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/************************************************
The code for "The Cash Conversion Cycle Spread" paper

To prepare:
First, uncompress the three zipped files (downloaded from WRDS) into a
folder. On my local hard drive,
      the folder is "H:\Papers\TradeCycle20180625_replication". Later, I will
name this folder in SAS as CCC.
I also renamed the three upcompressed files as follows.

The data sets used are
1. Fundq: CRSP/Compustat merged -- quarterly Compustat
2. Funda: CRSP/Compustat merged -- annual Compustat
3. MSF: monthly CRSP
************************************************/

LIBNAME CCC "H:\Papers\TradeCycle20180625_replication";  /*This is the folder
where I put all the three data sets.*/
RUN;

/************************************************
Step 1: To calculate CCC and asset turnover
standard filters; The FIC="USA" filter requires that
      the firm is incorporated in the US. It has very little effect on the
final result.
************************************************/
DATA FUNDQ;
SET CCC.FUNDQ;
IF INDFMT="INDL" AND DATAFMT="STD" AND POPSRC="D" AND CONSOL="C"  AND
GVKEY^="" AND FYEARQ^=. AND FIC="USA";
PERMNO=LPERMNO;  /*rename Lpermno to permno*/
SICCD=SIC;   /*rename SIC to SICCD*/
KEEP GVKEY PERMNO SICCD DATADATE FYEARQ fqtr ATQ INVTQ RECTQ APQ COGSQ
REVTQ  ; /*keep only useful variables*/
RUN;
PROC SORT DATA=FUNDQ NODUPKEY;
BY GVKEY FYEARQ fqtr;
RUN;
/*add the lagged variables*/
proc sql;
  create table FUNDQ2 as select A.*, B.INVTQ AS INVTQ1,B.RECTQ AS
RECTQ1,B.APQ AS APQ1,B.ATQ AS ATQ1
  from FUNDQ as a LEFT JOIN FUNDQ  as b
  ON a.GVKEY = b.GVKEY and
  (
  (A.fqtr=1 AND B.fqtr=4 AND  A.FYEARQ=B.FYEARQ+1) OR
  (A.fqtr>1 AND B.fqtr=A.FQTR-1 AND  A.FYEARQ=B.FYEARQ)
  );
run;
quit;
/*calcluate CCC, and asset turnover*/
DATA FUNDQ3;
SET FUNDQ2;
CCC=365*0.5*(INVTQ+INVTQ1)/COGSQ+365*0.5*(RECTQ+RECTQ1)/REVTQ-
365*0.5*(APQ+APQ1)/(COGSQ);

AssetTurnover=REVTQ/ATQ1;
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```
YEAR=YEAR(DATADATE);
QTR=QTR(DATADATE);  /*calculate CALENDAR year and quarter*/
IF PERMNO^=.;
KEEP GVKEY DATADATE YEAR QTR PERMNO SICCD CCC ASSETTURNOVER  ;
RUN;
/*drop duplicates based on firm and calendar (not fiscal) quarter.
      only a small number of obs. affected*/
PROC SORT DATA=FUNDQ3  NODUPKEY;
BY PERMNO YEAR QTR;
RUN;
QUIT;

/*CODE FOR FAMA FRENCH 48 INDUSTRY*/
/*SAS macro to define Fama-French 48 industries;
      input: input data set
      output: output data set
      SIC: should be name as SICCD
      IND: Fama-French 48 industry number*/

%MACRO FF48(INPUT,OUTPUT);
DATA TEMP;
SET &INPUT;
/*CODE FOR FAMA FRENCH 48 INDUSTRY*/
IF    100   <=SICCD<=   199   OR
      200   <=SICCD<=   299   OR
      700   <=SICCD<=   799   OR
      910   <=SICCD<=   919   OR
      2048  <=SICCD<=   2048        THEN IND=   1     ;


ELSE IF     2000  <=SICCD<=   2009  OR
      2010  <=SICCD<=   2019  OR
      2020  <=SICCD<=   2029  OR
      2030  <=SICCD<=   2039  OR
      2040  <=SICCD<=   2046  OR
      2050  <=SICCD<=   2059  OR
      2060  <=SICCD<=   2063  OR
      2070  <=SICCD<=   2079  OR
      2090  <=SICCD<=   2092  OR
      2095  <=SICCD<=   2095  OR
      2098  <=SICCD<=   2099        THEN IND=   2     ;


ELSE IF     2064  <=SICCD<=   2068  OR
      2086  <=SICCD<=   2086  OR
      2087  <=SICCD<=   2087  OR
      2096  <=SICCD<=   2096  OR
      2097  <=SICCD<=   2097        THEN IND=   3     ;


DATA TEMP;
SET TEMP;
IF    2080  <=SICCD<=   2080  OR
      2082  <=SICCD<=   2082  OR
      2083  <=SICCD<=   2083  OR
      2084  <=SICCD<=   2084  OR
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      2085  <=SICCD<=   2085        THEN IND=   4     ;

ELSE IF     2100  <=SICCD<=   2199        THEN IND=   5     ;

ELSE IF     920   <=SICCD<=   999   OR
      3650  <=SICCD<=   3651  OR
      3652  <=SICCD<=   3652  OR
      3732  <=SICCD<=   3732  OR
      3930  <=SICCD<=   3931  OR
      3940  <=SICCD<=   3949        THEN IND=   6     ;

ELSE IF     7800  <=SICCD<=   7829  OR
      7830  <=SICCD<=   7833  OR
      7840  <=SICCD<=   7841  OR
      7900  <=SICCD<=   7900  OR
      7910  <=SICCD<=   7911  OR
      7920  <=SICCD<=   7929  OR
      7930  <=SICCD<=   7933  OR
      7940  <=SICCD<=   7949  OR
      7980  <=SICCD<=   7980  OR
      7990  <=SICCD<=   7999        THEN IND=   7     ;

DATA TEMP;
SET TEMP;
IF    2700  <=SICCD<=   2709  OR
      2710  <=SICCD<=   2719  OR
      2720  <=SICCD<=   2729  OR
      2730  <=SICCD<=   2739  OR
      2740  <=SICCD<=   2749  OR
      2770  <=SICCD<=   2771  OR
      2780  <=SICCD<=   2789  OR
      2790  <=SICCD<=   2799        THEN IND=   8     ;

ELSE IF     2047  <=SICCD<=   2047  OR
      2391  <=SICCD<=   2392  OR
      2510  <=SICCD<=   2519  OR
      2590  <=SICCD<=   2599  OR
      2840  <=SICCD<=   2843  OR
      2844  <=SICCD<=   2844  OR
      3160  <=SICCD<=   3161  OR
      3170  <=SICCD<=   3171  OR
      3172  <=SICCD<=   3172  OR
      3190  <=SICCD<=   3199  OR
      3229  <=SICCD<=   3229  OR
      3260  <=SICCD<=   3260  OR
      3262  <=SICCD<=   3263  OR
      3269  <=SICCD<=   3269  OR
      3230  <=SICCD<=   3231  OR
      3630  <=SICCD<=   3639  OR
      3750  <=SICCD<=   3751  OR
      3800  <=SICCD<=   3800  OR
      3860  <=SICCD<=   3861  OR
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      3870  <=SICCD<=   3873  OR
      3910  <=SICCD<=   3911  OR
      3914  <=SICCD<=   3914  OR
      3915  <=SICCD<=   3915  OR
      3960  <=SICCD<=   3962  OR
      3991  <=SICCD<=   3991  OR
      3995  <=SICCD<=   3995        THEN IND=   9     ;

ELSE IF     2300  <=SICCD<=   2390  OR
      3020  <=SICCD<=   3021  OR
      3100  <=SICCD<=   3111  OR
      3130  <=SICCD<=   3131  OR
      3140  <=SICCD<=   3149  OR
      3150  <=SICCD<=   3151  OR
      3963  <=SICCD<=   3965        THEN IND=   10    ;

ELSE IF     8000  <=SICCD<=   8099        THEN IND=   11    ;

DATA TEMP;
SET TEMP;
IF    3693  <=SICCD<=   3693  OR
      3840  <=SICCD<=   3849  OR
      3850  <=SICCD<=   3851        THEN IND=   12    ;

ELSE IF     2830  <=SICCD<=   2830  OR
      2831  <=SICCD<=   2831  OR
      2833  <=SICCD<=   2833  OR
      2834  <=SICCD<=   2834  OR
      2835  <=SICCD<=   2835  OR
      2836  <=SICCD<=   2836        THEN IND=   13    ;

ELSE IF     2800  <=SICCD<=   2809  OR
      2810  <=SICCD<=   2819  OR
      2820  <=SICCD<=   2829  OR
      2850  <=SICCD<=   2859  OR
      2860  <=SICCD<=   2869  OR
      2870  <=SICCD<=   2879  OR
      2890  <=SICCD<=   2899        THEN IND=   14    ;

ELSE IF     3031  <=SICCD<=   3031  OR
      3041  <=SICCD<=   3041  OR
      3050  <=SICCD<=   3053  OR
      3060  <=SICCD<=   3069  OR
      3070  <=SICCD<=   3079  OR
      3080  <=SICCD<=   3089  OR
      3090  <=SICCD<=   3099        THEN IND=   15    ;

ELSE IF     2200  <=SICCD<=   2269  OR
      2270  <=SICCD<=   2279  OR
      2280  <=SICCD<=   2284  OR
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      2290  <=SICCD<=   2295  OR
      2297  <=SICCD<=   2297  OR
      2298  <=SICCD<=   2298  OR
      2299  <=SICCD<=   2299  OR
      2393  <=SICCD<=   2395  OR
      2397  <=SICCD<=   2399        THEN IND=   16    ;


DATA TEMP;
SET TEMP;
IF    800   <=SICCD<=   899   OR
      2400  <=SICCD<=   2439  OR
      2450  <=SICCD<=   2459  OR
      2490  <=SICCD<=   2499  OR
      2660  <=SICCD<=   2661  OR
      2950  <=SICCD<=   2952  OR
      3200  <=SICCD<=   3200  OR
      3210  <=SICCD<=   3211  OR
      3240  <=SICCD<=   3241  OR
      3250  <=SICCD<=   3259  OR
      3261  <=SICCD<=   3261  OR
      3264  <=SICCD<=   3264  OR
      3270  <=SICCD<=   3275  OR
      3280  <=SICCD<=   3281  OR
      3290  <=SICCD<=   3293  OR
      3295  <=SICCD<=   3299  OR
      3420  <=SICCD<=   3429  OR
      3430  <=SICCD<=   3433  OR
      3440  <=SICCD<=   3441  OR
      3442  <=SICCD<=   3442  OR
      3446  <=SICCD<=   3446  OR
      3448  <=SICCD<=   3448  OR
      3449  <=SICCD<=   3449  OR
      3450  <=SICCD<=   3451  OR
      3452  <=SICCD<=   3452  OR
      3490  <=SICCD<=   3499  OR
      3996  <=SICCD<=   3996        THEN IND=   17    ;


ELSE IF     1500  <=SICCD<=   1511  OR
      1520  <=SICCD<=   1529  OR
      1530  <=SICCD<=   1539  OR
      1540  <=SICCD<=   1549  OR
      1600  <=SICCD<=   1699  OR
      1700  <=SICCD<=   1799        THEN IND=   18    ;


ELSE IF     3300  <=SICCD<=   3300  OR
      3310  <=SICCD<=   3317  OR
      3320  <=SICCD<=   3325  OR
      3330  <=SICCD<=   3339  OR
      3340  <=SICCD<=   3341  OR
      3350  <=SICCD<=   3357  OR
      3360  <=SICCD<=   3369  OR
      3370  <=SICCD<=   3379  OR
      3390  <=SICCD<=   3399        THEN IND=   19    ;
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ELSE IF     3400  <=SICCD<=   3400  OR
      3443  <=SICCD<=   3443  OR
      3444  <=SICCD<=   3444  OR
      3460  <=SICCD<=   3469  OR
      3470  <=SICCD<=   3479        THEN IND=   20    ;


DATA TEMP;
SET TEMP;
IF    3510  <=SICCD<=   3519  OR
      3520  <=SICCD<=   3529  OR
      3530  <=SICCD<=   3530  OR
      3531  <=SICCD<=   3531  OR
      3532  <=SICCD<=   3532  OR
      3533  <=SICCD<=   3533  OR
      3534  <=SICCD<=   3534  OR
      3535  <=SICCD<=   3535  OR
      3536  <=SICCD<=   3536  OR
      3538  <=SICCD<=   3538  OR
      3540  <=SICCD<=   3549  OR
      3550  <=SICCD<=   3559  OR
      3560  <=SICCD<=   3569  OR
      3580  <=SICCD<=   3580  OR
      3581  <=SICCD<=   3581  OR
      3582  <=SICCD<=   3582  OR
      3585  <=SICCD<=   3585  OR
      3586  <=SICCD<=   3586  OR
      3589  <=SICCD<=   3589  OR
      3590  <=SICCD<=   3599        THEN IND=   21    ;


ELSE IF     3600  <=SICCD<=   3600  OR
      3610  <=SICCD<=   3613  OR
      3620  <=SICCD<=   3621  OR
      3623  <=SICCD<=   3629  OR
      3640  <=SICCD<=   3644  OR
      3645  <=SICCD<=   3645  OR
      3646  <=SICCD<=   3646  OR
      3648  <=SICCD<=   3649  OR
      3660  <=SICCD<=   3660  OR
      3690  <=SICCD<=   3690  OR
      3691  <=SICCD<=   3692  OR
      3699  <=SICCD<=   3699        THEN IND=   22    ;


ELSE IF     2296  <=SICCD<=   2296  OR
      2396  <=SICCD<=   2396  OR
      3010  <=SICCD<=   3011  OR
      3537  <=SICCD<=   3537  OR
      3647  <=SICCD<=   3647  OR
      3694  <=SICCD<=   3694  OR
      3700  <=SICCD<=   3700  OR
      3710  <=SICCD<=   3710  OR
      3711  <=SICCD<=   3711  OR
      3713  <=SICCD<=   3713  OR
      3714  <=SICCD<=   3714  OR
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      3715  <=SICCD<=   3715  OR
      3716  <=SICCD<=   3716  OR
      3792  <=SICCD<=   3792  OR
      3790  <=SICCD<=   3791  OR
      3799  <=SICCD<=   3799        THEN IND=   23    ;


DATA TEMP;
SET TEMP;
IF    3720  <=SICCD<=   3720  OR
      3721  <=SICCD<=   3721  OR
      3723  <=SICCD<=   3724  OR
      3725  <=SICCD<=   3725  OR
      3728  <=SICCD<=   3729        THEN IND=   24    ;


ELSE IF     3730  <=SICCD<=   3731  OR
      3740  <=SICCD<=   3743        THEN IND=   25    ;


ELSE IF     3760  <=SICCD<=   3769  OR
      3795  <=SICCD<=   3795  OR
      3480  <=SICCD<=   3489        THEN IND=   26    ;


ELSE IF     1040  <=SICCD<=   1049        THEN IND=   27    ;


ELSE IF     1000  <=SICCD<=   1009  OR
      1010  <=SICCD<=   1019  OR
      1020  <=SICCD<=   1029  OR
      1030  <=SICCD<=   1039  OR
      1050  <=SICCD<=   1059  OR
      1060  <=SICCD<=   1069  OR
      1070  <=SICCD<=   1079  OR
      1080  <=SICCD<=   1089  OR
      1090  <=SICCD<=   1099  OR
      1100  <=SICCD<=   1119  OR
      1400  <=SICCD<=   1499        THEN IND=   28    ;


DATA TEMP;
SET TEMP;
IF    1200  <=SICCD<=   1299        THEN IND=   29    ;


ELSE IF     1300  <=SICCD<=   1300  OR
      1310  <=SICCD<=   1319  OR
      1320  <=SICCD<=   1329  OR
      1330  <=SICCD<=   1339  OR
      1370  <=SICCD<=   1379  OR
      1380  <=SICCD<=   1380  OR
      1381  <=SICCD<=   1381  OR
      1382  <=SICCD<=   1382  OR
      1389  <=SICCD<=   1389  OR
      2900  <=SICCD<=   2912  OR
      2990  <=SICCD<=   2999        THEN IND=   30    ;
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ELSE IF     4900  <=SICCD<=   4900  OR
      4910  <=SICCD<=   4911  OR
      4920  <=SICCD<=   4922  OR
      4923  <=SICCD<=   4923  OR
      4924  <=SICCD<=   4925  OR
      4930  <=SICCD<=   4931  OR
      4932  <=SICCD<=   4932  OR
      4939  <=SICCD<=   4939  OR
      4940  <=SICCD<=   4942        THEN IND=   31    ;

ELSE IF     4800  <=SICCD<=   4800  OR
      4810  <=SICCD<=   4813  OR
      4820  <=SICCD<=   4822  OR
      4830  <=SICCD<=   4839  OR
      4840  <=SICCD<=   4841  OR
      4880  <=SICCD<=   4889  OR
      4890  <=SICCD<=   4890  OR
      4891  <=SICCD<=   4891  OR
      4892  <=SICCD<=   4892  OR
      4899  <=SICCD<=   4899        THEN IND=   32    ;

ELSE IF     7020  <=SICCD<=   7021  OR
      7030  <=SICCD<=   7033  OR
      7200  <=SICCD<=   7200  OR
      7210  <=SICCD<=   7212  OR
      7214  <=SICCD<=   7214  OR
      7215  <=SICCD<=   7216  OR
      7217  <=SICCD<=   7217  OR
      7219  <=SICCD<=   7219  OR
      7220  <=SICCD<=   7221  OR
      7230  <=SICCD<=   7231  OR
      7240  <=SICCD<=   7241  OR
      7250  <=SICCD<=   7251  OR
      7260  <=SICCD<=   7269  OR
      7270  <=SICCD<=   7290  OR
      7291  <=SICCD<=   7291  OR
      7292  <=SICCD<=   7299  OR
      7395  <=SICCD<=   7395  OR
      7500  <=SICCD<=   7500  OR
      7520  <=SICCD<=   7529  OR
      7530  <=SICCD<=   7539  OR
      7540  <=SICCD<=   7549  OR
      7600  <=SICCD<=   7600  OR
      7620  <=SICCD<=   7620  OR
      7622  <=SICCD<=   7622  OR
      7623  <=SICCD<=   7623  OR
      7629  <=SICCD<=   7629  OR
      7630  <=SICCD<=   7631  OR
      7640  <=SICCD<=   7641  OR
      7690  <=SICCD<=   7699  OR
      8100  <=SICCD<=   8199  OR
      8200  <=SICCD<=   8299  OR
      8300  <=SICCD<=   8399  OR
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      8400  <=SICCD<=   8499  OR
      8600  <=SICCD<=   8699  OR
      8800  <=SICCD<=   8899  OR
      7510  <=SICCD<=   7515        THEN IND=   33    ;


DATA TEMP;
SET TEMP;
IF    2750  <=SICCD<=   2759  OR
      3993  <=SICCD<=   3993  OR
      7218  <=SICCD<=   7218  OR
      7300  <=SICCD<=   7300  OR
      7310  <=SICCD<=   7319  OR
      7320  <=SICCD<=   7329  OR
      7330  <=SICCD<=   7339  OR
      7340  <=SICCD<=   7342  OR
      7349  <=SICCD<=   7349  OR
      7350  <=SICCD<=   7351  OR
      7352  <=SICCD<=   7352  OR
      7353  <=SICCD<=   7353  OR
      7359  <=SICCD<=   7359  OR
      7360  <=SICCD<=   7369  OR
      7370  <=SICCD<=   7372  OR
      7374  <=SICCD<=   7374  OR
      7375  <=SICCD<=   7375  OR
      7376  <=SICCD<=   7376  OR
      7377  <=SICCD<=   7377  OR
      7378  <=SICCD<=   7378  OR
      7379  <=SICCD<=   7379  OR
      7380  <=SICCD<=   7380  OR
      7381  <=SICCD<=   7382  OR
      7383  <=SICCD<=   7383  OR
      7384  <=SICCD<=   7384  OR
      7385  <=SICCD<=   7385  OR
      7389  <=SICCD<=   7390  OR
      7391  <=SICCD<=   7391  OR
      7392  <=SICCD<=   7392  OR
      7393  <=SICCD<=   7393  OR
      7394  <=SICCD<=   7394  OR
      7396  <=SICCD<=   7396  OR
      7397  <=SICCD<=   7397  OR
      7399  <=SICCD<=   7399  OR
      7519  <=SICCD<=   7519  OR
      8700  <=SICCD<=   8700  OR
      8710  <=SICCD<=   8713  OR
      8720  <=SICCD<=   8721  OR
      8730  <=SICCD<=   8734  OR
      8740  <=SICCD<=   8748  OR
      8900  <=SICCD<=   8910  OR
      8911  <=SICCD<=   8911  OR
      8920  <=SICCD<=   8999  OR
      4220  <=SICCD<=   4229        THEN IND=   34    ;


ELSE IF     3570  <=SICCD<=   3579  OR
      3680  <=SICCD<=   3680  OR
      3681  <=SICCD<=   3681  OR
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      3682  <=SICCD<=   3682  OR
      3683  <=SICCD<=   3683  OR
      3684  <=SICCD<=   3684  OR
      3685  <=SICCD<=   3685  OR
      3686  <=SICCD<=   3686  OR
      3687  <=SICCD<=   3687  OR
      3688  <=SICCD<=   3688  OR
      3689  <=SICCD<=   3689  OR
      3695  <=SICCD<=   3695  OR
      7373  <=SICCD<=   7373        THEN IND=   35    ;

DATA TEMP;
SET TEMP;
IF    3622  <=SICCD<=   3622  OR
      3661  <=SICCD<=   3661  OR
      3662  <=SICCD<=   3662  OR
      3663  <=SICCD<=   3663  OR
      3664  <=SICCD<=   3664  OR
      3665  <=SICCD<=   3665  OR
      3666  <=SICCD<=   3666  OR
      3669  <=SICCD<=   3669  OR
      3670  <=SICCD<=   3679  OR
      3810  <=SICCD<=   3810  OR
      3812  <=SICCD<=   3812        THEN IND=   36    ;

ELSE IF     3811  <=SICCD<=   3811  OR
      3820  <=SICCD<=   3820  OR
      3821  <=SICCD<=   3821  OR
      3822  <=SICCD<=   3822  OR
      3823  <=SICCD<=   3823  OR
      3824  <=SICCD<=   3824  OR
      3825  <=SICCD<=   3825  OR
      3826  <=SICCD<=   3826  OR
      3827  <=SICCD<=   3827  OR
      3829  <=SICCD<=   3829  OR
      3830  <=SICCD<=   3839        THEN IND=   37    ;

ELSE IF     2520  <=SICCD<=   2549  OR
      2600  <=SICCD<=   2639  OR
      2670  <=SICCD<=   2699  OR
      2760  <=SICCD<=   2761  OR
      3950  <=SICCD<=   3955        THEN IND=   38    ;

ELSE IF     2440  <=SICCD<=   2449  OR
      2640  <=SICCD<=   2659  OR
      3220  <=SICCD<=   3221  OR
      3410  <=SICCD<=   3412        THEN IND=   39    ;

DATA TEMP;
SET TEMP;
IF    4000  <=SICCD<=   4013  OR
      4040  <=SICCD<=   4049  OR
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        4100  <=SICCD<=   4100  OR
        4110  <=SICCD<=   4119  OR
        4120  <=SICCD<=   4121  OR
        4130  <=SICCD<=   4131  OR
        4140  <=SICCD<=   4142  OR
        4150  <=SICCD<=   4151  OR
        4170  <=SICCD<=   4173  OR
        4190  <=SICCD<=   4199  OR
        4200  <=SICCD<=   4200  OR
        4210  <=SICCD<=   4219  OR
        4230  <=SICCD<=   4231  OR
        4240  <=SICCD<=   4249  OR
        4400  <=SICCD<=   4499  OR
        4500  <=SICCD<=   4599  OR
        4600  <=SICCD<=   4699  OR
        4700  <=SICCD<=   4700  OR
        4710  <=SICCD<=   4712  OR
        4720  <=SICCD<=   4729  OR
        4730  <=SICCD<=   4739  OR
        4740  <=SICCD<=   4749  OR
        4780  <=SICCD<=   4780  OR
        4782  <=SICCD<=   4782  OR
        4783  <=SICCD<=   4783  OR
        4784  <=SICCD<=   4784  OR
        4785  <=SICCD<=   4785  OR
        4789  <=SICCD<=   4789        THEN IND=   40    ;

ELSE IF     5000  <=SICCD<=   5000  OR
        5010  <=SICCD<=   5015  OR
        5020  <=SICCD<=   5023  OR
        5030  <=SICCD<=   5039  OR
        5040  <=SICCD<=   5042  OR
        5043  <=SICCD<=   5043  OR
        5044  <=SICCD<=   5044  OR
        5045  <=SICCD<=   5045  OR
        5046  <=SICCD<=   5046  OR
        5047  <=SICCD<=   5047  OR
        5048  <=SICCD<=   5048  OR
        5049  <=SICCD<=   5049  OR
        5050  <=SICCD<=   5059  OR
        5060  <=SICCD<=   5060  OR
        5063  <=SICCD<=   5063  OR
        5064  <=SICCD<=   5064  OR
        5065  <=SICCD<=   5065  OR
        5070  <=SICCD<=   5078  OR
        5080  <=SICCD<=   5080  OR
        5081  <=SICCD<=   5081  OR
        5082  <=SICCD<=   5082  OR
        5083  <=SICCD<=   5083  OR
        5084  <=SICCD<=   5084  OR
        5085  <=SICCD<=   5085  OR
        5086  <=SICCD<=   5087  OR
        5088  <=SICCD<=   5088  OR
        5090  <=SICCD<=   5090  OR
        5091  <=SICCD<=   5092  OR
        5093  <=SICCD<=   5093  OR
```

```
      5094  <=SICCD<=   5094  OR
      5099  <=SICCD<=   5099  OR
      5100  <=SICCD<=   5100  OR
      5110  <=SICCD<=   5113  OR
      5120  <=SICCD<=   5122  OR
      5130  <=SICCD<=   5139  OR
      5140  <=SICCD<=   5149  OR
      5150  <=SICCD<=   5159  OR
      5160  <=SICCD<=   5169  OR
      5170  <=SICCD<=   5172  OR
      5180  <=SICCD<=   5182  OR
      5190  <=SICCD<=   5199        THEN IND=   41    ;


DATA TEMP;
SET TEMP;
IF    5200  <=SICCD<=   5200  OR
      5210  <=SICCD<=   5219  OR
      5220  <=SICCD<=   5229  OR
      5230  <=SICCD<=   5231  OR
      5250  <=SICCD<=   5251  OR
      5260  <=SICCD<=   5261  OR
      5270  <=SICCD<=   5271  OR
      5300  <=SICCD<=   5300  OR
      5310  <=SICCD<=   5311  OR
      5320  <=SICCD<=   5320  OR
      5330  <=SICCD<=   5331  OR
      5334  <=SICCD<=   5334  OR
      5340  <=SICCD<=   5349  OR
      5390  <=SICCD<=   5399  OR
      5400  <=SICCD<=   5400  OR
      5410  <=SICCD<=   5411  OR
      5412  <=SICCD<=   5412  OR
      5420  <=SICCD<=   5429  OR
      5430  <=SICCD<=   5439  OR
      5440  <=SICCD<=   5449  OR
      5450  <=SICCD<=   5459  OR
      5460  <=SICCD<=   5469  OR
      5490  <=SICCD<=   5499  OR
      5500  <=SICCD<=   5500  OR
      5510  <=SICCD<=   5529  OR
      5530  <=SICCD<=   5539  OR
      5540  <=SICCD<=   5549  OR
      5550  <=SICCD<=   5559  OR
      5560  <=SICCD<=   5569  OR
      5570  <=SICCD<=   5579  OR
      5590  <=SICCD<=   5599  OR
      5600  <=SICCD<=   5699  OR
      5700  <=SICCD<=   5700  OR
      5710  <=SICCD<=   5719  OR
      5720  <=SICCD<=   5722  OR
      5730  <=SICCD<=   5733  OR
      5734  <=SICCD<=   5734  OR
      5735  <=SICCD<=   5735  OR
      5736  <=SICCD<=   5736  OR
      5750  <=SICCD<=   5799  OR
      5900  <=SICCD<=   5900  OR
```

```
      5910  <=SICCD<=   5912  OR
      5920  <=SICCD<=   5929  OR
      5930  <=SICCD<=   5932  OR
      5940  <=SICCD<=   5940  OR
      5941  <=SICCD<=   5941  OR
      5942  <=SICCD<=   5942  OR
      5943  <=SICCD<=   5943  OR
      5944  <=SICCD<=   5944  OR
      5945  <=SICCD<=   5945  OR
      5946  <=SICCD<=   5946  OR
      5947  <=SICCD<=   5947  OR
      5948  <=SICCD<=   5948  OR
      5949  <=SICCD<=   5949  OR
      5950  <=SICCD<=   5959  OR
      5960  <=SICCD<=   5969  OR
      5970  <=SICCD<=   5979  OR
      5980  <=SICCD<=   5989  OR
      5990  <=SICCD<=   5990  OR
      5992  <=SICCD<=   5992  OR
      5993  <=SICCD<=   5993  OR
      5994  <=SICCD<=   5994  OR
      5995  <=SICCD<=   5995  OR
      5999  <=SICCD<=   5999        THEN IND=   42    ;

ELSE IF     5800  <=SICCD<=   5819  OR
      5820  <=SICCD<=   5829  OR
      5890  <=SICCD<=   5899  OR
      7000  <=SICCD<=   7000  OR
      7010  <=SICCD<=   7019  OR
      7040  <=SICCD<=   7049  OR
      7213  <=SICCD<=   7213        THEN IND=   43    ;

DATA &OUTPUT;
SET TEMP;
IF    6000  <=SICCD<=   6000  OR
      6010  <=SICCD<=   6019  OR
      6020  <=SICCD<=   6020  OR
      6021  <=SICCD<=   6021  OR
      6022  <=SICCD<=   6022  OR
      6023  <=SICCD<=   6024  OR
      6025  <=SICCD<=   6025  OR
      6026  <=SICCD<=   6026  OR
      6027  <=SICCD<=   6027  OR
      6028  <=SICCD<=   6029  OR
      6030  <=SICCD<=   6036  OR
      6040  <=SICCD<=   6059  OR
      6060  <=SICCD<=   6062  OR
      6080  <=SICCD<=   6082  OR
      6090  <=SICCD<=   6099  OR
      6100  <=SICCD<=   6100  OR
      6110  <=SICCD<=   6111  OR
      6112  <=SICCD<=   6113  OR
      6120  <=SICCD<=   6129  OR
      6130  <=SICCD<=   6139  OR
      6140  <=SICCD<=   6149  OR
```

```
      6150  <=SICCD<=   6159  OR
      6160  <=SICCD<=   6169  OR
      6170  <=SICCD<=   6179  OR
      6190  <=SICCD<=   6199        THEN IND=   44    ;

ELSE IF     6300  <=SICCD<=   6300  OR
      6310  <=SICCD<=   6319  OR
      6320  <=SICCD<=   6329  OR
      6330  <=SICCD<=   6331  OR
      6350  <=SICCD<=   6351  OR
      6360  <=SICCD<=   6361  OR
      6370  <=SICCD<=   6379  OR
      6390  <=SICCD<=   6399  OR
      6400  <=SICCD<=   6411        THEN IND=   45    ;

ELSE IF     6500  <=SICCD<=   6500  OR
      6510  <=SICCD<=   6510  OR
      6512  <=SICCD<=   6512  OR
      6513  <=SICCD<=   6513  OR
      6514  <=SICCD<=   6514  OR
      6515  <=SICCD<=   6515  OR
      6517  <=SICCD<=   6519  OR
      6520  <=SICCD<=   6529  OR
      6530  <=SICCD<=   6531  OR
      6532  <=SICCD<=   6532  OR
      6540  <=SICCD<=   6541  OR
      6550  <=SICCD<=   6553  OR
      6590  <=SICCD<=   6599  OR
      6610  <=SICCD<=   6611        THEN IND=   46    ;

ELSE IF     6200  <=SICCD<=   6299  OR
      6700  <=SICCD<=   6700  OR
      6710  <=SICCD<=   6719  OR
      6720  <=SICCD<=   6722  OR
      6723  <=SICCD<=   6723  OR
      6724  <=SICCD<=   6724  OR
      6725  <=SICCD<=   6725  OR
      6726  <=SICCD<=   6726  OR
      6730  <=SICCD<=   6733  OR
      6740  <=SICCD<=   6779  OR
      6790  <=SICCD<=   6791  OR
      6792  <=SICCD<=   6792  OR
      6793  <=SICCD<=   6793  OR
      6794  <=SICCD<=   6794  OR
      6795  <=SICCD<=   6795  OR
      6798  <=SICCD<=   6798  OR
      6799  <=SICCD<=   6799        THEN IND=   47    ;

ELSE IF     4950  <=SICCD<=   4959  OR
      4960  <=SICCD<=   4961  OR
      4970  <=SICCD<=   4971  OR
      4990  <=SICCD<=   4991        THEN IND=   48    ;
RUN;
```

```
%MEND;

%FF48(FUNDQ3,CCC);  /*Run the above SAS macro. The input dataset is FUNDQ3,
and output is CCC*/
RUN;

/*delete observations where sales is too low relative to lagged assets, to
avoid extreme values for CCC*/
data CCC;
SET CCC;
IF CCC^=. AND AssetTurnover>=0.025;
RUN;
/*calculate industry median CCC;
      merge back, and calculated industry adjusted CCC*/
PROC SORT DATA=CCC;
BY YEAR QTR IND;  /*year and qtr are calendar year and qtr based on datadate.
                            Using calendar year and qtr (rather than fiscal
year and qtr) is to make sure that the accounting data used are
                            indeed available to the investors*/
RUN;
PROC MEANS DATA=CCC NOPRINT;
BY YEAR QTR IND;
OUTPUT OUT=CCC_FF48 (DROP=_TYPE_ _FREQ_)
MEDIAN(CCC)=CCC_FF48;
RUN;
DATA CCC;
MERGE CCC CCC_FF48;
BY YEAR QTR IND;
RUN;
DATA CCC_industry_adjusted;
SET CCC;
CCC_ADJ=CCC-CCC_FF48;
RUN;

/*FM DATA*/
DATA A;
SET CCC.MSF;
YEAR=YEAR(DATE);
MONTH=MONTH(DATE);

/*adjusting for delisting. RET2 is the adjusted return, and will be used for
pricing analysis*/
IF DLRET^=. THEN DLRET2=DLRET;
ELSE IF DLSTCD IN (500 520 574 580  584) OR 551<=DLSTCD<=573 THEN DLRET2=-
0.30;
IF RET+0^=. THEN RET2=RET;
ELSE  RET2=DLRET2;

IF 1<=EXCHCD<=3 AND SHRCD IN (10 11); /*standard filters*/
IF YEAR>=1975;
IF MONTH<=3 THEN QTR=1;
ELSE IF MONTH<=6 THEN QTR=2;
ELSE IF MONTH<=9 THEN QTR=3;
ELSE QTR=4;
KEEP PERMNO RET2 DATE YEAR MONTH QTR;
RUN;
DATA A;
```

```
SET A;
RENAME RET2=RET;  /*ret2 is the delisting adjusted return*/
RUN;
/*add industry-adjusted CCC; add sic, will use it to drop financials;
      skip a quarter*/
proc sql;
      create table B
      as select unique a.*,B.GVKEY,B.CCC_ADJ,B.CCC,B.SICCD
      from A as a
    left join
    CCC_industry_adjusted as b
      on A.PERMNO=B.PERMNO AND (
      (A.QTR=1 AND B.QTR=3 AND A.YEAR=B.YEAR+1) OR
      (A.QTR=2 AND B.QTR=4 AND A.YEAR=B.YEAR+1) OR
      (A.QTR=3 AND B.QTR=1 AND A.YEAR=B.YEAR) OR
      (A.QTR=4 AND B.QTR=2 AND A.YEAR=B.YEAR)
      ) ;
quit;
proc sql;  /*add lagged market cap*/
      create table C
      as select unique A.*,ABS(B.PRC*B.SHROUT) AS SIZE
      from B as a
    left join
    CCC.MSF as b
      on A.PERMNO=B.PERMNO AND ((A.MONTH=1 AND MONTH(B.DATE)=12 AND
A.YEAR=YEAR(B.DATE)+1) OR (A.MONTH>1 AND A.YEAR=YEAR(B.DATE) AND
A.MONTH=MONTH(B.DATE)+1));
quit;
/*adding book equity from annual Compustat*/
DATA BE;
SET CCC.FUNDA;
IF INDFMT="INDL" AND DATAFMT="STD" AND POPSRC="D" AND CONSOL="C"  AND
GVKEY^="" AND FYEAR^=. AND FIC="USA";
/*calculate Book Equity following Fama and French*/
IF TXDITC =. THEN TXDITC=0;
IF PSTKL^=. THEN PREFER=PSTKL;
ELSE IF PSTKRV^=. THEN PREFER=PSTKRV;
ELSE IF PSTK^=. THEN PREFER=PSTK;
ELSE PREFER=0;
BE_FAMA_FRENCH08=AT-LT+TXDITC-PREFER;
PERMNO=LPERMNO;
KEEP  GVKEY DATADATE BE_FAMA_FRENCH08 PERMNO;
RUN;
proc sql; /*add book value, following Fama-French (1992) timing convention;
rename book equity to BE*/
      create table D
      as select unique a.*,B.BE_FAMA_FRENCH08 AS BE
      from C as a
    left join
    BE as b
      on A.GVKEY=B.GVKEY AND ( (A.YEAR=YEAR(B.DATADATE)+1 AND A.MONTH>=7)  OR
(A.YEAR=YEAR(B.DATADATE)+2 AND A.MONTH<=6)) ;
quit;
proc sql; /*add market cap at December of year t-1, following FF (1992)
timing convention*/
      create table E
      as select unique a.*,b.PRC*B.SHROUT AS SIZE12
```

```
      from D as a
    left join
    CCC.MSF as b
      on A.PERMNO=B.PERMNO AND A.YEAR=YEAR(B.DATE)+1 AND MONTH(B.DATE)=12;
quit;
/*calculate BM-book to market;
      drop book equity; and lagged december market cap*/
DATA E;
SET E;
BM_FAMA_FRENCH08=1000*BE/SIZE12;
DROP SIZE12  BE;
RUN;

/*drop observations with missing value*/
DATA FM_DATA;
SET E;
SIZE_LOG=LOG(SIZE);
BM=LOG(BM_FAMA_FRENCH08);
IF PERMNO^=. AND RET^=. AND BM^=. AND SIZE^=. AND CCC_ADJ^=.;  /*BM is
logged. Requiring nonmissing BM is equivalent to
           dropping firm-years with negative book equity, or missing market
cap at the end of last year*/
IF 201512>=YEAR*100+MONTH>=197607;   /*final sample period*/
IF 6000<=SICCD<=6999 THEN DELETE; /*drop financials*/
RUN;

DATA F;
SET FM_DATA;
CCC_ADJ=CCC_ADJ/365; /*Define it in number of years (rather than days), for
reporting purpose*/
RET=RET*100; /*scale return, for reporting purpose*/
YM=YEAR*100+MONTH;
RUN;
proc sort data=F;
by ym;
run;
/************************************************************
Purpose: trim or winsorize SAS dataset to remove the impact from extreme
values

Input
 dsetin  : dataset to winsorize/trim
 byvar   : define subset to winsorize/trim,e.g. 'date'. type 'none' for the
whole dataset
 type    : 'delete' or 'winsor' (delete will trim, winsor will winsorize
 vars    : subsetting variables to winsorize/trim on; type 'none for no byvar
 pctl    : the percenagte of left and right tails to trim/winsorize

Output
 dsetout : dataset to output with winsorized/trimmed values
************************************************************/

%macro winsor(dsetin=, dsetout=, byvar=, vars=, type=winsor, pctl=1 99);

%if &dsetout = %then %let dsetout = &dsetin;

%let varL=;
```

```
%let varH=;
%let xn=1;

%do %until ( %scan(&vars,&xn)= );
    %let token = %scan(&vars,&xn);
    %let varL = &varL &token.L;
    %let varH = &varH &token.H;
    %let xn=%EVAL(&xn + 1);
%end;

%let xn=%eval(&xn-1);

data xtemp;
    set &dsetin;
    run;

%if &byvar = none %then %do;

    data xtemp;
        set xtemp;
        xbyvar = 1;
        run;

    %let byvar = xbyvar;

%end;

proc sort data = xtemp;
    by &byvar;
    run;

proc univariate data = xtemp noprint;
    by &byvar;
    var &vars;
    output out = xtemp_pctl PCTLPTS = &pctl PCTLPRE = &vars PCTLNAME = L H;
    run;

data &dsetout;
    merge xtemp xtemp_pctl;
    by &byvar;
    array trimvars{&xn} &vars;
    array trimvarl{&xn} &varL;
    array trimvarh{&xn} &varH;

    do xi = 1 to dim(trimvars);

        %if &type = winsor %then %do;
            if not missing(trimvars{xi}) then do;
              if (trimvars{xi} < trimvarl{xi}) then trimvars{xi} =
trimvarl{xi};
              if (trimvars{xi} > trimvarh{xi}) then trimvars{xi} =
trimvarh{xi};
            end;
        %end;

        %else %do;
            if not missing(trimvars{xi}) then do;
```

```
            if (trimvars{xi} < trimvarl{xi}) then delete;
            if (trimvars{xi} > trimvarh{xi}) then delete;
          end;
        %end;

    end;
    drop &varL &varH xbyvar xi;
    run;

%mend winsor;


%winsor(dsetin=F, dsetout=G, byvar=YM, vars= CCC_ADJ , type=winsor, pctl=1
99); /*winzorize*/
run;
/*Fama-MacBeth regression*/
PROC SORT DATA=G;
BY YEAR MONTH;
PROC REG DATA=G OUTEST=OUTEST NOPRINT;
BY YEAR MONTH;
MODEL RET=CCC_ADJ;
RUN;
PROC UNIVARIATE DATA=OUTEST;
VAR CCC_ADJ;
RUN;
QUIT;
```