# Eventus® Calendar-Time Portfolio Regression

This article shows how to use Eventus to run just one of the available methods, a basic calendar-time portfolio regression, and explains what Eventus does in response.

## 1. Request file

The sample code below uses a SAS filename statement to point to a text request file containing CUSIP, event date and an optional user-determined unique ID variable. The following lines can be pasted into Notepad, TextPad (a third party program for Windows), Joe (Unix) or any other plain text file editor and saved in plain text format to make the request file. Alternatively, the user can write SAS code to make a SAS data set from the lines, then use the InSAS option of the Request statement in Eventus to point to the data set.

```
05461510    19971021    10718
37803P10    19971020    10719
00797310    19971017    10720
48007410    19971016    10721
70322410    19971015    10722
25375210    19971015    10723
62991310    19970618    10802
52903910    19970617    10803
02078710    19970612    10804
69487310    19970611    10805
41078310    19970611    10806
13886910    19970605    10810
74070610    19970429    10822
12658310    19970424    10823
44992310    19970423    10824
84610H10    19970416    10825
07367810    19970410    10830
46047F10    19970408    10831
00847410    19970408    10832
```

## 2. Eventus program

The Eventus program for this example appears below. The Eventus statement includes the option Monthly to select monthly return mode and the FFF option to point to the SAS data set containing the Fama-French factors. Calendar-time portfolio regressions in practice typically use monthly returns and Fama-French factors, as in this example, but Eventus does not require these settings. Monthly returns and Fama-French factors are independent Eventus options that can be used with many methods.

The Request statement includes the CusiPerm option to indicate that the request file identifies the stocks in the sample by their CRSP CUSIPs. In a monthly return event study, month 0 initially is the month of the date in the request file. For this example, we assume that the user wants to include each stock in the calendar-time portfolio for the twelve calendar months following (not including) the event month. We use the option `shift1=+1` to redefine month 0 as one month later than the date in the request file. The ID and IDFmt

options jointly indicate that the request file includes a user-supplied five-digit numeric identification variable that is to be designated SecurityEvent in Eventus output. An identification variable is optional and may be any data type and format.

On the EvtStudy statement, we specify `pre=0 post=11` to include each stock in the calendar-time portfolio from zero months before through 11 months after the new month 0. Eventus designates relative days or months based on the dates of CRSP returns.[1] If one prefers to think in terms of transaction prices, we buy each stock at its closing price at the end of new month –1 and sell at the closing price of new month +11. Assuming no missing data, each stock earns 12 monthly returns (0 through +11) during its time in the portfolio.

The FamaFrench option selects the Fama-French three-factor model. The CTPR option selects the calendar-time portfolio regression method.

```
filename request 'file path and name go here';
Eventus Monthly FFF=FF.Factors;
 Request CusiPerm shift1=+1 ID=SecurityEvent IDFmt=5.;
 EvtStudy pre=O post=11 FamaFrench CTPR;
```

## 3. What Eventus does

In this example, Eventus extracts CRSP monthly returns for each stock from zero months before through 11 months after its redefined month 0, and calculates the excess return by subtracting the risk-free return (from FF.Factors) from each stock return.[2] For each calendar month in which at least one stock excess return is obtained, Eventus calculates the portfolio excess return as the arithmetic mean of stock excess returns. The portfolio excess returns are merged with the Fama-French factor return series and a regression is estimated by OLS. The dependent variable is the monthly portfolio excess return and the independent variables are the monthly excess return of the market index and the monthly returns of the HML and SMB factors. Heteroskedasticity-consistent test statistics are reported.

## 4. Example results

The results are in Table 1 on the following page. The intercept, or alpha, estimates the component of the mean monthly return, over the 18-month calendar period, that is not explained by the three factors. The alpha of –0.17% is not significantly different from zero using either the OLS or the heteroskedasticity-consistent t-test.

## 5. Running the example in Eventus

The zip file http://www.eventstudy.com/Eventus9_ffctpr_demo.zip contains versions of the above Eventus program formatted for use in Eventus for Windows and Eventus for WRDS. The results appear in the Output window of PC SAS, the *.lst file from a command-line run or the result page from a web query.

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[1] The holding period for the month $t$ return is from the last market close of month $t$–1 to that of month $t$. Eventus takes the return from CRSP or the user's mini-database in a non-CRSP run.

[2] In Eventus terms, *excess return* means only a return in excess of the risk-free rate, not an abnormal return.

Table 1: Calendar-Time Portfolio Regression Event Study Results

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


        Fama-French Calendar-Time Portfolio Regression, Value Weighted Index


                                                        Hetero-
                                  Average                skedasticity
                                  Month in               Consistent
                                  (-0,+11)     OLS t       t (HC)
      _____

      Intercept (Abnormal Return)  -0.0017    -0.20       -0.22
      b(p)                          1.1415     6.48***      8.30***
      s(p)                          1.3511     5.79***      6.01***
      h(p)                          0.0091     0.02         0.03

      R-squared                    91.15%
      Adjusted R-squared           89.26%
      F(3,14)                      48.07***
      _____

            The symbols $,*,**, and *** denote statistical significance
                at the 10%, 5%, 1% and 0.1% levels, respectively.
```

## 6. Replicating the results outside of Eventus

Included in zip file http://www.eventstudy.com/Eventus9_ffctpr_demo.zip is an Excel workbook, Eventus_FFCTPR_demo.xlsx, showing the stock excess returns aligned in calendar time, the resulting portfolio excess returns and the Fama-French factor returns. The Fama-French factor returns and risk-free returns can be verified by using data from Ken French's web site. The stock and market excess returns can be replicated by using CRSP software or WRDS to obtain stock and value-weighted index returns for the indicated calendar months, then subtracting the corresponding risk-free returns. The final data for the calendar-time regression, which are in green in the spreadsheet, can be used with any statistical or econometric package to replicate the regression results.

More generally, Eventus 9 includes several options to obtain a file containing the portfolio or individual security data used in the calendar-time portfolio regression. The options are at the end of Table 2 below.

## 7. Additional options

Several potential ways to tailor the above calendar-time portfolio regression program to meet your research needs are in Table 2. If you don't see what you are looking for, please visit our support web site http://support.eventstudy.com and open a support ticket or post in our discussion forums, one of which can be used to request features to appear in future versions of Eventus.

## 8. About this article

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Table 2: How to modify the example program for selected Eventus calendar-time portfolio regression tasks

| To do this | Change, add or omit option(s) | Of this statement |
|---|---|---|
| Run the calendar-time portfolio regression for the year ending the month before the request-file date. | Shift1=–1 *and* | Request |
| | Pre=11 Post=0 | EvtStudy |
| Run the calendar-time portfolio regression for the year beginning the month of the request-file date. | (*omit* Shift1=+1) | Request |
| Indicate that the first column of my request file is PERMNO, not CUSIP. | (*omit* CusiPerm) | Request |
| Do not use an optional ID variable. | (*omit* ID= *and* IDFMT= *options*) | Request |
| Extend the model to four factors by adding the momentum factor UMD. | Momentum | EvtStudy |
| Exclude any stock that has a missing return in the months to be used. | MaxMiss=0 | EvtStudy |
| Allow one missing return, but exclude a stock that has two or more. | MaxMiss=1 | EvtStudy |
| Use weighted least squares (WLS) estimation where the weight of each calendar month (or other period in a non-monthly run) is based on the number of securities in the portfolio in that month. | WLS | EvtStudy |
| Use GMM estimation. | GMM | EvtStudy |
| Use my own factors instead of Fama-French factors. (Please see the User's Guide for detailed requirements for these options.) | (*omit* FFF=*etc.*) *and add* MyFactors=*etc.* (*omit* FamaFrench) *and add* Factors=*n* | Eventus Eventus EvtStudy EvtStudy |
| Make a four- or five-factor model by adding one factor that I construct myself to the three or four Fama-French (and momentum) factors. | Same as "my own factors" immediately above. Create the MyFactors= data set by merging the Fama-French factor data set with the data set containing the additional factor, and rename the Fama-French factor return columns Factor*i* where *i* is a sequential positive integer. | |

Table 2 continued

| To do this | Change, add or omit option(s) | Of this statement |
|---|---|---|
| Allow each stock to be in the calendar-time portfolio for a different number of months, where the start and end date are based on two date columns in the request file. (Please see the User's Guide for detailed requirements.) | Twin *and* | Eventus |
| | (*omit or include* Shift1= *or* Shift2= *as desired*) *and* | Request |
| | | EvtStudy |
| | (*omit* Pre= *and* Post=) | |
| Calculate the portfolio return with each stock weighted by its market capitalization immediately preceding its inclusion in the portfolio. | ValueWeightSample | EvtStudy |
| Calculate the portfolio return with each stock's monthly return weighted by its ending market capitalization the previous month (or daily by previous day). | ValueWeightSample = Update | EvtStudy |
| Add a wild bootstrap test of the intercept | Boot=Wild | EvtStudy |
| Customize the bootstrap methods | Various options are available; see documentation | EvtStudy |
| Fill in missing post-delisting return months | Various specifications of the Fill= option are available; see documentation | EvtStudy |
| Output calendar-time portfolio returns and corresponding market and factor returns to a SAS data set or Excel, CSV or Stata file | OutPortfolio=, ExcelPortfolio=, CSVPortfolio=, DTAPortfolio= | EvtStudy |
| Output individual firm returns and corresponding market and factor returns used to create the above portfolio data set, one row per trading date per security-event to a SAS data set or Excel, CSV or Stata file | OutAR=, ExcelAR=, CSVAR=, DTAAR= | EvtStudy |