Withdrawn Equity Offerings: Event Study and Cross-Sectional Regression Analysis Using Eventus® Software

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This note demonstrates the use of Eventus® software to conduct an event study and, with the SAS regression procedure, cross-sectional analysis. The demonstration is conducted in SAS® 8.1 with the CRSPAccess™ daily stock database. Other operating systems, SAS versions, and data sources are supported. It is assumed that Eventus software is already installed.

The user has an Excel™ spreadsheet file containing information about 180 withdrawn common stock offerings filed from 1991–1997. The data will make up the *request file*™, which Eventus uses to identify the stocks and event dates for the study. The first several rows of the spreadsheet are displayed below.

|	A	B	C	D	E	F
1	idnum	Withdrawn	Filed	Amt Filed -	SecPct	CUSIP
2	1	19971106	19970929	41.1	0.062	00365410
3	2	19910717	19910703	38.3	0.333	00432510
4	3	19951120	19951024	72.3	0.56	00493410
5	4	19980213	19971021	73.4	0.516	00686610
6	5	19930722	19930610	16.4	0	00738310
7	6	19970718	19940207	34.5	0	00795210
8	7	19980121	19971023	60.8	0.333	01922310
9	8	19970520	19960614	43.8	0.143	02316210
10	9	19930212	19930119	29.4	0	03234610

The user opens SAS and starts to import the spreadsheet by selecting File, Import Data.
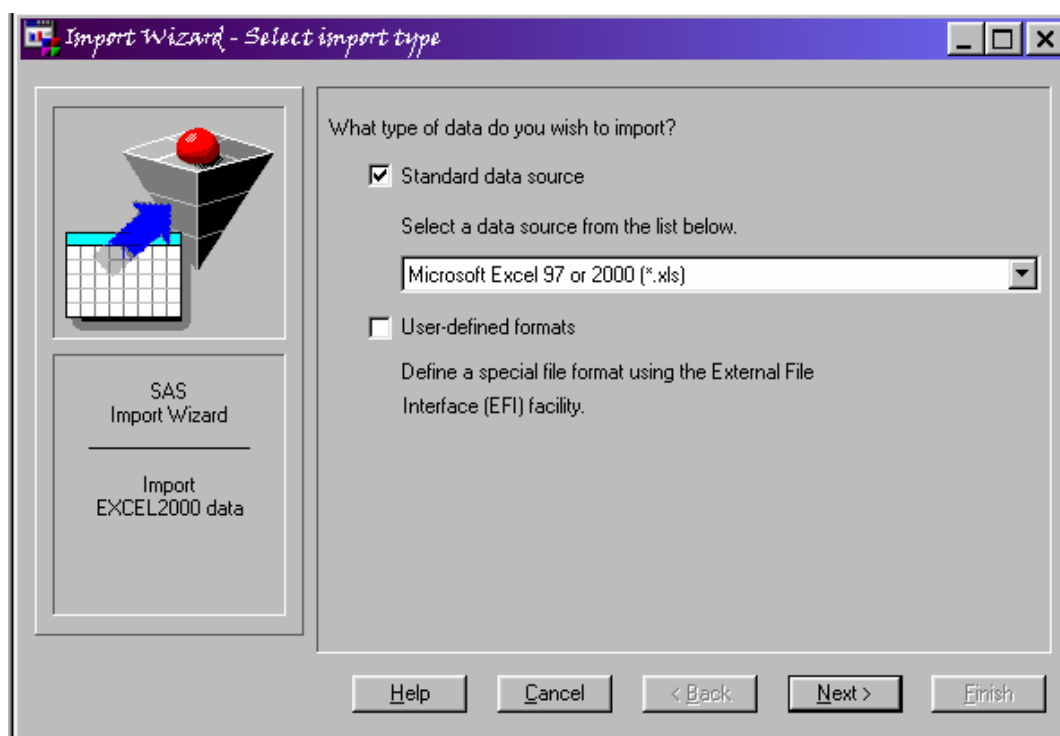
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The user selects the type of file being imported (above) and in the next wizard screen types in or browses for the drive, folder and file name (not shown).

In the Import Wizard page that asks for the SAS destination, the user chooses the default
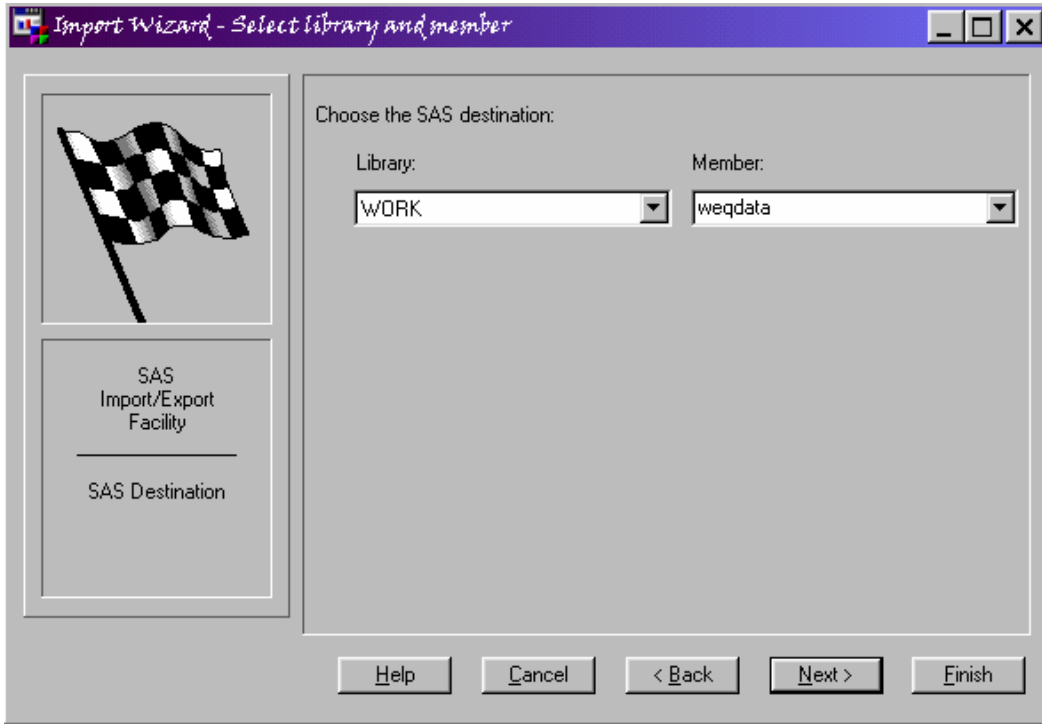
library, `work`, and names the member `weqdata` (weq for "withdrawn equity").

After clicking Finish, the user can view the contents of the SAS data set by using the SAS Explorer to navigate through Libraries, Work, then right-clicking the icon marked Weqdata and choosing Open from the context menu.

The user wants to conduct an event study centered on the withdrawal date as day 0. The table view (not shown) reveals that SAS has imported the Excel column heading `with-drawn` as the SAS column (variable) name. `Eventus` looks for a variable named `eventdat`, so the user types the following statements in the Enhanced Editor window and clicks the Submit icon.

```
proc datasets library=work;
 modify weqdata;
 rename withdrawn=eventdat;
quit;
```

In some SAS releases, SAS may import the column as a datetime variable, which is a different type from the date variable that `Eventus` needs. To correct this situation, the following code can be substituted for the above:

```
data weqdata;
 set weqdata;
 eventdat=datepart(withdrawn);
run;
```

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To run the event study, the user types the following statements in the SAS Editor window and clicks Submit. If desired, the statements can be typed and submitted one at a time instead of in a block.

```
Eventus;
  request insas=work.weqdata autodate cusiperm id=idnum est=-101
       minestn=40;
  evtstudy outsas=work.study1 package=dg;
```

The `Eventus;` statement initializes `Eventus` software. An `Eventus;` statement is needed at the beginning of each event study. The request statement sets options related to the user's request file and sets options related to the request file and parameter estimation. Only a few of the possible request statement options are demonstrated here.

The `insas=work.weqdata` option points to the request file in the form of a SAS data set. Instead of a SAS data set, the user could have created an ASCII file and associated it with the SAS file shortcut **request**. A SAS file shortcut is defined using the SAS Explorer, or by constructing a **filename** statement in the Editor window and submitting it. The `autodate` and `cusiperm` options change non-trade dates to the next CRSP trading day, and match CUSIP identifiers to their respective CRSP PERMNO identifiers, respectively.

The `id=idnum` option causes SAS to use the `idnum` variable, a variable created by the user in the original spreadsheet, to identify observations in the output. The use of an identifying variable is optional, but recommended, especially with the `cusiperm` option. Finally, `est=-101` and `minestn=40` specify that the default 255 trading-day parameter estimation period is to end on trading day –101 and that only events with at least 40 non-missing returns in the estimation period are to be used for the event period analysis.

The `evtstudy` statement completes the event study. Many options are available to customize the event study, but the only ones used here are `outsas=work.study1 package=dg`. The `outsas` option stores return and parameter data for each event in a SAS file for later use. `work.study1` specifies that the file to be created is to be placed in the `work` library and given the name `study1`. (In SAS, the default prefix `work.` usually can be omitted, but here it must be included.) The `package` option specifies which data to store in the output file; the codes `d` and `g`, obtained from the `Eventus` *User's Guide*, specify that event-period daily abnormal returns and weights for standardized abnormal returns are to be stored.

The output is generated in the SAS Output window; Appendix A (page 6) contains an excerpt of the full output. The default output for an event study consists of four parts: a summary page that lists key options and sample size information; a listing of the event-by-event results of the CRSP data extraction and sample assembly process; a listing of the market model parameter estimates and descriptive return statistics; and the event study results for the full sample.

The CRSP data extraction listing (page 7) includes the ID variable (if any), the PERMNO, company name, the event date, the number of returns found in the estimation and event periods, and an explanation if no usable data are found. The `autodate` option ensures that event dates on weekends and holidays are interpreted as the next trading day. One explanation for no useable data is "Data end before… ". This means that the event date, or the entire parameter estimation period, is outside the range of return data available.

Several other events appear with an asterisk under PERMNO and the notation "PERMNO not found". The asterisk denotes a missing PERMNO. The `cusiperm` option matches the CUSIP from the request file to the header CUSIP and historical CUSIP data on the CRSP database in order to locate the corresponding PERMNO. If the exact 8-character CUSIP is not found in the database, the PERMNO is set to missing. The final distinct notation in the example output is "<40 for estim.", which indicates that the event (idnum=36) fails the screen established by the `minestn=40` option, as only 20 estimation period returns are found.

By default, if the user does not select specific statistical tests, Eventus reports the Patell test and the generalized sign test. The Patell uses a cross-sectional independence assumption to increase the power of the test. The generalized sign test checks whether the frequency of positive returns in the event period differs from the frequency in the estimation period. The Eventus *User's Guide* describes the default tests in more detail and lists other abnormal return methods and parametric and nonparametric tests available by specifying appropriate options.

At the bottom of the page for each abnormal return-test method combination are the results for three cumulative "windows" spanning the 61-day event period. The three windows are generated by default when no `windows` statement appears immediately before the `evtstudy` statement. Using a `windows` statement, the user can specify up to 200 custom windows instead.

Assume that the user wants to perform cross-sectional regression analysis on cumulative abnormal returns (CARs) for selected windows. To facilitate regression, Eventus provides an `extract` statement that sets up a SAS or ASCII file in a convenient format for merging with explanatory variables. The `extract` statement should be immediately preceded by a `windows` statement that lists one or more desired windows. If the `extract` statement and its accompanying `windows` statement immediately follow the `evtstudy` statement, it is not necessary to include another `Eventus;` statement.

The user types the following statements in the Editor window and clicks Submit.

```
windows (-1,0) (-1,+1);
extract id=idnum insas=work.study1 outsas=work.ext1 wprefix=wgt;
```

The `windows` statement lists two windows to be extracted. One of them was not included in the output of the `evtstudy` statement. This works because the days in the window are within the range of days (–30 through +30) in the event period. The `extract` statement options specify the identification variable to be used, the SAS file that cumulative abnormal returns are to be extracted from (the `outsas` file from `evtstudy`, now specified as the `insas` file), and the new SAS file to be created. The final option used above, `wprefix`, causes optional weights to be included in the output file. The weights are specifically designed to be used with the weight statement in PROC REG and to achieve the same relative implied weighting of observations as occurs in the standardized residual method test statistic. They are not portfolio weights in the usual sense.

The output SAS file, `work.ext1`, contains the variables `permno, idnum, winar1` and `winar2,` the cumulative abnormal returns for the first and second listed windows, and `wgt1` and `wgt2`, the weights for the respective windows.

The SAS file `work.weqdata`, the result of importing the Excel worksheet, contains a variable called `SecPct`, which is the fraction of the withdrawn equity issue that consists of secondary (shareholder-offered) shares. To perform a WLS regression of the CAR for (—1,0) on `SecPct`, the user types the following statements in the Editor window and clicks Submit.

```
data ext1;
 merge ext1 weqdata;
 by idnum;
run;

proc reg data=ext1;
 model winar1=secpct;
 weight wgt1;
 title 'Weighted Least Squares Regression of CAR on Secondary Percentage';
quit;
```

The first block of statements merges the SAS files containing the extracted CARs and explanatory variables. The second block estimates the regression. The results appear in Appendix B (page 10). To run an OLS regression, the user would simply omit the `weight` statement.

Only a few of the many analytical possibilities available with Eventus software, alone or in combination with native SAS features, appear in this note. For more complete information, please see the features list in the Eventus information kit, or see the *User's Guide*, which is viewable on the Internet at http://www.eventstudy.com/.

Appendix A: Event Study Results

```
              Eventus (R) Software from Cowan Research, L.C.                    1


   Eventus (R) software is produced by Cowan Research, L.C.
   http://www.eventstudy.com/


   ESTIMATION PERIOD:  Ends 101 days before the event date; 255 days in length.

   TOTAL NUMBER OF EVENTS:        180
     EVENTS WITH USEABLE RETURNS:  161
     EVENTS DROPPED:               19
   MINIMUM RETURN DATA REQUIRED FOR ESTIMATION:        40

   NOTE: Any non-trading dates were converted to the next trading date.




   STATISTICAL SIGNIFICANCE LEVELS:  1 tailed




   NOTE:  Useable returns means all nonmissing returns except the
          first day after a missing estimation period return.
```

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Results of Daily Stock Return Data Input

```
idnum   PERMNO   cusip     Name on Event Date                                Event Date

   1    75107   00365410   ABIOMED INC                          Thursday, November 6, 1997
   2    10114   00432520   ACCLAIM ENTERTAINMENT INC              Wednesday, July 17, 1991
   3    79467   00493410   ACTEL CORP                           Monday, November 20, 1995
   4    80914   00686610   ADFLEX SOLUTIONS INC                 Friday, February 13, 1998
   5    10867   00738310   ADVANCE CIRCUITS INC                   Thursday, July 22, 1993
   6    76715   00795210   ADVANCED PROMOTION TECHS INC              Friday, July 18, 1997
   7    79591   01922310   ALLIED HOLDINGS INC               Wednesday, January 21, 1998
   8    77174   02316210   AMBAR INC                               Tuesday, May 20, 1997
   9    77264   03234610   AMYLIN PHARMACEUTICALS INC           Friday, February 12, 1993
  10    79674   04661310   ATCHISON CASTING CORP                Monday, October 16, 1995
  11      *                (Unusable PERMNO)                       Monday, May 19, 1997
  12    76584   04951310   ATMEL CORP                             Thursday, July 7, 1994
  13    15721   05009510   ATWOOD OCEANICS INC                   Thursday, March 6, 1997
  14    10360   05435010   AVONDALE INDUSTRIES INC           Wednesday, August 13, 1997
  15    82554   05517620   B A B HOLDINGS INC              Wednesday, December 11, 1996
  16    17049   06977910   BASE TEN SYS INC          B            Monday, August 12, 1996
  17    38471   08725710   BETHLEHEM CORP                       Monday, January 6, 1997
  18    17903   08889110   BIG B INC                         Wednesday, June 10, 1992


                          Esti-
                         mation    Event
                         Period   Period
                         Returns  Returns
idnum   PERMNO           <=255    <=61     Reason if no useable returns

   1    75107             255       61
   2    10114             255       61
   3    79467             255       61
   4    80914             255       61
   5    10867             255       61
   6    76715              *         *      Data end before 07/18/1997**
   7    79591             255       61
   8    77174              *         *      Data end before 05/20/1997**
   9    77264             171       61
  10    79674             255       61
  11      *                *         *      PERMNO not found
  12    76584             255       61
  13    15721             255       61
  14    10360             255       61
  15    82554             163       61
  16    17049             253       61
  17    38471             255       61
  18    17903             255       61


              * No useable returns found. ** Or beyond estimation period.


(The rest of this section of output is omitted to save space.)
```

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Parameter Estimates and Estimation Period Statistics

-------------------------------------- Index Weight=Equal --------------------------------------

idnum	PERMNO	Event Date	Alpha	Beta	Mean Return	% of Raw Returns >0
1	75107	06NOV1997	-0.00075	1.61	0.00046	38.43%
2	10114	17JUL1991	-0.00003	2.56	0.00156	38.03%
3	79467	20NOV1995	-0.00151	2.93	0.00251	42.35%
4	80914	13FEB1998	0.00053	2.96	0.00498	45.88%
5	10867	22JUL1993	-0.00038	1.45	0.00183	38.43%
7	79591	21JAN1998	0.00105	1.42	0.00295	40.39%
9	77264	12FEB1993	-0.00897	5.25	-0.00390	35.08%
10	79674	16OCT1995	-0.00059	1.05	0.00060	36.07%
12	76584	07JUL1994	0.00036	2.41	0.00410	50.19%
13	15721	06MAR1997	0.00257	0.87	0.00367	47.05%
14	10360	13AUG1997	-0.00033	1.33	0.00094	38.43%
15	82554	11DEC1996	0.00606	0.28	0.00645	48.46%
16	17049	12AUG1996	0.00021	0.90	0.00178	32.41%
17	38471	06JAN1997	-0.00058	1.17	0.00081	29.41%
18	17903	10JUN1992	-0.00111	1.25	0.00235	39.21%
19	92508	06APR1993	0.00392	1.20	0.00575	40.78%

idnum	PERMNO	Market Model Residuals>0	Total Variance	Residual Standard Deviation	Autocorrelation*
1	75107	46.66%	0.00284	0.05264	-0.3515
2	10114	45.88%	0.00348	0.05649	0.1873
3	79467	46.66%	0.00173	0.04042	0.0658
4	80914	45.09%	0.00329	0.05608	-0.0301
5	10867	48.23%	0.00066	0.02476	-0.1039
7	79591	46.27%	0.00120	0.03426	-0.1299
9	77264	49.12%	0.00319	0.05115	-0.0616
10	79674	48.23%	0.00051	0.02236	-0.2934
12	76584	48.23%	0.00098	0.02979	0.1179
13	15721	42.74%	0.00058	0.02368	-0.0156
14	10360	46.27%	0.00097	0.03040	0.0007
15	82554	47.85%	0.00282	0.05324	-0.1560
16	17049	42.29%	0.00118	0.03422	-0.1983
17	38471	38.82%	0.00381	0.06148	-0.0156
18	17903	48.23%	0.00088	0.02882	0.0304
19	92508	43.13%	0.00299	0.05439	-0.1828

(The rest of this section of output is omitted to save space.)

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Market Model, Equally Weighted Index

Day	N	Mean Abnormal Return	Positive: Negative	Z	Generalized Sign Z
-30	161	0.16%	81:80	3.371***	1.351$
-29	161	-0.36%	74:87	-1.904*	0.242
-28	161	-0.31%	74:87	0.894	0.242
(lines from actual output are omitted here to save space)					
-15	161	-0.25%	62:99	0.434	-1.659*
-14	161	-0.44%	75:86	-2.952**	0.400
-13	161	-0.28%	65:96	-1.093	-1.184
-12	161	-0.64%	65:96	-2.511**	-1.184
-11	161	-0.64%	70:91	-1.365$	-0.392
-10	161	-0.99%	61:100	-3.255***	-1.817*
-9	161	-0.19%	68:93	-0.449	-0.709
-8	161	0.01%	61:100	-0.704	-1.817*
-7	161	-0.34%	68:93	-1.230	-0.709
-6	161	-0.59%	58:103	-2.338**	-2.293*
-5	161	-0.90%	57:104	-2.562**	-2.451**
-4	161	-1.05%	59:102	-3.818***	-2.134*
-3	161	-0.69%	66:95	-2.719**	-1.025
-2	161	0.14%	64:97	1.149	-1.342$
-1	161	-0.37%	70:91	-0.896	-0.392
0	160	-0.08%	74:86	-0.756	0.314
+1	161	1.11%	78:83	4.132***	0.876
+2	161	0.00%	78:83	0.540	0.876
(lines from actual output are omitted here to save space)					

The symbols $,*,**, and *** denote statistical significance at the
10%, 5%, 1% and 0.1% levels, respectively, using a 1-tail test.

Market Model, Equally Weighted Index

Days	N	Mean Cumulative Abnormal Return	Precision Weighted CAAR	Positive: Negative	Z	Generalized Sign Z
(-30,-2)	161	-10.51%	-8.89%	45:116	-6.286***	-4.352***
(-1,0)	161	-0.45%	-0.43%	70:91	-1.168	-0.392
(+1,+30)	161	-7.51%	-5.43%	60:101	-3.782***	-1.976*

The symbols $,*,**, and *** denote statistical significance at the
10%, 5%, 1% and 0.1% levels, respectively, using a 1-tail test.

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Appendix B: Cross-sectional Regression Results

```
                           The REG Procedure
                             Model: MODEL1
                    Dependent Variable: WINAR1 (-1,0) MM


                               Weight: wgt1


                           Analysis of Variance

                               Sum of           Mean
    Source              DF    Squares         Square    F Value    Pr > F

    Model                1    0.84770        0.84770       0.59    0.4428
    Error              159  227.66748        1.43187
    Corrected Total    160  228.51518


              Root MSE               1.19661    R-Square     0.0037
              Dependent Mean        -0.00478    Adj R-Sq    -0.0026
              Coeff Var               -25035


                           Parameter Estimates

                         Parameter       Standard
    Variable   Label      DF    Estimate        Error    t Value    Pr > |t|

    Intercept  Intercept   1    -0.00307      0.00450      -0.68      0.4953

    SecPct     SecPct      1    -0.01017      0.01322      -0.77      0.4428
```