOTE: DATA statement used (Total process time):
      real time   0.40 seconds
      user cpu time   0.03 seconds
      system cpu time   0.21 seconds
      memory   643.34k
      OS Memory   13296.00k
      Timestamp   06/01/2024 12:02:18 PM
      Step Count   4 Switch Count 0

85   proc sort data= or_ee_trans_tax
86   out = or_ee_trans_sort NODUPKEY;
87   by rf_id or_name exec_dt;
88   run;

NOTE: There were 200806 observations read from the data set WORK.OR_EE_TRANS_TAX.
NOTE: SAS threaded sort was used.
NOTE: 62410 observations with duplicate key values were deleted.
NOTE: The data set WORK.OR_EE_TRANS_SORT has 138396 observations and 9 variables.

```
NOTE: PROCEDURE SORT used (Total process time):
      real time           1.15 seconds
      user cpu time       0.26 seconds
      system cpu time     0.32 seconds
      memory              128767.00k
      OS Memory           140944.00k
      Timestamp           06/01/2024 12:02:25 PM
      Step Count                        5  Switch Count  0


89   sasfile Crsp_comp_ccm load;
NOTE: The file WORK.CRSP_COMP_CCM.DATA has been loaded into memory by the SASFILE
      statement.
90   proc sql;
90 !            * with 327470 rows and 11 columns.;
91   create table or_ee_trans_permno1 as
92   select rf_id
93          ,or_name
94          ,exec_dt
95          ,exec_year
96          ,or_gvkey
97          ,relation
98          ,lpermno as permno
99          ,lpermco as permco
100         ,fyear
101         ,datadate
102         ,costat
103         ,deciles_for
104         ,foreign_tran
105         from or_ee_trans_sort as a
106             left join
107             Crsp_comp_ccm as b
108             on a.or_gvkey=b.gvkey
109                 AND fyear-2 LE exec_year LE fyear+1 ;
NOTE: SAS threaded sort was used.
NOTE: Table WORK.OR_EE_TRANS_PERMNO1 created, with 361576 rows and 13 columns.

110   quit;
NOTE: PROCEDURE SQL used (Total process time):
      real time           1.25 seconds
      user cpu time       0.76 seconds
      system cpu time     0.21 seconds
      memory              39215.25k
      OS Memory           76380.00k
      Timestamp           06/01/2024 12:02:36 PM
      Step Count                        6  Switch Count  0


111   run;
112   sasfile Crsp_comp_ccm close;
NOTE: The file WORK.CRSP_COMP_CCM.DATA has been closed by the SASFILE statement.
113   proc sort data = or_ee_trans_permno1 NODUPKEY
114             out  = or_ee_trans_permno2 ;
115      by rf_id or_name exec_dt permno;
116   run;
```

```
NOTE: There were 361576 observations read from the data set WORK.OR_EE_TRANS_PERMNO1.
NOTE: SAS threaded sort was used.
NOTE: 221507 observations with duplicate key values were deleted.
NOTE: The data set WORK.OR_EE_TRANS_PERMNO2 has 140069 observations and 13 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.40 seconds
      user cpu time       0.43 seconds
      system cpu time     0.32 seconds
      memory              177183.12k
      OS Memory           191596.00k
      Timestamp           06/01/2024 12:02:41 PM
      Step Count                        7  Switch Count  0


117  proc sql;
118    create table for_event_study1 as
119    select a.rf_id as rf_id
120          ,permno
121          ,relation
122          ,deciles_for
123          ,foreign_tran
124          ,exec_dt
125          ,record_dt
126          ,or_name
127          ,a.or_gvkey as or_gvkey
128          from or_ee_trans_permno2 as a
129              inner join assignment as b
130              on a.rf_id =b.rf_id
131              where NOT missing(permno) and relation=1
132              ;
NOTE: Table WORK.FOR_EVENT_STUDY1 created, with 27651 rows and 9 columns.

133   quit;
NOTE: PROCEDURE SQL used (Total process time):
      real time           9.51 seconds
      user cpu time       3.57 seconds
      system cpu time     5.67 seconds
      memory              5790.56k
      OS Memory           20988.00k
      Timestamp           06/01/2024 12:02:57 PM
      Step Count                        8  Switch Count  0



134  run;

135  proc sort data = for_event_study1
136          out  = for_event_study_v2  NODUPKEYS;
137          by permno record_dt;
138  run;

NOTE: There were 27651 observations read from the data set WORK.FOR_EVENT_STUDY1.
NOTE: SAS sort was used.
NOTE: 8777 observations with duplicate key values were deleted.
NOTE: The data set WORK.FOR_EVENT_STUDY_V2 has 18874 observations and 9 variables.
```

```
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.03 seconds
      user cpu time       0.01 seconds
      system cpu time     0.01 seconds
      memory              8726.15k
      OS Memory           24092.00k
      Timestamp           06/01/2024 12:03:15 PM
      Step Count                        9  Switch Count  0


139  data for_event_study_relation;
140      format permno record_dt;
141      set for_event_study_v2 ( where= (NOT missing(permno) )
142                               keep=permno record_dt
143                             );
144  run;

NOTE: There were 18874 observations read from the data set WORK.FOR_EVENT_STUDY_V2.
      WHERE not MISSING(permno);
NOTE: The data set WORK.FOR_EVENT_STUDY_RELATION has 18874 observations and 2 variable
NOTE: DATA statement used (Total process time):
      real time           0.03 seconds
      user cpu time       0.01 seconds
      system cpu time     0.01 seconds
      memory              646.53k
      OS Memory           16116.00k
      Timestamp           06/01/2024 12:03:24 PM
      Step Count                       10  Switch Count  0


NOTE: A byte-order mark in the file
      "C:\Users\lihon\Downloads\sas_code\mergecode\after_merge_postProcessing.sas" (fo
      fileref "#LN00064") indicates that the data is encoded in "utf-8".  This encodin
      will be used to process the file.
NOTE: A byte-order mark in the file
      "C:\Users\lihon\Downloads\sas_code\mergecode\after_merge_postProcessing.sas" (fo
      fileref "#LN00064") indicates that the data is encoded in "utf-8".  This encodin
      will be used to process the file.
The operation was canceled by the user.
145  libname mergback "C:\Users\lihon\Downloads\merge_back";
NOTE: Libref MERGBACK refers to the same physical library as TMP4.
NOTE: Libref MERGBACK was successfully assigned as follows:
      Engine:        V9
      Physical Name: C:\Users\lihon\Downloads\merge_back
146  /*https://wrds-www.wharton.upenn.edu/pages/support/applications/event-studies/eve
146! -study-research-application/*/
147
148  /* ********************************************************************************
149  /* ********* W R D S   R E S E A R C H   A P P L I C A T I O N S **************
150  /* ********************************************************************************
151  /* Program : EVTSTUDY.SAS
152  /* Summary : Provides a sample methodology for calculating Cumulative
153  /*           Abnormal Returns(CARs)& Buy-Hold Abnormal Returns(BHARs)
154  /*           with various t-statistics (CS test, Standardized CS test&Patell Z)
155  /*           in an event study setting. Displays the dynamics of mean CARs and
```

```
156  /*            BHARs in the event window specified by the user
157  /*
158  /* Date    : Sep 2011
159  /* Author  : Denys Glushkov, WRDS
160  /* *************************************************************************

161
162  /* STEP 1A: Speficify the parameters necessary to run the event study such as
163  /* the length of estimation period and event window, gap b/w estimation & event
164  /* window, etc
165  *%libname mycrsp "C:\Users\hli5\OneDrive - Kent State University\aaaa\event_Study
166  libname mycrsp "C:\Users\lihon\patent Dropbox\Victor Li\wrds_data";
NOTE: Libref MYCRSP was successfully assigned as follows:
     Engine:        V9
     Physical Name: C:\Users\lihon\patent Dropbox\Victor Li\wrds_data
167  %let crsp=mycrsp; /*CRSP libary to be used (CRSPQ - quarterly, CRSP-annual update
167! */
168  %let estper=150; /*Length of the estimation period in trading days over which
169                   /*the risk model is estimated
170
171  %let start=-2; /*Beginning of the event window (wtr to the event date,e.g. -2)
172  %let end=2;    /*End of the event window (relative to the event date, e.g., +1)
173  %let gap=30;   /*Length of pre-event window,i.e., number of trading days b/w
174                   /*the end of estimation period and the start of the event window
175
176  %let minest=70; /*Minimum of non-missing returns required for estimation        *
177  %let evtwin=%eval(&end-&start+1);      /*length of event window in trading days
178
179  /* STEP 1B: As an example, create the input table containing Permno-event dates
180  /* corresponding to the stock additions to and deletions from S&P 500 index
181
182
183  *  %event_crack(relation_exec) ;
184  * %let permno_list=relation_exec;
185  *%let permno_list=foreign_relation;
186  %let permno_list=For_event_study1;
187  *%macro event_crack(permno_list, evt_date=exec_dt);
188
189  proc sql;
190    create table input
191    as select distinct permno, record_dt as edate format MMDDYY10.
192    from &permno_list where not missing(&start) and year(record_dt);
NOTE: SAS threaded sort was used.
NOTE: Table WORK.INPUT created, with 18874 rows and 2 columns.

193  quit;
NOTE: PROCEDURE SQL used (Total process time):
     real time           0.34 seconds
     user cpu time       0.07 seconds
     system cpu time     0.01 seconds
     memory              27543.46k
     OS Memory           67188.00k
     Timestamp           06/04/2024 09:52:15 AM
     Step Count                        11  Switch Count  0
```

```sas
194
195   /* STEP 2. Creating Trading Calendar that accounts for the presence of  */
196   /* weekends, holidays and other non-trading days in the estimation      */
197   /* and event windows                                                    */
198   data caldates;
199
200    merge &crsp..dsi(keep=date rename=(date=estper_beg))
201      &crsp..dsi(keep=date firstobs=&estper rename=(date=estper_end))
202      &crsp..dsi(keep=date firstobs=%eval(&estper+&gap+1) rename=(date=evtwin_beg))
203      &crsp..dsi(keep=date firstobs=%eval(&estper+&gap-&start+1)
203! rename=(date=evtdate))
204      &crsp..dsi(keep=date firstobs=%eval(&estper+&gap+&evtwin)
204! rename=(date=evtwin_end));
```

INFO: Data file MYCRSP.DSI.DATA is in a format that is native to another host, or the file encoding does not match the session encoding. Cross Environment Data Access will be used, which might require additional CPU resources and might reduce performance.
INFO: Data file MYCRSP.DSI.DATA is in a format that is native to another host, or the file encoding does not match the session encoding. Cross Environment Data Access will be used, which might require additional CPU resources and might reduce performance.
INFO: Data file MYCRSP.DSI.DATA is in a format that is native to another host, or the file encoding does not match the session encoding. Cross Environment Data Access will be used, which might require additional CPU resources and might reduce performance.
INFO: Data file MYCRSP.DSI.DATA is in a format that is native to another host, or the file encoding does not match the session encoding. Cross Environment Data Access will be used, which might require additional CPU resources and might reduce performance.
INFO: Data file MYCRSP.DSI.DATA is in a format that is native to another host, or the file encoding does not match the session encoding. Cross Environment Data Access will be used, which might require additional CPU resources and might reduce performance.

```sas
205
206    format estper_beg estper_end evtwin_beg evtdate evtwin_end date9.;
207    label  estper_beg='Start of the Estimation Window'
208           estper_end='End of the Estimation Window'
209           evtwin_beg='Start of the Event Window'
210           evtwin_end='End of the Event Window'
211           evtdate='Event Date';
212     index+1;
213    if nmiss(estper_beg,estper_end,evtwin_beg,evtwin_end,evtdate)=0;
214   run;
```

NOTE: There were 25799 observations read from the data set MYCRSP.DSI.
NOTE: There were 25650 observations read from the data set MYCRSP.DSI.
NOTE: There were 25619 observations read from the data set MYCRSP.DSI.
NOTE: There were 25617 observations read from the data set MYCRSP.DSI.
NOTE: There were 25615 observations read from the data set MYCRSP.DSI.
NOTE: The data set WORK.CALDATES has 25615 observations and 6 variables.
NOTE: DATA statement used (Total process time):
      real time   0.26 seconds
      user cpu time   0.07 seconds
      system cpu time   0.03 seconds
      memory   1856.43k
      OS Memory   41704.00k
      Timestamp   06/04/2024 09:52:15 AM
      Step Count   12 Switch Count 0

```
215
216  /*STEP 3: If event date is a non-trading day*/
217  /*      select the closest trading day that*/
218  /* follows the event day
219  proc sql;
219!          create table temp
220   as select a.permno
221              ,b.*
222    from input a
223        left join
224        caldates b
225    on b.evtdate-a.edate>=0
226    group by a.edate
227    having (b.evtdate-a.edate)=min(b.evtdate-a.edate);
NOTE: The execution of this query involves performing one or more Cartesian product
      joins that can not be optimized.
NOTE: The query requires remerging summary statistics back with the original data.
NOTE: SAS threaded sort was used.
NOTE: Table WORK.TEMP created, with 18874 rows and 7 columns.

228
229
230    /*Returns for sample securities around the event dates */
NOTE: PROCEDURE SQL used (Total process time):
      real time           44.89 seconds
      user cpu time       1:02.70
      system cpu time     10.73 seconds
      memory              4992879.70k
      OS Memory           5032012.00k
      Timestamp           06/04/2024 09:53:00 AM
      Step Count                        13  Switch Count  0


231    proc sql;
232    create table evtrets_temp
233    as select a.permno, a.date format date9., a.ret as ret1,
234            b.evtdate, b.estper_beg, b.estper_end,
235            b.evtwin_beg, b.evtwin_end
236    from &crsp..dsf a, temp b
237    where a.permno=b.permno and b.estper_beg<=a.date<=b.evtwin_end;
INFO: Data file MYCRSP.DSF.DATA is in a format that is native to another host, or the
file encoding does not match the session encoding. Cross Environment Data Access will
be used, which might require additional CPU resources and might reduce performance.
NOTE: Table WORK.EVTRETS_TEMP created, with 3259356 rows and 8 columns.

238    quit;
NOTE: PROCEDURE SQL used (Total process time):
      real time           44.02 seconds
      user cpu time       43.15 seconds
      system cpu time     0.82 seconds
      memory              5927.31k
      OS Memory           46828.00k
      Timestamp           06/04/2024 09:53:44 AM
      Step Count                        14  Switch Count  0
```

```
239   /* Merge in the risk factors                                      */
240   /* User can create her own risk factors and use it instead of FF+M ones*/
241    proc sql;
242   create view evtrets1
243     as select a.*, (b.mktrf+b.rf) as mkt, b.mktrf, b.rf,b.smb, b.hml, b.umd
244     from evtrets_temp a left join
245         &crsp..ff_factors_daily (keep=date mktrf smb hml umd rf) b
246     on a.date=b.date;
NOTE: SQL view WORK.EVTRETS1 has been defined.
247      quit;
NOTE: PROCEDURE SQL used (Total process time):
      real time           0.04 seconds
      user cpu time       0.01 seconds
      system cpu time     0.01 seconds
      memory              101.65k
      OS Memory           41704.00k
      Timestamp           06/04/2024 09:53:44 AM
      Step Count                        15  Switch Count  0


248   /*Bring in delisting returns*/
249      proc sql;
250   create table evtrets (drop=ret1 where=(not missing(mkt)))
251     as select a.*,
252     (1+a.ret1)*sum(1,b.dlret)-1-a.mkt as exret label='Market-adjusted total ret',
253     (1+a.ret1)*sum(1,b.dlret)-1 as ret "Ret adjusted for delisting"
254     from evtrets1 a left join &crsp..dsedelist (where=(missing(dlret)=0)) b
255     on a.permno=b.permno and a.date=b.dlstdt
256   order by a.permno,a.evtdate,a.date;
INFO: Data file MYCRSP.FF_FACTORS_DAILY.DATA is in a format that is native to another
host, or the file encoding does not match the session encoding. Cross Environment Data
Access will be used, which might require additional CPU resources and might reduce
performance.
INFO: Data file MYCRSP.DSEDELIST.DATA is in a format that is native to another host, o
the file encoding does not match the session encoding. Cross Environment Data Access
will be used, which might require additional CPU resources and might reduce performanc
NOTE: SAS threaded sort was used.
NOTE: Table WORK.EVTRETS created, with 3259356 rows and 15 columns.

257  quit;
NOTE: PROCEDURE SQL used (Total process time):
      real time           5.40 seconds
      user cpu time       9.06 seconds
      system cpu time     2.28 seconds
      memory              549582.23k
      OS Memory           588024.00k
      Timestamp           06/04/2024 09:53:50 AM
      Step Count                        16  Switch Count  0


258
259  /* STEP 4. Estimating Factor Exposures over the estimation period*/
260  proc printto log=junk; run;
```

```
ERROR: Insufficient authorization to access C:\Windows\system32\junk.log.
NOTE: The SAS System stopped processing this step because of errors.
NOTE: PROCEDURE PRINTTO used (Total process time):
      real time              0.00 seconds
      user cpu time          0.00 seconds
      system cpu time        0.00 seconds
      memory                 132.93k
      OS Memory              42216.00k
      Timestamp              06/04/2024 09:53:50 AM
      Step Count                           17  Switch Count  0

261


262  proc reg data=evtrets edf outest=params  noprint;
NOTE: Writing HTML Body file: sashtml.htm
263     where estper_beg<=date<=estper_end;
264     by permno evtdate;
265     eq0: model exret=;       /*past market-premium return: ret-mkt as a benchmark*/
266     eq1: model ret=mktrf;   /*  CAPM      */
267     eq2: model ret=mktrf smb hml; /* FF 3 factor **/
268     eq3: model ret=mktrf smb hml umd; /*FF 4 factor */
269  run;


ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=12799 Event Date=18JAN2023
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=12799 Event Date=03FEB2023
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=27167 Event Date=22OCT2014
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=27167 Event Date=30OCT2014
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=27167 Event Date=03NOV2014
```

```
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=27167 Event Date=18DEC2014
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=27167 Event Date=17JUN2015
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=32791 Event Date=05MAY2016
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=32791 Event Date=15JUL2020
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=40695 Event Date=03APR2000
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=52250 Event Date=11JAN2002
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=64785 Event Date=28MAY1996
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=75760 Event Date=13JAN1997
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=77208 Event Date=12NOV2008
ERROR: No valid observations are found.
```

```
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=77324 Event Date=14AUG1998
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=78001 Event Date=05APR2010
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=78001 Event Date=27MAY2010
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=78179 Event Date=27APR2012
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=79837 Event Date=25NOV1998
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=80993 Event Date=01DEC1994
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=84521 Event Date=31AUG2007
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=84757 Event Date=04APR2017
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=88987 Event Date=07AUG2019
ERROR: No valid observations are found.
ERROR: No valid observations are found.
```

ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=89833 Event Date=18DEC2009
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=91612 Event Date=14OCT2013
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=92683 Event Date=14NOV2019
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=92683 Event Date=21DEC2020
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=92683 Event Date=18MAR2021
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=92683 Event Date=25MAR2021
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
ERROR: No valid observations are found.
NOTE: The above message was for the following BY group:
      PERMNO=92683 Event Date=18NOV2021
NOTE: Interactivity disabled with BY processing.
NOTE: PROCEDURE REG used (Total process time):
      real time   6.10 seconds
      user cpu time   3.45 seconds
      system cpu time   0.56 seconds
      memory   7094.35k
      OS Memory   43500.00k
      Timestamp   06/04/2024 09:53:56 AM
      Step Count   18 Switch Count 0

NOTE: The data set WORK.PARAMS has 70884 observations and 17 variables.

270 proc printto;run;

NOTE: PROCEDURE PRINTTO used (Total process time):

```
real time            0.00 seconds
user cpu time        0.00 seconds
system cpu time      0.00 seconds
memory               6.68k
OS Memory            43240.00k
Timestamp            06/04/2024 09:53:56 AM
Step Count                      19  Switch Count  0
```

```
271
272
273  /* STEP 5. Calculating Abnormal Returns for all models */
274  /* for each trading day in the event window           */
275  data abrets1/view=abrets1; merge
276    evtrets(where=(evtwin_beg<=date<=evtwin_end) in=in_evtrets)
277    params (where=(_model_='eq0')
278       keep=permno evtdate _model_ _rmse_ _p_ _edf_
279       rename=(_rmse_=std0 _p_=p0 _edf_=edf0))
280
281    params (where=(_model_='eq1')
282       keep=permno evtdate _model_ _rmse_ intercept mktrf
283       rename=(_rmse_=std1 intercept=alpha1 mktrf=beta1))
284
285    params (where=(_model_='eq2')
286       keep=permno evtdate _model_ _rmse_ intercept mktrf smb hml
287       rename=(_rmse_=std2 intercept=alpha2 mktrf=beta2 smb=sminb2 hml=hminl2))
288
289    params (where=(_model_='eq3')
290       keep=permno evtdate _model_ _rmse_ intercept mktrf smb hml umd
291       rename=(_rmse_=std3 intercept=alpha3 mktrf=beta3 smb=sminb3 hml=hminl3
291! umd=umind3));
292    by permno evtdate;
293
294    retain missret;
295    if first.permno then missret=missing(ret);
296    if missing(ret) then missret+1; /*count number of missing returns*/
297
298    var0=std0**2;
299    var1=std1**2;
300    var2=std2**2;
301    var3=std3**2;
302
303    abret0  = exret; *extra over market;
304    expret1 = alpha1 + beta1*mktrf;  *CAPM;
305    abret1  = ret-expret1;
306
307    expret2 = alpha2+beta2*mktrf+sminb2*smb+hminl2*hml;
308    abret2=ret-expret2;
309
310    expret3 =alpha3+beta3*mktrf+sminb3*smb+hminl3*hml+umind3*umd;
311    abret3=ret-expret3;
312
313   nobs=p0+edf0;  /*number of observations used in estimation*/
314   drop p0 edf0 estper_beg estper_end std0 std1 std2 std3 _model_ exret;
315   if in_evtrets and nobs>&minest;
```

```
316   run;

NOTE: DATA STEP view saved on file WORK.ABRETS1.
NOTE: A stored DATA STEP view cannot run under a different operating system.
NOTE: DATA statement used (Total process time):
      real time           0.12 seconds
      user cpu time       0.00 seconds
      system cpu time     0.01 seconds
      memory              1339.68k
      OS Memory           43500.00k
      Timestamp           06/04/2024 09:53:56 AM
      Step Count                        20  Switch Count  0


317
318   /* Transform dates to event time using CRSP Trading Calendar      */
319   /* Using the latter takes into account non-consecutive date records*/
320   /* do not use lag to avoid non-consecutive date records*/
321   proc sql;
322     create table abrets
323       as select a.*, (b.index-c.index) as evttime
324     from            abrets1 a
325         left join  caldates b
326     on a.date     = b.evtdate
327          left join caldates c
328     on a.evtdate = c.evtdate
329     order by permno, evtdate, date;
NOTE: SAS threaded sort was used.
INFO: The variable _MODEL_ on data set WORK.PARAMS will be overwritten by data set
      WORK.PARAMS.
INFO: The variable _MODEL_ on data set WORK.PARAMS will be overwritten by data set
      WORK.PARAMS.
INFO: The variable _MODEL_ on data set WORK.PARAMS will be overwritten by data set
      WORK.PARAMS.
INFO: The variable _MODEL_ on data set WORK.PARAMS will be overwritten by data set
      WORK.PARAMS.
INFO: The variable _MODEL_ on data set WORK.PARAMS will be overwritten by data set
      WORK.PARAMS.
INFO: The variable _MODEL_ on data set WORK.PARAMS will be overwritten by data set
      WORK.PARAMS.
NOTE: Missing values were generated as a result of performing an operation on missing
      values.
      Each place is given by: (Number of times) at (Line):(Column).
      301 at 383:12   307 at 384:12   315 at 385:12   320 at 386:12   589 at 389:27
      642 at 390:16   589 at 392:25   642 at 393:13   589 at 395:24   642 at 396:13
      295 at 398:10
NOTE: View WORK.ABRETS1.VIEW used (Total process time):
      real time           1.17 seconds
      user cpu time       1.04 seconds
      system cpu time     0.53 seconds
      memory              56450.43k
      OS Memory           98696.00k
      Timestamp           06/04/2024 09:53:58 AM
      Step Count                        21  Switch Count  390
```

```
NOTE: There were 87673 observations read from the data set WORK.EVTRETS.
      WHERE (evtwin_beg<=date) and (date<=evtwin_end);
NOTE: There were 17721 observations read from the data set WORK.PARAMS.
      WHERE _model_='eq0';
NOTE: There were 17721 observations read from the data set WORK.PARAMS.
      WHERE _model_='eq1';
NOTE: There were 17721 observations read from the data set WORK.PARAMS.
      WHERE _model_='eq2';
NOTE: There were 17721 observations read from the data set WORK.PARAMS.
      WHERE _model_='eq3';
NOTE: Table WORK.ABRETS created, with 87063 rows and 37 columns.

330  quit;
NOTE: PROCEDURE SQL used (Total process time):
      real time           1.34 seconds
      user cpu time       1.06 seconds
      system cpu time     0.57 seconds
      memory              56450.43k
      OS Memory           98696.00k
      Timestamp           06/04/2024 09:53:58 AM
      Step Count                        21  Switch Count  391


331
332  /*
333  proc contents data=abrets short varnum;
334  run;
335  */
336  proc sort data=abrets  nodupkey;
337    by PERMNO evtdate DATE
338       evtwin_beg evtwin_end
339       mkt mktrf rf smb hml umd ret
340       alpha1 beta1
341       alpha2 beta2 sminb2 hminl2
342       alpha3 beta3 sminb3 hminl3 umind3
343       missret var0 var1 var2 var3
344       abret0 expret1 abret1 expret2 abret2 expret3 abret3 nobs evttime ;
345  run;

NOTE: There were 87063 observations read from the data set WORK.ABRETS.
NOTE: SAS sort was used.
NOTE: 280 observations with duplicate key values were deleted.
NOTE: The data set WORK.ABRETS has 86783 observations and 37 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.15 seconds
      user cpu time       0.09 seconds
      system cpu time     0.06 seconds
      memory              52376.56k
      OS Memory           97564.00k
      Timestamp           06/04/2024 09:53:58 AM
      Step Count                        22  Switch Count  0


346
347  /* 673  proc sql;
```

```
348  674    create table abrets as
349  675    select distinct * from abrets;
350  WARNING: This CREATE TABLE statement recursively references the target table. A
350! consequence of this
351          is a possible data integrity problem.
352  NOTE: Table WORK.ABRETS created, with 253797 rows and 37 columns.
353
354    */
355  /* Calculating Rolling Cumulative Abnormal Returns and various stats */
356  /* Transformout= calculates cumulative product of gross returns and  */
357  /* subtracts 1 to arrive at the total net cumulative return          */
358  proc expand data=abrets
359           out=car  /* Cumulative returns*/
360           method=none;
361    by permno evtdate;
362    id date;
363    convert ret=cret/transformout=(+1 cuprod -1);       /*actural cumulative
363! return from CRSP*/
364    convert mkt=cmkt/transformout=(+1 cuprod -1);       /*cumulative  market
364! return*/
365
366    /*cumulative market model return: expret1= alpha1 + beta1*mktrf; */
367    convert expret1 =cexpret1 /transformout=(+1 cuprod -1);
368
369    /*expret2 = alpha2+ beta2*mktrf+ sminb2*smb+ hminl2*hml; */
370    convert expret2 =cexpret2 /transformout=(+1 cuprod -1); /*cumulative FF-3 facto
370! return */
371
372    /*  expret3 =alpha3+beta3*mktrf+sminb3*smb+hminl3*hml+umind3*umd; */
373    convert expret3 =cexpret3 /transformout=(+1 cuprod -1);/*cumulative FF-4 factor
373! return */
374
375    convert abret0=car0/transformout=(sum);
376    convert abret1=car1/transformout=(sum);
377    convert abret2=car2/transformout=(sum);
378    convert abret3=car3/transformout=(sum);
379  run;

WARNING: The variable ret has only 0 nonmissing observations, which is too few to appl
         the conversion method. The result series is set to missing.
WARNING: The variable abret0 has only 0 nonmissing observations, which is too few to
         apply the conversion method. The result series is set to missing.
WARNING: The variable abret1 has only 0 nonmissing observations, which is too few to
         apply the conversion method. The result series is set to missing.
WARNING: The variable abret2 has only 0 nonmissing observations, which is too few to
         apply the conversion method. The result series is set to missing.
WARNING: The variable abret3 has only 0 nonmissing observations, which is too few to
         apply the conversion method. The result series is set to missing.
NOTE: The above message was for the following BY group:
      PERMNO=12789 Event Date=31OCT2022
WARNING: The variable ret has only 0 nonmissing observations, which is too few to appl
         the conversion method. The result series is set to missing.
WARNING: The variable abret0 has only 0 nonmissing observations, which is too few to
         apply the conversion method. The result series is set to missing.
WARNING: The variable abret1 has only 0 nonmissing observations, which is too few to
```

```
              apply the conversion method. The result series is set to missing.
WARNING: The variable abret2 has only 0 nonmissing observations, which is too few to
              apply the conversion method. The result series is set to missing.
WARNING: The variable abret3 has only 0 nonmissing observations, which is too few to
              apply the conversion method. The result series is set to missing.
NOTE: The above message was for the following BY group:
        PERMNO=25961 Event Date=24DEC2002
WARNING: The variable ret has only 0 nonmissing observations, which is too few to appl
              the conversion method. The result series is set to missing.
WARNING: The variable abret0 has only 0 nonmissing observations, which is too few to
              apply the conversion method. The result series is set to missing.
WARNING: The variable abret1 has only 0 nonmissing observations, which is too few to
              apply the conversion method. The result series is set to missing.
WARNING: The variable abret2 has only 0 nonmissing observations, which is too few to
              apply the conversion method. The result series is set to missing.
WARNING: The variable abret3 has only 0 nonmissing observations, which is too few to
              apply the conversion method. The result series is set to missing.
NOTE: The above message was for the following BY group:
        PERMNO=59256 Event Date=10AUG2001
WARNING: The variable ret has only 0 nonmissing observations, which is too few to appl
              the conversion method. The result series is set to missing.
WARNING: The variable abret0 has only 0 nonmissing observations, which is too few to
              apply the conversion method. The result series is set to missing.
WARNING: The variable abret1 has only 0 nonmissing observations, which is too few to
              apply the conversion method. The result series is set to missing.
WARNING: The variable abret2 has only 0 nonmissing observations, which is too few to
              apply the conversion method. The result series is set to missing.
WARNING: The variable abret3 has only 0 nonmissing observations, which is too few to
              apply the conversion method. The result series is set to missing.
NOTE: The above message was for the following BY group:
        PERMNO=77763 Event Date=25OCT2019
WARNING: The variable ret has only 0 nonmissing observations, which is too few to appl
              the conversion method. The result series is set to missing.
WARNING: The variable abret0 has only 0 nonmissing observations, which is too few to
              apply the conversion method. The result series is set to missing.
WARNING: The variable abret1 has only 0 nonmissing observations, which is too few to
              apply the conversion method. The result series is set to missing.
WARNING: The variable abret2 has only 0 nonmissing observations, which is too few to
              apply the conversion method. The result series is set to missing.
WARNING: The variable abret3 has only 0 nonmissing observations, which is too few to
              apply the conversion method. The result series is set to missing.
NOTE: The above message was for the following BY group:
        PERMNO=84529 Event Date=11APR2003
WARNING: The variable ret has only 0 nonmissing observations, which is too few to appl
              the conversion method. The result series is set to missing.
WARNING: The variable abret0 has only 0 nonmissing observations, which is too few to
              apply the conversion method. The result series is set to missing.
WARNING: The variable abret1 has only 0 nonmissing observations, which is too few to
              apply the conversion method. The result series is set to missing.
WARNING: The variable abret2 has only 0 nonmissing observations, which is too few to
              apply the conversion method. The result series is set to missing.
WARNING: The variable abret3 has only 0 nonmissing observations, which is too few to
              apply the conversion method. The result series is set to missing.
NOTE: The above message was for the following BY group:
        PERMNO=87634 Event Date=29AUG2003
```

WARNING: The variable ret has only 0 nonmissing observations, which is too few to appl
         the conversion method. The result series is set to missing.
WARNING: The variable abret0 has only 0 nonmissing observations, which is too few to
         apply the conversion method. The result series is set to missing.
WARNING: The variable abret1 has only 0 nonmissing observations, which is too few to
         apply the conversion method. The result series is set to missing.
WARNING: The variable abret2 has only 0 nonmissing observations, which is too few to
         apply the conversion method. The result series is set to missing.
WARNING: The variable abret3 has only 0 nonmissing observations, which is too few to
         apply the conversion method. The result series is set to missing.
NOTE: The above message was for the following BY group:
      PERMNO=89833 Event Date=24FEB2009
NOTE: The data set WORK.CAR has 86783 observations and 46 variables.
NOTE: PROCEDURE EXPAND used (Total process time):
      real time   1.00 seconds
      user cpu time   0.62 seconds
      system cpu time   0.32 seconds
      memory   971.18k
      OS Memory   46576.00k
      Timestamp   06/04/2024 09:53:59 AM
      Step Count   23 Switch Count 0

380 /*
381 proc contents data =car;
382
383
384 proc contents data =car;
385 ods select Variables;
386 run;
387 */
388
389
390 /* Car_Evtdate Table: */
391 /* the cross-sectional output that contains for each   */
392 /* "firm-event date":   */
393 /*   1) CAR, BHAR, and SCAR (standardized CAR)   */
394 /*   2) Alpha and Beta from the estimation period   */
395 /*   3) Estimation period variance   */
396
397 /* Car_Evtwin Table contains Raw, Abnormal, Std. and Buy-and-Hold Abnormal */
398 /* Daily Returns "firm-date" in event time   */
399 proc printto log=junk;run;

ERROR: Insufficient authorization to access C:\Windows\system32\junk.log.
NOTE: The SAS System stopped processing this step because of errors.
NOTE: PROCEDURE PRINTTO used (Total process time):
      real time   0.00 seconds
      user cpu time   0.00 seconds
      system cpu time   0.00 seconds
      memory   132.96k
      OS Memory   46056.00k
      Timestamp   06/04/2024 09:54:00 AM
      Step Count   24 Switch Count 0

```
400

401  data car_evtdate
402          (drop=evttime ret mkt smb hml umd date calpha1 calpha2 calpha3
403                cmrkt csmb chml cumd evtwin_beg evtwin_end abret0 abret1
404                abret2 abret3 sar0 sar1 sar2 sar3 missret cexpret1 cexpret2 cexpret
405      car_evtwin
406          (keep=permno evtdate evttime date ret cret abret0 abret1 abret2 abret3
407           sar0 sar1 sar2 sar3 bhar0 bhar1 bhar2 bhar3 car0 car1 car2 car3);
408    set car;
409    by permno evtdate date;
410    /*Standardized CARs and ARs for various models*/
411    scar0=car0/(&evtwin*var0)**0.5;
412    scar1=car1/(&evtwin*var1)**0.5;
413    scar2=car2/(&evtwin*var2)**0.5;
414    scar3=car3/(&evtwin*var3)**0.5;
415
416    sar0=abret0/sqrt(var0);
417    sar1=abret1/sqrt(var1);
418    sar2=abret2/sqrt(var2);
419    sar3=abret3/sqrt(var3);
420
421    pat_scale=(nobs-2)/(nobs-4); /*Patell Z scaling factor*/
422
423    /*Buy-Hold Abnormal Returns*/
424    bhar0=cret-cmkt;
425    bhar1=cret-cexpret1;
426    bhar2=cret-cexpret2;
427    bhar3=cret-cexpret3;
428
429    if last.evtdate then do;
430        nrets=&evtwin-missret;
431      output car_evtdate;
432    end;
433    output car_evtwin;
434  run;

WARNING: The variable calpha1 in the DROP, KEEP, or RENAME list has never been
         referenced.
WARNING: The variable calpha2 in the DROP, KEEP, or RENAME list has never been
         referenced.
WARNING: The variable calpha3 in the DROP, KEEP, or RENAME list has never been
         referenced.
WARNING: The variable cmrkt in the DROP, KEEP, or RENAME list has never been reference
WARNING: The variable csmb in the DROP, KEEP, or RENAME list has never been referenced
WARNING: The variable chml in the DROP, KEEP, or RENAME list has never been referenced
WARNING: The variable cumd in the DROP, KEEP, or RENAME list has never been referenced
NOTE: Missing values were generated as a result of performing an operation on missing
      values.
      Each place is given by: (Number of times) at (Line):(Column).
      35 at 411:13   35 at 412:13   35 at 413:13   35 at 414:13   43 at 416:14
      43 at 417:14   43 at 418:14   43 at 419:14   35 at 424:13   35 at 425:13
      35 at 426:13   35 at 427:13
```

NOTE: There were 86783 observations read from the data set WORK.CAR.
NOTE: The data set WORK.CAR_EVTDATE has 17364 observations and 39 variables.
NOTE: The data set WORK.CAR_EVTWIN has 86783 observations and 22 variables.
NOTE: DATA statement used (Total process time):
      real time   0.12 seconds
      user cpu time   0.00 seconds
      system cpu time   0.12 seconds
      memory   1077.18k
      OS Memory   45800.00k
      Timestamp   06/04/2024 09:54:00 AM
      Step Count   25 Switch Count 0

435
436 proc printto;run;

NOTE: PROCEDURE PRINTTO used (Total process time):
      real time   0.00 seconds
      user cpu time   0.00 seconds
      system cpu time   0.00 seconds
      memory   7.06k
      OS Memory   45800.00k
      Timestamp   06/04/2024 09:54:00 AM
      Step Count   26 Switch Count 0

437
438 /*Put Cross-sectional and aggregate results together for further analysis*/
439 data allcars;
440   merge
441   car_evtwin
442   (rename=(bhar0=bhar0win
443   bhar1=bhar1win
444   bhar2=bhar2win
445   bhar3=bhar3win
446   car0=car0win
447   car1=car1win
448   car2=car2win
449   car3=car3win
450   cret=cretwin))
451   car_evtdate;
452   by permno evtdate;
453 run;

NOTE: There were 86783 observations read from the data set WORK.CAR_EVTWIN.
NOTE: There were 17364 observations read from the data set WORK.CAR_EVTDATE.
NOTE: The data set WORK.ALLCARS has 86783 observations and 59 variables.
NOTE: DATA statement used (Total process time):
      real time   0.09 seconds
      user cpu time   0.04 seconds
      system cpu time   0.04 seconds
      memory   1192.93k
      OS Memory   45800.00k
      Timestamp   06/04/2024 09:54:00 AM
      Step Count   27 Switch Count 0

```
454
455  /* STEP 6: Compute Cumulative Average Abnormal Return (CAR_MEAN) */
456  /* and Average Buy-Hold Abnormal Return (BHAR_MEAN)             */
457  /* and other stats across all distinct events                  */
458  proc means data=allcars noprint;
459    class evttime; id nobs;
460    var ret cret
461    car0 car1 car2 car3
462    bhar0 bhar1 bhar2 bhar3
463    bhar0win bhar1win bhar2win bhar3win
464    cretwin
465    car0win car1win car2win car3win
466    scar0 scar1 scar2 scar3
467    abret0 abret1 abret2 abret3
468    sar0 sar1 sar2 sar3
469    pat_scale;
470    output out=allstats
471    mean =
472      n =
473      t =
474    sum =/autoname;
475  run;

NOTE: Multiple concurrent threads will be used to summarize data.
NOTE: There were 86783 observations read from the data set WORK.ALLCARS.
NOTE: The data set WORK.ALLSTATS has 6 observations and 132 variables.
NOTE: PROCEDURE MEANS used (Total process time):
      real time            0.45 seconds
      user cpu time        0.84 seconds
      system cpu time      0.07 seconds
      memory               6689.10k
      OS Memory            50932.00k
      Timestamp            06/04/2024 09:54:01 AM
      Step Count                         28  Switch Count  0


476
477  /*calculate different stats for assessing    */
478  /*statistical signficance of abnormal returns*/
479  data MA_Evtdate (keep=evttime car0_n cret_mean car0_mean car0_t scar0_t
480                   bhar0_mean pat_car0 model)
481      MM_Evtdate (keep=evttime car1_n cret_mean car1_mean car1_t scar1_t
482                   bhar1_mean pat_car1 model )
483      FF_Evtdate (keep=evttime car2_n cret_mean car2_mean car2_t scar2_t
484                   bhar2_mean pat_car2 model )
485     FFM_Evtdate (keep=evttime car3_n cret_mean car3_mean car3_t scar3_t
486                   bhar3_mean pat_car3 model )
487      MA_Evtwin  (keep=evttime cretwin_mean abret0_n ret_mean abret0_mean
488                   car0win_mean bhar0win_mean abret0_t sar0_t pat_ar0 )
489      MM_Evtwin  (keep=evttime cretwin_mean abret1_n ret_mean abret1_mean
490                   car1win_mean bhar1win_mean abret1_t sar1_t pat_ar1 )
491      FF_Evtwin  (keep=evttime cretwin_mean abret2_n ret_mean abret2_mean
492                   car2win_mean bhar2win_mean abret2_t sar2_t pat_ar2 )
```

```
493      FFM_Evtwin (keep=evttime cretwin_mean abret3_n ret_mean abret3_mean
494                  car3win_mean bhar3win_mean abret3_t sar3_t pat_ar3 );
495    set allstats;
496    by evttime;
497      if _n_=1 and missing(evttime) then do;
498      abret0_mean=.;
499      abret1_mean=.;
500      abret2_mean=.;
501      abret3_mean=.;
502      cretwin_mean=0;
503      ret_mean=.;
504      bhar1win_mean=0;
505      bhar1win_mean=0;
506      bhar2win_mean=0;
507      bhar3win_mean=0;
508      end;
509      /*Patell Z statistics*/
510      pat_car0=scar0_mean/(sqrt(pat_scale_sum)/scar0_n);
511      pat_car1=scar1_mean/(sqrt(pat_scale_sum)/scar1_n);
512      pat_car2=scar2_mean/(sqrt(pat_scale_sum)/scar2_n);
513      pat_car3=scar3_mean/(sqrt(pat_scale_sum)/scar3_n);
514      pat_ar0=sar0_mean/(sqrt(pat_scale_sum)/sar0_n);
515      pat_ar1=sar1_mean/(sqrt(pat_scale_sum)/sar1_n);
516      pat_ar2=sar2_mean/(sqrt(pat_scale_sum)/sar2_n);
517      pat_ar3=sar3_mean/(sqrt(pat_scale_sum)/sar3_n);
518    label
519      pat_ar0=        'Patell Z for AR_MA'  pat_ar1=        'Patell Z for AR_MM'
520      pat_ar2=        'Patell Z for AR_FF'  pat_ar3=        'Patell Z for AR_FFM'
521      abret0_t=       'CS t-stat, AR_MA'    abret1_t=       'CS t-stat, AR_MM'
522      abret2_t=       'CS t-stat, AR_FF'    abret3_t=       'CS t-stat, AR_FFM'
523      sar0_t=         'Std CS test, AR_MA'  sar1_t=         'Std CS test, AR_MM'
524      sar2_t=         'Std CS test, AR_FF'  sar3_t=         'Std CS test, AR_FFM'
525      abret0_mean=    'Mean AR_MA'          abret1_mean=    'Mean AR_MM'
526      abret2_mean=    'Mean AR_FF'          abret3_mean=    'Mean AR_FFM'
527      car0_n=         'Number of events in the portfolio'
528      abret0_n=       'Number of events in the portfolio'
529      evttime=        'Event Time t'
530      cret_mean=      "Mean CTR (&start, &end)"
531      cretwin_mean=   "Mean CTR (&start,t) "
532      car0win_mean=   "Average CAR_MA (&start, t)"
533      car1win_mean=   "Average CAR_MM (&start, t)"
534      car2win_mean=   "Average CAR_FF (&start, t)"
535      car3win_mean=   "Average CAR_FFM (&start, t)"
536      bhar0win_mean=  "Mean BHAR_MA (&start, t)"
537      bhar1win_mean=  "Mean BHAR_MM (&start, t)"
538      bhar2win_mean=  "Mean BHAR_FF (&start, t)"
539      bhar3win_mean=  "Mean BHAR_FFM (&start, t)"
540    ;
541      format ret_mean cret_mean abret0_mean abret1_mean abret2_mean abret3_mean
542             car0_mean car1_mean car2_mean car3_mean bhar0_mean bhar1_mean
543             bhar2_mean bhar3_mean cretwin_mean
544             bhar0win_mean bhar1win_mean bhar2win_mean bhar3win_mean
545             car0win_mean car1win_mean car2win_mean car3win_mean
546        percent7.4
547             abret0_t abret1_t abret2_t abret3_t sar0_t sar1_t sar2_t sar3_t
```

```
548            pat_car0 pat_car1 pat_car2 pat_car3 pat_ar0 pat_ar1 pat_ar2 pat_ar3
549            car0_t car1_t car2_t car3_t scar0_t scar1_t scar2_t scar3_t
550        comma10.2;
551    if evttime=0 then do; model='Market-Adjusted'; output MA_Evtdate;
552                         model='Market Model';    output MM_Evtdate;
553                         model='FF Model';        output FF_Evtdate;
554                         model='Carhart Model';   output FFM_Evtdate;
555                    end;
556    if missing(evttime) then evttime=&start-1;
557    output MA_Evtwin;
558    output MM_Evtwin;
559    output FF_Evtwin;
560    output FFM_Evtwin;
561  run;
```

NOTE: There were 6 observations read from the data set WORK.ALLSTATS.
NOTE: The data set WORK.MA_EVTDATE has 1 observations and 9 variables.
NOTE: The data set WORK.MM_EVTDATE has 1 observations and 9 variables.
NOTE: The data set WORK.FF_EVTDATE has 1 observations and 9 variables.
NOTE: The data set WORK.FFM_EVTDATE has 1 observations and 9 variables.
NOTE: The data set WORK.MA_EVTWIN has 6 observations and 10 variables.
NOTE: The data set WORK.MM_EVTWIN has 6 observations and 10 variables.
NOTE: The data set WORK.FF_EVTWIN has 6 observations and 10 variables.
NOTE: The data set WORK.FFM_EVTWIN has 6 observations and 10 variables.
NOTE: DATA statement used (Total process time):
      real time   0.04 seconds
      user cpu time   0.01 seconds
      system cpu time   0.03 seconds
      memory   2800.62k
      OS Memory   46824.00k
      Timestamp   06/04/2024 09:54:01 AM
      Step Count   29 Switch Count 0


```
562
563  /* STEP 7. Putting Event Date CARs and BHARS for various risk models together*/
564  data allevtdate; set
565    MA_Evtdate  (rename=(car0_mean=car_mean bhar0_mean=bhar_mean
566                car0_n=n car0_t=car_t scar0_t=scar_t pat_car0=pat_car))
567    MM_Evtdate  (rename=(car1_mean=car_mean bhar1_mean=bhar_mean
568                car1_n=n car1_t=car_t scar1_t=scar_t pat_car1=pat_car))
569    FF_Evtdate  (rename=(car2_mean=car_mean bhar2_mean=bhar_mean
570                car2_n=n car2_t=car_t scar2_t=scar_t pat_car2=pat_car))
571    FFM_evtdate (rename=(car3_mean=car_mean bhar3_mean=bhar_mean
572                car3_n=n car3_t=car_t scar3_t=scar_t pat_car3=pat_car));
573    length=&evtwin;
574    label pat_car=   'Patell Z'
575          car_mean=  "Mean CAR (&start, &end)"
576          bhar_mean= "Mean BHAR (&start, &end)"
577          car_t=     'Cross-sectional t-stat for CAR'
578          scar_t=    'Standaridized cross-sectional t-stat for CAR'
579          length=    'Length of event window in trading days';
580  run;
```

NOTE: There were 1 observations read from the data set WORK.MA_EVTDATE.

```
581
582
583   /*Cross-sectional output for CARs/BHARs at the firm-event level*/
584   data car_evtdate;
585     retain permno evtdate alpha1 beta1 cret car0 bhar0 var0 car1 bhar1 var1
586           car2 bhar2 var2 car3 bhar3 var3 nrets nobs;
587     set car_evtdate;
588     label alpha1= 'Alpha (Market Model)'
589           beta1=  'Beta (Market Model'
590           car0=   'CAR_MA'
591           car1=   'CAR_MM'
592           car2=   'CAR_FF'
593       car3=   'CAR_FFM'
594           bhar0=  'BHAR_MA'
595       bhar1=  'BHAR_MM'
596           bhar2=  'BHAR_FF'
597       bhar3=  'BHAR_FFM'
598           var0=   'Estimation period variance (Market-adjusted returns)'
599           var1=   'Estimation period variance (Market Model)'
600           var2=   'Estimation period variance (FF Model)'
601           var3=   'Estimation period variance (Carhart Model)'
602           cret=   'Cumulative Total Return'
603           nrets=  'Number of non-missing returns in event window'
604           nobs=   'Length of the estimation period';
605     keep permno evtdate alpha1 beta1 cret car0 bhar0 var0 car1 bhar1 var1
606           car2 bhar2 var2 car3 bhar3 var3 nrets nobs;
607     format cret alpha1
608           car0 bhar0
609       car1 bhar1
610       car2 bhar2
611       car3 bhar3
612           percent7.4
613           beta1 comma10.3;
614   run;
```

```
         memory              707.50k
         OS Memory           46056.00k
         Timestamp           06/04/2024 09:54:01 AM
         Step Count                          31  Switch Count  0


615
616  /* As an illustration, plot Carhart CAARs and average BHARs in the event window*/
617  options nodate orientation=landscape; ods pdf file='Carhart_evtrets_5days.pdf';
NOTE: Writing ODS PDF output to DISK destination "C:\Windows\system32\Carhart_evtrets_
618  goptions device=pdfc; /* Plot Saved in Home Directory */
619  axis1 label=(angle=90 "Cumulative Returns");
620  axis2 label=("Event time");
621  symbol interpol=join w=3 l=1;
622
623
624
625  proc gplot data =MA_Evtwin;
626   where evttime>=&start;
627   Title "Market average: Cumulative Total Returns vs. Carhart CAARs and BHARs arou
628   plot (cretwin_mean car0win_mean bhar0win_mean)*evttime
629        /overlay legend vaxis=axis1 haxis=axis2;
630

WARNING: Unsupported device 'PDFC' for HTML destination. Using default device 'PNG'.
WARNING: TITLE1 is too long. Height has been reduced to  90.7 pct of specified or defa
NOTE: 44381 bytes written to C:\Users\lihon\AppData\Local\Temp\SAS Temporary Files\_TD
NOTE: There were 5 observations read from the data set WORK.MA_EVTWIN.
      WHERE evttime>=-2;
NOTE: At least one W.D format was too small for the number to be printed. The decimal
      format.
NOTE: PROCEDURE GPLOT used (Total process time):
      real time            2.03 seconds
      user cpu time        0.25 seconds
      system cpu time      0.36 seconds
      memory               9082.09k
      OS Memory            56256.00k
      Timestamp            06/04/2024 09:54:04 AM
      Step Count                          32  Switch Count  0


631  proc gplot data =MM_Evtwin;
632   where evttime>=&start;
633   Title "CAMP:Cumulative Total Returns vs. Carhart CAARs and BHARs around the even
634   plot (cretwin_mean car1win_mean bhar1win_mean)*evttime
635        /overlay legend vaxis=axis1 haxis=axis2;

NOTE: 48072 bytes written to C:\Users\lihon\AppData\Local\Temp\SAS Temporary Files\_TD
NOTE: There were 5 observations read from the data set WORK.MM_EVTWIN.
      WHERE evttime>=-2;
NOTE: At least one W.D format was too small for the number to be printed. The decimal
      format.
NOTE: PROCEDURE GPLOT used (Total process time):
      real time            0.45 seconds
      user cpu time        0.25 seconds
```

```
            system cpu time      0.14 seconds
            memory               7526.18k
            OS Memory            56512.00k
            Timestamp            06/04/2024 09:54:05 AM
            Step Count                      33  Switch Count  0


636  proc gplot data =FF_Evtwin;
637   where evttime>=&start;
638   Title "3 factor:Cumulative Total Returns vs. Carhart CAARs and BHARs around the
639   plot (cretwin_mean car2win_mean bhar2win_mean)*evttime
640       /overlay legend vaxis=axis1 haxis=axis2;
641

WARNING: TITLE1 is too long. Height has been reduced to 98.88 pct of specified or defa
NOTE: 51477 bytes written to C:\Users\lihon\AppData\Local\Temp\SAS Temporary Files\_TD
NOTE: There were 5 observations read from the data set WORK.FF_EVTWIN.
      WHERE evttime>=-2;
NOTE: At least one W.D format was too small for the number to be printed. The decimal
      format.
NOTE: PROCEDURE GPLOT used (Total process time):
            real time            0.45 seconds
            user cpu time        0.23 seconds
            system cpu time      0.12 seconds
            memory               7567.03k
            OS Memory            56512.00k
            Timestamp            06/04/2024 09:54:05 AM
            Step Count                      34  Switch Count  0


642  proc gplot data =FFM_Evtwin;
643   where evttime>=&start;
644   Title "4 Factor model:Cumulative Total Returns vs. Carhart CAARs and BHARs aroun
645   plot (cretwin_mean car3win_mean bhar3win_mean)*evttime
646       /overlay legend vaxis=axis1 haxis=axis2;
647

WARNING: TITLE1 is too long. Height has been reduced to 91.85 pct of specified or defa
NOTE: 54061 bytes written to C:\Users\lihon\AppData\Local\Temp\SAS Temporary Files\_TD
NOTE: There were 5 observations read from the data set WORK.FFM_EVTWIN.
      WHERE evttime>=-2;
NOTE: At least one W.D format was too small for the number to be printed. The decimal
      format.
NOTE: PROCEDURE GPLOT used (Total process time):
            real time            0.43 seconds
            user cpu time        0.25 seconds
            system cpu time      0.12 seconds
            memory               7543.15k
            OS Memory            56512.00k
            Timestamp            06/04/2024 09:54:06 AM
            Step Count                      35  Switch Count  0


648  proc  gplot data =allstats;
649   where evttime>=&start;
```

```
650   Title "Cumulative Abnormal by 4 models: around the event date";
651   plot (car0win_mean  car1win_mean  car2win_mean  car3win_mean )*evttime
652         /overlay legend vaxis=axis1 haxis=axis2;
653
```

NOTE: 45477 bytes written to C:\Users\lihon\AppData\Local\Temp\SAS Temporary Files_TD
NOTE: There were 5 observations read from the data set WORK.ALLSTATS.
      WHERE evttime>=-2;
NOTE: PROCEDURE GPLOT used (Total process time):
      real time   0.35 seconds
      user cpu time   0.18 seconds
      system cpu time   0.10 seconds
      memory   7656.96k
      OS Memory   56768.00k
      Timestamp   06/04/2024 09:54:06 AM
      Step Count   36 Switch Count 0


```
654  proc  gplot data =allstats;
655   where evttime>=&start;
656   Title "buy and Hold: BHARs around the event date";
657   plot (bhar0_mean  bhar1_mean  bhar2_mean  bhar3_mean )*evttime
658         /overlay legend vaxis=axis1 haxis=axis2;
659  run;
```

NOTE: 25965 bytes written to C:\Users\lihon\AppData\Local\Temp\SAS Temporary Files_TD
```
659!    quit;
```

NOTE: There were 5 observations read from the data set WORK.ALLSTATS.
      WHERE evttime>=-2;
NOTE: PROCEDURE GPLOT used (Total process time):
      real time   0.34 seconds
      user cpu time   0.17 seconds
      system cpu time   0.10 seconds
      memory   7659.62k
      OS Memory   56768.00k
      Timestamp   06/04/2024 09:54:07 AM
      Step Count   37 Switch Count 0


```
660
661  ods pdf close;
```
ERROR: Insufficient authorization to access C:\Windows\system32\Carhart_evtrets_5days.
```
662  run;quit; ods pdf close;
663
664  run;quit; ods pdf close;
665
666  /*house cleaning*
667   proc sql;
668    drop table abrets, allcars, allstats, caldates, car, car_evtwin, evtrets, temp,
669            evtrets_temp,ffm_evtdate, ff_evtdate, ma_evtdate, mm_evtdate, params
670    drop view  evtrets1, abrets1; quit;
671  */
672  *%mend  event_crack;
673  /* ********************************************************************************
```