# An Event Study Example Using **Eventus**

O'Hara and Shaw (1990) conduct an event study of the statement by the U.S. Comptroller of the Currency in 1984 that some banks are too big to be allowed to fail. Figure 1 shows the Eventus program to replicate the study for the sample of 22 banks that were insolvent according to a measure proposed by Swary (1986). The `EVENTUS` statement needs no options for this study. O'Hara and Shaw state that their estimation period is days $-55$ through $-6$, relative to the event date of September 20, 1984. To replicate their estimation period we specify `EST=-6` and `ESTLEN=50` on the `REQUEST` statement. We identify the individual bank stocks using the numbers from Swary's (1986) list, so we call the identifying variable `Swarynum`. The specification `IDFMT=2.0` means that the identifying values are integers of up to two digits.

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Figure 1: Eventus program for an event study of the "Too Big to Fail" policy.

```
eventus;
 title "O'Hara and Shaw, JF, Dec 1990, pp.1587-1600";
 title2 "Replication of Table III.C:  Insolvent Bank Sample";
 request est=-6 estlen=50 id=Swarynum idfmt=2.0;
 evtstudy nomar nostd value post=5 pre=5 tail=2;
```

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O'Hara and Shaw (1990) report only market model abnormal returns; the option `NOMAR` on the `EVTSTUDY` statement suppresses the computation and reporting of market adjusted returns. Because the firms are all in the same industry and have a common event date, the authors do not use a standardized residual test, but base their test statistic "on a standard devi-

Figure 2: Request file for the "Too Big to Fail" study.

```
56480910    840920  01
16161010    840920  02
17303410    840920  04
06605010    840920  05
16372210    840920  06
46371210    840920  07
22682210    840920  08
61688010    840920  09
06636510    840920  10
94974010    840920  11
29443250    840920  12
56828710    840920  13
31945510    840920  14
33607210    840920  15
81482310    840920  16
06071610    840920  17
58550910    840920  18
33761C10    840920  19
33616010    840920  20
76071910    840920  21
45891610    840920  22
32054810    840920  69
```

ation estimated for the portfolio of sample firms from residual returns in the estimation period". [See Chandra and Balachandran (1990) and Chandra, Moriarity and Willinger (1990) for further discussion of cross-sectional dependencies in event studies.] We suppress standardized tests with the `NOSTD` option. The `NOMAR` and `NOSTD` options are not necessary; they only eliminate extra output that is not of interest in this study. The `VALUE` option is necessary because O'Hara and Shaw use the CRSP value weighted index instead of the Eventus default equally weighted index. The `POST=5` and `PRE=5` specifications limit the event period to days $-5$ through $+5$. Finally, `TAIL=2` means that significance level symbols will reflect two-tailed tests.

Besides the program in figure 1, SAS `filename` statments, operating system commands, control language statements or environment variables must associate the filerefs `CRSPINDX`, `CRSPSTOK`, and `REQUEST` with the CRSP daily index and daily NYSE-AMEX stock files and the request file. The available methods of associating the filerefs varies considerably from one operating system to another, but SAS `filename` statements should always work if the

Figure 3: The first page of Eventus output.

```
          O'Hara and Shaw, JF, Dec 1990, pp.1587-1600                1
        Replication of Table III.C:  Insolvent Bank Sample
ESTIMATION PERIOD:  Ends 6 days before the event date;
                    50 days in length.
TOTAL NUMBER OF EVENTS:         22
  EVENTS WITH USEABLE RETURNS:  22
  EVENTS DROPPED:               0

STATISTICAL SIGNIFICANCE LEVELS:  2 tailed
NONPARAMETRIC TEST:  Generalized sign test in all event studies.
For nonparametric tests, significance levels of .10, .05, .01 and .001
are denoted by (, <, <<, <<< or ), >, >>, >>> respectively.  Left
brackets -- (, < -- appear when the ratio of positive to negative
is less than in the parameter estimation period.  Right brackets
mean that the ratio is more positive than in the estimation period.

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

corresponding files are disk files. Figure 2 displays the request file. Note that it is sorted by `Swarynum` but need not be sorted at all. The CUSIPs are current as of the 1989 version of the CRSP file (released in 1990).

Figure 3 shows the first page of Eventus output. The output will be in the SAS procedure output file, `SASLIST`. The first page lists the estimation period, summarizes the results of searching the CRSP file for the sample, explains the statistical significance symbols, and may contain other information depending on the options selected.

In figure 4 is a listing of the sample and a detailed report of the number of returns Eventus found for each observation. The firm names listed are current as of the event date, based on the CRSP file name structures. The names are truncated in some cases, but if there is a letter distinguishing a class of common stock, Eventus always includes it at the end of the name. None of the 22 sample firms has classified stock. Eventus prints the untruncated name in the wide output format (`PAGE=WIDE` on the `EVENTUS` statement). If Eventus drops an observation from the sample, an explanatory message appears under "Reason if no usable returns".

Figure 5 presents the Eventus parameter estimate listing. The user can suppress this listing by specifying `NOPLIST` on the `EVENTUS` statement. Eventus

Figure 4: The Eventus sample listing and input report.

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Replication of Table III.C: Insolvent Bank Sample
Report of Daily Stock Returns Input

| Swarynum | CUSIP | Name on Event Date | Event Date | Estimation Period Returns <=50 | Event Period Returns <=11 | Reason if no usable returns |
|---|---|---|---|---|---|---|
| 1 | 56480910 | MANUFACTURERS HAN | 09/20/84 | 50 | 11 | |
| 2 | 16161010 | CHASE MANHATTAN C | 09/20/84 | 50 | 11 | |
| 4 | 17303410 | CITICORP | 09/20/84 | 50 | 11 | |
| 5 | 06605010 | BANKAMERICA CORP | 09/20/84 | 50 | 11 | |
| 6 | 16372210 | CHEMICAL NEW YORK | 09/20/84 | 50 | 11 | |
| 7 | 46371210 | IRVING BK CORP | 09/20/84 | 50 | 11 | |
| 8 | 22682210 | CROCKER NATL CORP | 09/20/84 | 50 | 11 | |
| 9 | 61688010 | MORGAN J P & CO I | 09/20/84 | 50 | 11 | |
| 10 | 06636510 | BANKERS TR N Y CO | 09/20/84 | 50 | 11 | |
| 11 | 94974010 | WELLS FARGO & CO | 09/20/84 | 50 | 11 | |
| 12 | 29443250 | EQUIMARK CORP | 09/20/84 | 50 | 11 | |
| 13 | 56828710 | MARINE MIDLAND BK | 09/20/84 | 50 | 11 | |
| 14 | 31945510 | FIRST CHICAGO COR | 09/20/84 | 50 | 11 | |
| 15 | 33607210 | FIRST PA CORP | 09/20/84 | 50 | 11 | |
| 16 | 81482310 | SECURITY PACIFIC | 09/20/84 | 50 | 11 | |
| 17 | 06071610 | BANK OF BOSTON CO | 09/20/84 | 50 | 11 | |
| 18 | 58550910 | MELLON NATIONAL C | 09/20/84 | 50 | 11 | |
| 19 | 33761C10 | FIRST WIS CORP | 09/20/84 | 50 | 11 | |
| 20 | 33616010 | REPUBLICBANK CORP | 09/20/84 | 50 | 11 | |
| 21 | 76071910 | REPUBLIC NEW YORK | 09/20/84 | 50 | 11 | |
| 22 | 45891610 | INTERFIRST CORP | 09/20/84 | 50 | 11 | |
| 69 | 32054810 | FIRST INTERSTATE | 09/20/84 | 50 | 11 | |

prints more statistics, including the first-order autocorrelation of the market model residuals, if the `PAGE=WIDE` option appears on the `EVENTUS` statement.

The event study results appear in figure 6. The results are substatially the same as O'Hara and Shaw (1990) report. The authors report average and median abnormal returns on day 0 of 0.42% and −0.24%, while Eventus reports 0.43% and −0.24%. If we use the `OUTSAS=` option to save the event study, then run a program with the `EXTRACT` statement to examine the results, we find that 0.0042 is the truncated value of the mean, 0.0042566. Eventus correctly rounds the result to 0.43% (for reporting only, not computation). Thus truncation may explain the 0.01% discrepancy in the reported average abnormal return. O'Hara and Shaw report a $t$ statistic of 0.78 and Eventus reports 0.77. O'Hara and Shaw compute the estimation period residual standard deviaton by dividing the sum of squared differences by 49, or one less than the number of days in the estimation period. Eventus divides by two less than the number of days, because we estimate two market model parameters. The difference in computation of the residual standard deviation would tend to make the statistic that Eventus reports smaller, and so may explain the difference.[1]

Eventus reports that 10 of the 22 abnormal returns on day 0 are positive, which is the same 45.5% fraction that the original study reports. The authors provide a significance level for the median abnormal return of 0.516. The article does not seem to define the statistic explicitly. Eventus reports a generalized sign test statistic of −0.04 for day 0. The statistic is based on the normal approximation to the binomial, so it has an approximately standard normal distribution. A table of the standard normal distribution shows that the probability of observing a value of $z \leq -0.04$ is 0.5160. Thus O'Hara and Shaw (1990) appear to use the generalized sign test. [See Cowan (1992) and Sprent (1989) for further discussion of the generalized sign test.]

Note that when the program does not include an `WINDOWS` statement, Eventus reports three windows that jointly cover the entire event period. In this study, the authors focus on day 0 because there is no reason for any other day to have a stock price reaction.

[1] If O'Hara and Shaw used the same untruncated average abnormal return that Eventus used, their result would differ from ours by a factor of $\sqrt{(49/48)} = 1.010363$; and $1.010363 \times 0.77 = 0.78$, rounded.

Figure 5: The Eventus parameter estimate listing.

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Replication of Table III.C: Insolvent Bank Sample
Parameter Estimates and Estimation Period Statistics

---------- Index Weight=Value ----------

| SWARYNUM | CUSIP | Alpha | Beta | Mean Return | Market Model Residuals>0 | Residual Standard Deviation |
|---|---|---|---|---|---|---|
| 1 | 56480910 | 0.00102 | 1.12 | 0.00285 | 50.00% | 0.02192 |
| 2 | 16161010 | 0.00081 | 1.10 | 0.00260 | 47.99% | 0.01216 |
| 4 | 17303410 | 0.00019 | 1.70 | 0.00297 | 45.99% | 0.01388 |
| 5 | 06605010 | -0.00042 | 1.39 | 0.00185 | 51.99% | 0.01747 |
| 6 | 16372210 | 0.00190 | 1.43 | 0.00424 | 41.99% | 0.01909 |
| 7 | 46371210 | 0.00103 | 1.05 | 0.00275 | 45.99% | 0.02000 |
| 8 | 22682210 | 0.00716 | 0.31 | 0.00766 | 43.99% | 0.03187 |
| 9 | 61688010 | 0.00089 | 1.04 | 0.00259 | 41.99% | 0.01129 |
| 10 | 06636510 | 0.00273 | 1.09 | 0.00451 | 50.00% | 0.01106 |
| 11 | 94974010 | 0.00394 | 0.95 | 0.00550 | 51.99% | 0.01283 |
| 12 | 29443250 | -0.00140 | 1.13 | 0.00045 | 50.00% | 0.02894 |
| 13 | 56828710 | 0.00321 | 0.46 | 0.00396 | 47.99% | 0.01535 |
| 14 | 31945510 | 0.00171 | 1.52 | 0.00419 | 43.99% | 0.01643 |
| 15 | 33607210 | 0.00258 | 0.83 | 0.00394 | 50.00% | 0.02685 |
| 16 | 81482310 | 0.00196 | 0.82 | 0.00330 | 41.99% | 0.01171 |
| 17 | 06071610 | 0.00134 | 1.01 | 0.00299 | 47.99% | 0.01261 |
| 18 | 58550910 | -0.00069 | 1.12 | 0.00114 | 43.99% | 0.01719 |
| 19 | 33761C10 | 0.00210 | 0.49 | 0.00291 | 47.99% | 0.01944 |
| 20 | 33616010 | 0.00073 | 0.86 | 0.00213 | 43.99% | 0.01932 |
| 21 | 76071910 | 0.00070 | 0.83 | 0.00205 | 43.99% | 0.01494 |
| 22 | 45891610 | 0.00478 | -0.26 | 0.00436 | 31.99% | 0.02361 |
| 69 | 32054810 | 0.00254 | 0.65 | 0.00360 | 43.99% | 0.01539 |
| | MEAN | 0.00176 | 0.94 | 0.00330 | 45.90% | 0.01788 |
| | MEDIAN | 0.00153 | 1.02 | 0.00298 | 45.99% | 0.01681 |

Figure 6: Event study results.

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Replication of Table III.C: Insolvent Bank Sample

Market Model, VW Index

| Day | Average Abnormal Return | Median Abnormal Return | t | N | Positive: Negative | Generalized Sign Z |
|---|---|---|---|---|---|---|
| -5 | 1.27% | 1.51% | 2.29* | 22 | 16:6 | 2.52> |
| -4 | 1.21% | 1.08% | 2.18* | 22 | 17:5 | 2.95>> |
| -3 | 0.27% | 0.14% | 0.49 | 22 | 12:10 | 0.81 |
| -2 | 0.18% | 0.32% | 0.33 | 22 | 15:7 | 2.10> |
| -1 | 0.21% | -0.12% | 0.38 | 22 | 10:12 | -0.04 |
| 0 | 0.43% | -0.24% | 0.77 | 22 | 10:12 | -0.04 |
| +1 | 0.30% | 0.29% | 0.54 | 22 | 15:7 | 2.10> |
| +2 | -0.55% | -0.84% | -1.00 | 22 | 8:14 | -0.90 |
| +3 | -0.38% | -0.41% | -0.68 | 22 | 9:13 | -0.47 |
| +4 | 0.61% | -0.46% | 1.10 | 22 | 8:14 | -0.90 |
| +5 | 0.33% | -0.12% | 0.59 | 22 | 10:12 | -0.04 |

| Days | Cumulative Average Abnormal Return | Median Cumulative Abnormal Return | t | Positive: Negative | Gen Sign Z |
|---|---|---|---|---|---|
| (-5,-2) | 2.92% | 3.40% | 2.64** | 19:3 | 3.81>>> |
| (-1,0) | 0.63% | 0.44% | 0.81 | 12:10 | 0.81 |
| (+1,+5) | 0.30% | -1.14% | 0.24 | 7:15 | -1.33 |

$, (, ) significant at .10 *, <, > significant at .05

**, <<, >> significant at .01 ***, <<<, >>> significant at .001

Every SAS program, including an Eventus program, produces a SAS log. For an Eventus program, the SAS log output mostly reports the completion of data steps and procedures that Eventus executes internally. Most Eventus users will find that these reports have no meaning for them and they may ignore the reports. However, it is still a good idea to look briefly through the SAS log for messages that begin with `EVENTUS NOTE`, `EVENTUS WARNING`, or `EVENTUS ERROR`. If your Eventus program stops executing before it is completed, these messages may explain what went wrong.

# References


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