What's New in Eventus® 9.0

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1.1   Output files

1.1.1   New output file options and formats

The EvtStudy statement has several new options for creating output files. All options in the table on the following page are new in Eventus 9 except OutWin and FileWin, which first appeared in Eventus 8. Multiple options can be specified on the same statement. The OutSAS option of the EvtStudy statement remains available but is not recommended for new users or new application development because other options provide the same data in easier to use file formats.

SAS data set names specified by the user may consist only of a member name (equivalent to a file name), or may be in libref.membername format. If you give only a member name, the data set will be created in the SAS Work library unless you have already used the SAS system option User= to specify a default permanent SAS library. The Work library is temporary by definition, so to preserve a Work data set after your WRDS SAS/Eventus run ends or after you close PC SAS, you must copy or move the data set to a permanent library. A permanent SAS library name (libref) is a shortcut to a folder or directory on the system. Please see SAS documentation for further information on SAS data sets and libraries.

For the options that create a non-SAS file type, you can specify the file name as nothing more than a name, or you can specify a fully qualified name that includes the directory or folder (start with the drive letter and : if you provide a fully qualified name in Windows). If you omit the directory or folder, the file is created in the current directory or folder. In Windows, the current folder is identified along the bottom edge of the SAS application. Also, you can omit *.extension* from the end; if you omit it, Eventus creates the file with the appropriate extension. In Windows, the extension created by Eventus allows the system to identify the file type. If any part of the file name (including the folder if you are providing it) contains at least one blank or special character, enclose the entire name in single quotes.

The Excel workbook format created by Eventus is an XML format and is created with an extension of .xml. The XML format, although different from the xls and xlsx formats usually created when one saves a workbook from Excel, is recognized by Excel 2002 and later. The output of the ExcelAR option often will have too many columns to be opened in Excel versions earlier than 2007. If the one row per security-event format is used with monthly data, or the Vertical ExcelAR option combination is used with a sample size of fewer than 250 security-events, there is a good chance the resulting workbook can be opened in Excel 2002 and 2003 even though the table indicates Excel 2007 and later.

Variable names in SAS and Eventus are not case sensitive. For example, if a variable is defined with the name PERMNO, it is stored this way but may also be referenced as permno, PermNo or any other case mixture. Stata variable names are case sensitive, so for convenience, Stata output files created by Eventus have the names of all variables in all lower case. To prevent changing the case of variable names, add the option Skip to the EvtStudy statement.

When you run a two-step event study with more than one benchmark type in the same run (e.g. market adjusted returns and market-model abnormal returns) or with both equal and value weighted indexes in

the same run, most of the options produce and output data set or file with the different set of results stacked. That is, a full set of results for one combination of benchmark and index appears at the beginning of the file, followed by the next combination on subsequent rows using the same columns, and so on. The Excel options, instead of stacking the results in this manner, create separate worksheets within the workbook file for the different combinations of benchmark and index.

Type of results	Type of file	EvtStudy statement option
For two-step event studies		
Time series (e.g. daily or monthly) of abnormal returns, one row per security-event	SAS data set Excel 2007+ CSV Stata	OutAR=*SAS_data_set_name* ExcelAR=*file_name* CSVAR=*file_name* DTAAR=*file_name*
Time series (e.g. daily or monthly) of abnormal returns, one column per security-event	SAS data set Excel 2007+ CSV Stata	Vertical OutAR=*SAS_data_set_name* Vertical ExcelAR=*file_name* Vertical CSVAR=*file_name* Vertical DTAAR=*file_name*
Cumulative or buy-and-hold abnormal returns for the windows, one row per security-event	SAS data set Text Excel 2002+ CSV Stata	OutWin=*SAS_data_set_name* FileWin=*file_name* ExcelWin=*file_name* CSVWin=*file_name* DTAWin=*file_name*
Estimation period statistics and estimated linear model parameters (if applicable)	SAS data set Excel 2002+ CSV Stata	OutParam=*SAS_data_set_name* ExcelParam=*file_name* CSVParam=*file_name* DTAParam=*file_name*
For calendar-time portfolio regression event studies		
Calendar-time portfolio returns and corresponding market and factor returns	SAS data set Excel 2002+ CSV Stata	OutPortfolio=*SAS_data_set_name* ExcelPortfolio=*file_name* CSVPortfolio=*file_name* DTAPortfolio=*file_name*
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	SAS data set Excel 2002+ CSV Stata	OutAR=*SAS_data_set_name* ExcelAR=*file_name* CSVAR=*file_name* DTAAR=*file_name*

1.1.2 Issuer names in output data sets

The CAR or BHAR data set created by the EvtStudy statement OutWin= or the Extract statement option OutSAS= now includes the issuer name by default if the run uses a CRSP database or if it is a SAS-NONCRSP run where the mini-database includes a names data set. If you prefer to leave the issuer name out of the output data set, for example if you expect the data set to be very large and do not need the name, you can suppress it by specifying the EvtStudy statement NoNameOut.

1.1.3   Default variable names

The default variable-name stems for CARs, etc. in the created by the EvtStudy statement OutWin= or the Extract statement option OutSAS= now vary depending on whether the data set contains cumulative abnormal returns, buy-and-hold abnormal returns or cumulative abnormal relative volumes. As in previous versions, you can specify your own stem using the VPrefix= option of the EvtStudy statement.

1.2   Enhancements to non-CRSP data handling

1.2.1   Increased error checking

Eventus 9 performs more automatic checking on input data sets for non-CRSP event studies (SAS-NONCRSP mode). This should greatly increase the percentage of mini-database problems that result in clear, specific error messages in the SAS log. Also, there is a new option of the Eventus statement, AnalyzeMini, that performs even more detailed checks and lists every non-conforming data set row.

1.2.2   IndexDS data set not always required

In SASNONCRSP runs where custom factor, Fama-French factor, custom index or companion index returns are used instead of a market-wide index, so that the market index return columns in a IndexDS= data set are not needed, the IndexDS= specification may be omitted. In Eventus 8 and earlier, the IndexDS= data set was required because it was used as the master calendar for the mini-database. If provided, it is still used as the master calendar. If it is omitted (and the market index returns it would have provided are not needed), Eventus automatically selects the custom factor, Fama-French factor, custom index or companion index data set to use as the master calendar. As in Eventus 8 and earlier, Eventus requires the data set used as the master calendar to contain at least all calendar dates of individual security returns in the mini-database, with each calendar date appearing only once in the master calendar.

1.2.3   Automatic index-option selection

In SASNONCRSP runs where the IndexDS= data set is needed and contains only one of the allowed market index return column names in the format wWRETy, where w is replaced by E or V and y is replaced by D or X, Eventus now uses the market index return even if the column name indicates that the index is value weighted but the user omits the Value option or the column name indicates that the index is without dividends but the omits the NoDivIdx option. If applicable, Eventus automatically activates the needed option(s) and provides a message to that effect in the SAS log.

1.2.4   Ability to use data with values <−1.0

As in previous versions, the default behavior of Eventus 9 is to flag values less than −1.0 in a return column as an error, preventing the completion of a run until the values are corrected. A new option in Eventus 9 makes it possible to conduct event studies using non-return data that legitimately may include values less than −1.0. To do so, set up the mini-database following the instructions in the User's Guide, as if the data were returns, and add the option AllowAllRet to the EvtStudy statement to prevent rejection of values less than −1.0.

1.3   Companion portfolio enhancements

The optional MyCompanionIndex data set now may have up to 10,000 companion portfolio series, increased from 400 in Eventus 8.

The MyCompanionFreq option now accepts a new argument Constant (case doesn't matter) to indicate that the portfolio assignments data set lists each security identifier only once, instead of once per year or quarter.

The Companion option (Request statement) and Factors= option (EvtStudy statement) can now be used in the same event study. The matched companion portfolio return replaces an overall market index in the custom factor model. Except for the addition of being able to be used together and the other enhancements in this document, both options work as in Eventus 8.

The companion portfolio feature can be used with the EstInter option, which selects different return frequencies for the estimation and event periods. Ask us for details if you are interested in using this.

1.4 Expanded features to value-weight samples or subsamples

1.4.1 New ValueWeightSample=Update specification
The existing EvtStudy statement option ValueWeightSample treats the sample as an unequally weighted portfolio, where the weights are based on the closing market capitalizations of the securities on the day or month (or other return interval being used in SASNONCRSP mode) before the event period. Eventus 9 introduces an additional specification of this option, ValueWeightSample=Update, which causes the portfolio weight to be updated for each return interval. For example, in a monthly return study, the weight for each security-event's return is based on the closing market capitalization of the prior month. The market capitalization is calculated from prices and shares outstanding. Therefore, if the new specification is used with non-CRSP data, the mini-database must include prices and shares data sets.

1.4.2 Automatic value-weighting of grouped security-events
The existing Request statement option GrWeight has new specifications, GrWeight=Value and GrWeight=ValueUpdate. The GrWeight option is used in combination with the Group= option. The Group= option specifies the name of a grouping variable; security-events with a common value of the grouping variable are formed into a portfolio that is treated as a single security in the event study. In Eventus 8 and earlier, the GrWeight option required a group weight variable to be included in the request file. This still is true when GrWeight is specified without an = and argument. When you use GrWeight=Value, instead of a user-supplied weight, Eventus calculates the weight of each group member based on its market capitalization immediately before the event period and applies this constant weight for every day, month or window in the event period. When GrWeight=ValueUpdate is specified, the weight for the first day or month of the event period is the same as with GrWeight=Value, but the weight is updated each day or month. The market capitalization used in these specifications is calculated from prices and shares outstanding. Therefore, if these specifications are used with non-CRSP data, the mini-database must include prices and shares data sets.

The Request statement option SizeIndex=CRSPAccess can now be abbreviated to SizeIndex=CRSP. This specification selects the size decile index series embedded in the main CRSP U.S. stock database, which is available to you only if you subscribe to the separate CRSP Indices product.

1.5   Calendar-time tests

1.5.1   General

The options for calendar-time tests have been revamped in Eventus 9. The CalendarTime option of the EvtStudy statement has the same meaning as in Eventus 8, so users who are familiar with this option can continue to use it the same way in Eventus 9. However, this option had different meanings in different contexts and therefore could be confusing. The CalendarTime option is no longer suggested for new users or new Eventus applications because Eventus 9 offers clearer, more specific options to perform the same tasks and more.

Eventus offers two types of calendar-time event study methods, calendar-time portfolio regression and Jaffe-Mandelker-style tests. Both involve, as a step preliminary to calculating test statistics, find the mean calendar-time abnormal returns of portfolios. The portfolios are not merely imaginary portfolios of securities that a real investor could not hold because the securities are aligned in event time but experience the event on different calendar dates. Instead, a security is assigned to a calendar-date portfolio if the calendar date falls in a desired window relative to the security's literal event date.

The calendar-time portfolio regression method uses a time-series regression to estimate the relation between the portfolio return and a set of one or more factors that have been shown to be correlated with returns. The estimated regression intercept shows the average effect of the event per calendar period. The Jaffe-Mandelker-style methods use a separate estimation period to derive the parameters of a linear benchmark model, if one is used, at the security level, and also, in most of the methods of this type, to obtain the variances of portfolio mean abnormal returns. The mean abnormal return across calendar-time portfolios is tested directly.

The new CTMin=n option of the EvtStudy statement allows you to specify the minimum number of members a calendar-time portfolio must have to be used in the analysis. If fewer than n firms with non-missing data are included in the portfolio for a given calendar date, the date is omitted from the calendar-time portfolio regression or from the Jaffe-Mandelker-style test statistic calculation. If the option is not specified, the default is to use every calendar date for which at least one security has non-missing data.

In Eventus 8, calendar time tests were not eligible for bootstrapping. In Eventus 9, all calendar-time tests of both types are eligible for the new wild bootstrap (see the Bootstrap=Wild option specification). The older nonparametric bootstrap is not available for calendar-time tests.

1.5.2   Calendar-time portfolio regression method

To run the calendar-time portfolio regression method, specify the CTPR option of the EvtStudy statement. As in Eventus 8, this method is implied when the FamaFrench option is specified without adding the TwoStep option; the CTPR option may be included or omitted in this context with the same result. The CTPR option now may be used with the default single factor market model. Only one calendar-time portfolio regression is allowed in a single run. So, for example, you can specify CTPR MM or CTPR Fama-French but not CTPR with both the above benchmark options at the same time.

The CTPR option also works with custom factor models. The Factors= option no longer automatically invokes calendar-time portfolio regression as it did in Eventus 8.

If Eventus is running under SAS 9.2, you can control the type of heteroskedasticity-consistent standard error used in the calendar-time portfolio regression. In SAS 9.1.3, and by default when using daily data in SAS 9.2, Eventus 9 reports CTPR significance tests based on the White (1980) heteroskedasticity-consistent covariance matrix estimator. This can also be selected explicitly by specifying the EvtStudy statement option HCCMethod=0. By default when using monthly data in SAS 9.2, Eventus 9 reports CTPR significance tests based on the MacKinnon and White (1985) HC_3 estimator. This estimator can be selected explicitly by specifying the EvtStudy statement option HCCMethod=3.

The displayed output from a calendar-time portfolio regression now includes the adjusted R^2 and the regression F statistic. Also, the PValue option of the EvtStudy statement now works for calendar-time portfolio regressions.

Eventus 8 and earlier used the MktRf column in the data set pointed to by the FFF= option as the source of the excess return of the market index (market return minus risk-free return). Starting with version 9, Eventus calculates the excess market return using the market return from the main database (CRSP or user-built mini-database) and the risk-free return from the FFF= data set. The market index used to build the Fama-French factor data set available on Professor Kenneth French's web site is the CRSP value-weighted market index. Therefore, starting in version 9, the EvtStudy statement option Value is the default setting for Fama-French calendar-time portfolio regressions. (The former default of using the equally weighted index is still in effect for all other situations.) The purpose of this change is to maintain consistency with Eventus 8 and earlier. However, when using CRSP data, there may be a very small change in results, because the Fama-French file's MktRf column used by Eventus 8 is more rounded than the index return data that Eventus 9 reads from the CRSP database. The results also can be affected by a 2009 CRSP database change for a subset of subscribers, explained in section 5.8.

1.5.3   Jaffe-Mandelker method

For Jaffe-Mandelker-style calendar-time tests in event studies, there are four new options, CTJM, CTMod, CTLBT and CTHSC. At most one of the CTJM, CTLBT or CTHSC options may be used in the same Eventus run. CTMod and CTJM can be used together or separately. Only one calendar-time test may be bootstrapped in one Eventus run. These tests may be run at the same time as non-calendar time two-step event study tests. However, a calendar-time test and a non-calendar-time test cannot be boot-strapped in the same run.

The CTJM option produces the test developed by Jaffe (1974) and Mandelker (1974) with the following differences. Jaffe (unnumbered equation between equations 3 and 4) and Mandelker (equation 9) esti-mate the variance of each monthly portfolio return over the immediately preceding 50 calendar months. The Eventus version of this test, however, uses the estimation period for a given security-event that Eventus would use with any other two-step event-study test (essentially anything other than calendar-time portfolio regression, Ibbotson RATS or the event-parameter approach.) As in earlier versions of Eventus, you can control the estimation period with the Est= and EstEnd= options. With the CTJM op-

tion, Eventus lines up the estimation-period returns, of the members of a calendar-time portfolio, in calendar time and takes the mean return of each calendar month or day. The resulting time series of calendar-time mean estimation-period returns is used to calculate the variance of abnormal returns for the calendar-time portfolio. When testing a window of two or more months or days, the number of distinct calendar trading days in the time series used for variance estimation can exceed the length of the estimation period for any one security-event. This is because the estimation period is defined relative to each security-event's month 0 or day 0, but two security-events with different event dates can be in the same calendar-time portfolio if their event dates overlap.

For example, suppose in a monthly event study we use Request statement options Est=–13 Estlen=36, and firms A and B have event dates in January 2007 and April 2007, respectively. Based on the options and event dates, firm A's estimation period is January 2003 through December 2005 and B's is April 2003 through March 2006. If we test window (–2,+2), a security belongs to a given calendar month portfolio if the month falls within two months before to two months after the security's month 0. Thus, both A and B belong to the February 2007 and March 2007 calendar time portfolios. Assuming A and B are the only members of the two portfolios, the variance of each portfolio is calculated from the 39-month January 2003–March 2006 time series of mean returns. In the first three months of the 39, the mean is only A's return and in the last three months the mean is only B's return.

Besides the period used to calculate the variance of a calendar-time portfolio return, another difference from Jaffe and Mandelker has to do with the test of the null hypothesis that the mean calendar-time portfolio abnormal return across all calendar months or days, applicable to a given window in event time, is equal to zero. Jaffe (1974) and Mandelker (1974) assume that the time-series variance of this calendar time series is equal to one. (See Jaffe, equation 7 and Mandelker, equation 12.) Eventus 9 estimates the variance across the time series.

Eventus 9 also provides an additional test statistic corrected for first-order serial correlation of the calendar-time portfolio returns. This statistic does not take into account the fact that two consecutive returns in the calendar time series may not be adjacent in real time. For example, for a given window in event time, there may be firms that have calendar months May, June and August 2009 in the window, but none that has July 2009. In this case, June and August 2009 would be treated as consecutive months in estimating the first-order serial correlation. Therefore, the statistic corrected for serial correlation should not automatically be considered more accurate for every sample.

Jaffe and Mandelker use only the single-factor market model as the benchmark for abnormal returns, but their testing method is not specific to this benchmark. Eventus 9 can perform the test in conjunction with any benchmark method available for two-step event studies.

The CTMod option performs the same test of monthly or daily abnormal returns as the CTJM option. For windows of two or more months or days, the CTMod option performs a modified calendar-time test. Assume that monthly returns are being used. We form a subportfolio of all firms having the same calendar month 0 and therefore the same estimation period in calendar time. We calculate the time-series variance of the subportfolio mean abnormal return across the estimation-period months. This variance

is used to standardize the subportfolio mean cumulative abnormal return (CAR) in the event window. For example, to get the standardized CAR for window (−2,+2), multiply the variance by 5, take the square root, and divide into the subportfolio mean CAR for the window. Once we have the standardized CARs for all subportfolios, we calculate the test statistic for the window as a simple t-test using the standardized CARs. This modified test is computationally faster than the original Jaffe-Mandelker test, especially with daily data and multiple window definitions, but as of this writing no simulation evidence of its power and specification is known to exist.

The CTLBT option performs a version of the Jafee-Mandelker test proposed by Lyon, Barber and Tsai (1999). This test differs from the test performed by the CTJM option only in that the calendar-time portfolio returns are not standardized.

The CTHSC option performs the HSC_t test, an extension of the Lyon, Barber and Tsai (1999) version of the Jafee-Mandelker test developed by Jegadeesh and Karceski (2009) to correct for heteroskedasticity and autocorrelation. Jegadeesh and Karceski demonstrate the test using control portfolios or control firms as benchmarks for calculating abnormal returns, but their testing method is not specific to this type of benchmark. Eventus 9 can perform the test in conjunction with any of the benchmark methods available for two-step event studies. The HSC_t test is performed only for event windows. The calendar-time test produced by the CTHSC option for the monthly or daily abnormal return section of the output is the same as the CTLBT option.

1.6 Bootstrap event-study tests

1.6.1 Wild bootstrap option

In addition to the nonparametric bootstrap (sometimes called a percentile-t bootstrap or case bootstrap) of Eventus 8 and earlier, Eventus 9 offers the wild bootstrap, a relatively new and potentially more robust method in the statistics literature. To obtain the wild bootstrap, specify Bootstrap=Wild on the EvtStudy statement. Specifying the option Bootstrap (or just Boot) without =Wild continues to invoke the nonparametric bootstrap.

Wild bootstrapping requires an auxiliary distribution, from which pseudo-random drawings independent of the original data are generated and used to modify the residuals to create a resample. By default, Eventus uses the Rademacher distribution to generate an auxiliary random variable. An alternative is to use a product of normal random variables proposed by Liu (1988); to use this in the wild bootstrap instead of the Rademacher distribution, specify the additional EvtStudy statement option Regina.

When bootstrapping event-study tests, Eventus computes the eligible test statistics selected by the user for each resample. In a wild bootstrap, each resample contains the same observations as the original sample, but with the residuals modified by the auxiliary random variable. For event-study tests other than calendar-time portfolio regression, Eventus 9 treats the abnormal return as the residual. The nonparametric bootstrap as implemented in Eventus 9 and earlier does not impose the null hypothesis. The wild bootstrap as implemented in Eventus 9 imposes the null hypothesis.

1.6.2   Additional bootstrap issues

1.6.2.1   One- and two-tail tests

The former BTail= option of Eventus 8 and earlier is no longer available in Eventus 9. Bootstrap significance levels or p-values now follow the Tail= option. When Tail=1, the bootstrap significance level or p-value is determined for a lower- (upper-) tailed alternative hypothesis if the parametric test statistic is negative (positive).

1.6.2.2   Number of bootstrap iterations

The default number of iterations (also called resamples, replications or bootstraps) has been reduced from 1000 to 999. Davidson and MacKinnon (2000) recommend that the number of iterations B be such that $(B+1)\alpha$ is an integer, where α is the nominal significance level of the test. A new option of the EvtStudy statement, Iterations=n, now allows the user to select the number of iterations.

1.6.2.3   Resampling ratio

The default resampling ratio (the size of each resample as a fraction of the original sample size) is now 1.0 instead of 0.25 in previous versions. To reduce the resampling ratio of a nonparametric bootstrap, use the Resample= option of the EvtStudy statement, e.g., Resample=0.25. In the nonparametric bootstrap procedure, resamples are selected with replacement from the original sample. For example, with an original sample size of 100 security-events and the default settings of Eventus 9, the nonparametric bootstrap is based on 999 resamples of size 100, each of which is drawn with replacement from the original sample using a discrete uniform random number generator. The Resample option has no effect on a wild bootstrap, in which each resample is based on all original observations.

1.6.2.4   Random-number generator seed value

The new EvtStudy statement option Seed=n allows you to specify the random-number generator seed for bootstrapping. Please see the SAS documentation of random number routines for an explanation of seeds. By default, Eventus creates a seed for each run based on the time of day and the number of seconds past the minute. The seed is shown in the SAS log. Specifying the same seed in another run with the identical request file and options will produce the same bootstrap results.

1.6.2.5   Miscellaneous

The EvtStudy statement has a new option BootAtOnce=n, where n is an integer from 1 to the number of bootstrap iterations. This determines how many iterations (resamples) Eventus internally runs at once. The total number of iterations used to derive the bootstrap results is not affected. In most cases this option should not be needed, because Eventus automatically selects an appropriate number. However, if you are trying to run a bootstrap on a large sample and are running out of disk space or memory, you can try specifying the option with n equal to the number of iterations divided by an integer such that the dividend also is an integer.

As in Eventus 8 and earlier, only event window tests are bootstrapped. To bootstrap a test of a single day or month, specify a window with the same beginning and ending relative date on the Windows statement. The calendar-time portfolio regression test of alpha, where the entire event period is the only window, also is eligible for wild bootstrapping.

The bootstrapping algorithm in Eventus 9 is somewhat less disk-space intensive than in previous versions and tends to run slightly faster, all else being equal.

1.7   Post-delisting returns

Eventus 9 adds the ability to "fill in" a security-return time series that ends before the security's event period ends. In Eventus 8, and by default in Eventus 9, there is no explicit compensation for a security that has only a partial event-period time series. For example, suppose that in an event study on daily data where the user specifies windows including the 61-day window (−30,+30). Assume that security A is delisted from CRSP after trading day +15, so that day +15 is the last return observation available. Also assume that the user does not specify the MaxMiss option (which can be used in Eventus 8 and 9 to exclude security-events with more than a specified number of missing values in the event period from all analysis in the current run). The CAR or BHAR for security A, by default, is calculated from the available 46 trading days −30 through +15 only.

In Eventus 9, the post-delisting trading days can be replaced by various values using the new Fill= option of the EvtStudy statement as shown in the table below.

To fill post-delisting date return cells with	Use EvtStudy option
Zero	Fill=Z
The market index return being used in the event study.	Fill=M
Companion index returns (requires MyCompanionIdx and Port1DS specifications on the Eventus statement)	Fill=C
Custom fill returns (requires MyFillReturns and Port1FillDS specifications on the Eventus statement)	Fill=F
CRSP delisting return, when available, in addition to the above	Fill=Dx where x is one of the above fill codes
Missing value codes (equivalent to omitting the Fill= option)	Fill=N

If you specify Fill=Dx and a CRSP delisting return is found, the delisting return is compounded with the other fill return. For example, if you specify Fill=DM and a CRSP delisting return r_{dt} is found for day t (a day after the final regular CRSP return), the filled return for day t is equal to $(1+r_{dt})(1+r_{mt})-1$ where r_{mt} is the market index return. The CRSP delisting return is a special field of the CRSP database that is separate from the time series of trading date returns. As of this writing, delisted stocks have a CRSP delisting return for at most one day or month. Please see CRSP documentation for further information on this type of data.

The new MyFillReturns and Port1FillDS options of the Eventus statement point to user-provided SAS data sets that contain various series of fill returns and map security codes to fill series. The structure of these data sets is the same as the MyCompanionIdx and Port1DS options respectively, except that the return columns in MyFillReturns must have sequential names starting with FillIdxR instead of CmpIdxR. There is a new MyFillFreq= option of the Eventus statement that is similar to the existing MyCompa-

nionFreq option. The default is MyFillFreq=constant, meaning that each security is mapped to the same fill return time series (i.e. the same column of MyFillReturns) regardless of date.

In a companion portfolio event study (where the Companion option appears on the Request statement), the companion return takes the place of the market index return (as in Eventus 8). Therefore, Fill=C and Fill=M are equivalent in this context.

1.8   New option to reverse short and long positions

The following description of the new feature assumes a little familiarity with the existing Short option, which is documented in the Eventus User's Guide.

The Request statement has a new option, ShortReverse=n, used in conjunction with the existing Short option to specify that long and short positions are to be interchanged on the specified relative date in the event period. For example, ShortReverse=+1 indicates that long and short positions are interchanged starting on trading day or month +1 relative to the event date.

As with all Eventus syntax allowing the user to specify a relative date in event time, the date specified by the ShortReverse option refers to the date of a return. Therefore, in effect, securities designated L in the request file are purchased at the last closing price before the event period; then, at the closing price on day n-1 or the last trading day of month n-1, the long position is liquidated and a new short position simultaneously established and held until the end of the event period, i.e., it is covered at the last closing price of the event period. Securities designated S are sold short at the last closing price before the event period, then the short position is covered and a new long position established at the close of n-1, to be liquidated at the last closing price of the event period. In addition to the existing L and S indications of long or short status, Eventus 9 allows A for always short and N for never short. If the Short and ShortReverse options are used, A and N securities are initially sold short or purchased in the same manner as S and L securities respectively, but A and N securities are not reversed, i.e., they hold their short or long status for the entire event period. If Short is specified but ShortReverse is not, the Short option works as in Eventus 8 and earlier, with A and N acting as synonyms for S and L respectively.

The existing TradingCost option of the EvtStudy statement interacts with the new ShortReverse option as follows. When ShortReverse is in effect, the TradingCost option may be omitted or TradingCost=LongShort specified. In the latter case, short positions are established at the bid or low price and covered at the ask or high price; long positions are established at the ask or high price and covered at the bid or low price. For example, an S stock is sold short at the closing bid or low just before the event period, bought back (covered) at the closing ask or high of day or month n-1 and immediately bought long at the closing ask or high of day or month n-1, then sold at the last closing bid or low of the event period.

1.9   Absolute return and volume event studies

Bailey, Karolyi and Salva (2006), Fernandes and Ferreira (2008), Gomes, Gorton and Madureira (2006) and Rogers and Van Buskirk (2008), among others, use the absolute of abnormal return, cumulative abnormal return or (cumulative) abnormal volume as a volatility-based measure of the information con-

tent of an announcement. To run an absolute return or absolute relative volume event study, add the option Absolute to the EvtStudy statement. For multi-day or multi-month windows, the signed abnormal return or abnormal relative volume is cumulated, then the absolute value taken.

1.10 Additional event-study options

1.10.1 Linear model intercepts
Two new EvtStudy statement options affect the use of a constant term in the market model or other linear factor model. The NoIntercept option omits the constant term from the model, so no intercept is estimated; the intercept is constrained to be zero. The DiscardIntercept option, which is applicable only to two-step methods, allows the intercept to be estimated normally in the estimation step, while in the event period abnormal return calculations, the intercept is assumed to be zero.

1.10.2 Risk-free return
Two new EvtStudy statement options affect the subtraction of a risk-free return from the security and market index returns. Where a risk-free return is not used by default, for example in two-step methods, you can specify RfAdjust to subtract Rf. Where a risk-free return is used by default, for example Fama-French calendar-time portfolio regressions and the IRATS method, NoRfAdjust omits the subtraction.

If you specify RfAdjust, you must make the risk-free available to Eventus. The CRSP U.S. Stock Database does not include a risk-free return, nor does the Eventus SASNONCRSP mini-database standard provide for a mandatory risk-free rate column. When using CRSP, a simple way to provide a risk-free return is to use the FFF= option of the Eventus statement to point to a Fama-French factor data set. This can also be done in a non-CRSP run if you have a factor data set built to cover the same trading dates as the mini-database. Alternatively, include the risk-free return in a custom index or custom factor data set or in the IndexDS= component of the mini-database. The risk-free return variable must have the name Rf.

1.10.3 One-tail and two-tail tests
The Tail= option of the EvtStudy statement has two new specifications in addition to the existing Tail=1 and Tail=2. The new specifications are Tail=L and Tail=U for one-tailed tests. The new specifications select the alternative hypotheses to be lower or upper tailed respectively, in contrast to Tail=1, which provides "generic" one-tailed tests where each alternative hypothesis is signed the same as the corresponding test statistic. Tail= applies to all tests in a run; it isn't possible to specify the tail on a test-by-test basis. This affects only the significance levels or p-values in the displayed output. The default still is Tail=1.

1.10.4 Broadened meaning of the MinEstN option
The MinEstN= option of the Request statement now causes benchmark returns such as market index returns, companion portfolio returns or factor returns, in addition to individual security returns, to be screened for the specified number of non-missing returns. In Eventus 8 and earlier, only security returns were screened by MinEstN. This change has no practical effect when using CRSP unless a user-provided benchmark return data set is being used at the same time, e.g., with MyCompanionIndex= and Companion. If the user-provided data have more missing values than CRSP does, MinEstN may screen out more events than in previous versions. Similarly, the new MinEstN behavior can affect SASNONCRSP runs.

2   Data retrieval (other than event studies) features

2.1   IndexData statement to obtain market index data from CRSP

This new statement in Eventus 9 allows index data to be extracted when no individual stocks are involved or over a period when the individual stocks are not listed. (Eventus 8 and earlier could extract market index data in the context of an event study or with the Returns statement, but only in connection with individual stocks and only during the stocks' period of listing.) The request file format is the same as for other Eventus functions, except that you have the option to make the request file a single row with no security identifier.

Options specific to the IndexData statement:

Compound   adds a column of compounded index returns to the output file (default is cumulative)
CUSIP   specifies that there are security CUSIPs in the request file
PERMNO   specifies that there are security PERMNOs in the request file

Other options that can be used on the IndexData statement:

The following options are used in the same way as the Request statement options of the same names: InSAS, ID, IDFmt, SizeIndex, BetaIndex, StdIndex, SP500, Composit, NoDivIdx, AllMktIdx, Companion, DateFmt, AutoDate, NDays, NMonths, Shift1, Shift2, AllowMissingDate.

The following options are used in the same way as the Returns statement options of the same names: NoPrint, NoNames, VSAS, HSAS, Text, HText, Value, Equal, Both, ExtFile=, OutSAS=

Example of IndexData statement usage (partial screen shot of output SAS data set on next page):

```
data request;
 input permno:5.0 eventda1:yymmdd8. eventda2:yymmdd8.;
datalines;
76104 19891212 19900111
76110 19900108 19900207
80204 19931107 19931207
86332 19980505 19980604
86322 19980512 19980611
89048 20010601 20010701
89172 20000711 20000810
89213 20010709 20010808
90366 20040309 20040408
90980 20050715 20050814
90962 20050923 20051023
run;

Eventus GetData;
 IndexData permno insas=request autodate value compound
   outsas=market_pre_offer;
```

	PERMNO	Date of Data	Market index distinction	CRSPDay1	Running Compound Index Return	crspday	Market
1	76104	19891212	Value	17222	0.0064290664	17222	0.0064290664
2	76104	19891213	Value	17222	0.0093640393	17223	0.0029162243
3	76104	19891214	Value	17222	0.0041830736	17224	-0.005132901
4	76104	19891215	Value	17222	0.0007162266	17225	-0.003452405
5	76104	19891218	Value	17222	-0.01592497	17226	-0.016629286
6	76104	19891219	Value	17222	-0.019968293	17227	-0.004108755
7	76104	19891220	Value	17222	-0.018608632	17228	0.0013873639
8	76104	19891221	Value	17222	-0.013239553	17229	0.0054708854
9	76104	19891222	Value	17222	-0.005294445	17230	0.0080517083
10	76104	19891226	Value	17222	-0.005802216	17231	-0.000510473
11	76104	19891227	Value	17222	-0.000716967	17232	0.005114927
12	76104	19891228	Value	17222	0.003911891	17233	0.0046321787
13	76104	19891229	Value	17222	0.0118450553	17234	0.0079022516
14	76104	19900102	Value	17222	0.0264493337	17235	0.014433315
15	76104	19900103	Value	17222	0.0264716426	17236	0.000021734
16	76104	19900104	Value	17222	0.0198133787	17237	-0.006486554
17	76104	19900105	Value	17222	0.0120309153	17238	-0.007631262
18	76104	19900108	Value	17222	0.0151430566	17239	0.0030751445
19	76104	19900109	Value	17222	0.0057336142	17240	-0.00926908
20	76104	19900110	Value	17222	-0.00114964	17241	-0.006844013
21	76104	19900111	Value	17222	0.0014667693	17242	0.0026194209
22	76110	19900108	Value	17239	0.0030751445	17239	0.0030751445
23	76110	19900109	Value	17239	-0.006222439	17240	-0.00926908
24	76110	19900110	Value	17239	-0.013023866	17241	-0.006844013
25	76110	19900111	Value	17239	-0.010438561	17242	0.0026194209
26	76110	19900112	Value	17239	-0.032753731	17243	-0.022550566
27	76110	19900115	Value	17239	-0.041364951	17244	-0.008902821
28	76110	19900116	Value	17239	-0.033002945	17245	0.0087228259
29	76110	19900117	Value	17239	-0.039720934	17246	-0.006947269
30	76110	19900118	Value	17239	-0.039401416	17247	0.0003327339
31	76110	19900119	Value	17239	-0.036375459	17248	0.0031500747
32	76110	19900122	Value	17239	-0.057782316	17249	-0.022214936
33	76110	19900123	Value	17239	-0.05785905	17250	-0.00008144
34	76110	19900124	Value	17239	-0.062357315	17251	-0.004774513
35	76110	19900125	Value	17239	-0.071596625	17252	-0.009853764

Example of IndexData statement without security identifiers (sample output not shown):

```
data request;
 input eventda1:yymmdd8. eventda2:yymmdd8.;
datalines;
19891212 19900111
run;


Eventus GetData;
 IndexData insas=request autodate outsas=some_ew_mkt_returns;
```

2.2   Issuer names, original dates and CUSIP in output data set

The Returns, Prices, Volume and new IndexData statements include a new option IncludeName to in-clude the issuer name in the output data set. This is available only for the default vertical format of the output data set, not the format specified by the HSAS option.

In GetData runs where request file dates or CUSIPs are affected by Shift1, Shift2, AutoDate or CusiPerm options or the standardization of dates in monthly event studies (Eventus uses the first of the month internally), the original dates and CUSIP are now added to the output SAS data set (but not a text output file).

2.3   SAS data set and text file output in same run

The Returns, Prices, Volume and new IndexData statements now allow the user to specify both an out-put SAS data set and a text output file in the same run.

3   General options for request files

3.1   Use six-character CUSIPs with CRSP data

When using Eventus with CRSP data and specifying the CusiPerm option of the Request statement, the request file may contain either six- or eight-character CUSIPs. Before Eventus 9, eight-character CUSIPs were required. The request file must contain all six-character or all eight-character CUSIPs, not a mix-ture. It is not necessary to specify an additional option to cause Eventus to accept six-character CUSIPs. As with all past versions of the CusiPerm option, Eventus matches current header and historical CUSIPs on the CRSP database. Please be aware that eight characters are required to uniquely identify a security; using six-character CUSIPs can produce unexpected matches. For example, if an issuer has two publicly traded classes of common stock outstanding on the request file date, the six-character CUSIP, which identifies only the issuer, is likely to match both classes, potentially increasing the sample size. You may want to check the report of security names that Eventus includes in the default listing output.

When the request file contains six-character CUSIPs, you can have Eventus select the stock from the CRSP database by only a five-character match when no six-character match is available by specifying CusiPerm=5 instead of CusiPerm. This option is available only if the request file contains six-character CUSIPs. When a five-character match is used, a warning appears in the SAS log. Five-character matches must be verified manually, because fewer than six characters cannot uniquely identify an issuer.

3.2   Missing dates in request files

Eventus 9, as a default setting, no longer allows a date variable, in a request file that is a SAS data set, to have a missing value. If you want to allow missing date values, add AllowMissingDate to the Request, DateConv or IndexData statement. Otherwise, a missing date value in a SAS data set request file will cause Eventus to stop and provide an error message in the SAS log.

3.3   Integer date format

When the request file is a SAS data set, the new Request statement option DateFmt=Integer allows the dates in the request file to be integer dates instead of SAS date values. A SAS date value is an integer

equal to the number of days (potentially negative) since January 1, 1960. An integer date is a numeric value recognizable as a date in a YYYYMMDD pattern, e.g. 20090430. Data sets imported from Excel may contain integer dates, SAS date values or a mixture depending on column headings and the import method. To determine the type of values in a data set, run the following SAS code to display them:

```
proc print data=datasetname;
 var names of date columns;
 format  names of date columns YYMMDDN8.;
run;
```

Replace the italicized words with actual names before running. The results appear in the SAS Output window or *.lst file. If the dates column values are recognizable as correct dates, they are SAS date values. If you re-run the above code with YYMMDDN8. in the format statement changed to 8.0 and the dates look good, they are integer dates.

3.4   Automatic assignment of SAS format for ID= variable

When the request file is a SAS data set, if the ID= option is specified but not the IDFMT= option, Eventus tries to select a format for the ID variable automatically.

3.5   More flexible date variable naming rules

If the request file is a SAS data set, the variable names EventDat and EventDa1 are now interchangeable. If DateFmt=CRSP is specified, then CRSPDay and CRSPDay1 are interchangeable. This means that it is no longer necessary to change names or make duplicate variables when the same request file is used to run an event study centered on a single date and in a Twin event study or GetData run.

If the request file is a SAS data set, the event date column can have the variable name EventDate or EventDay instead of EventDat when running an event study centered on a single date only.

4   SuperReg: A new regression tool

4.1   Overview

Eventus 9 introduces SuperReg, a new tool that is not specifically related to event studies but is designed to extend the regression capabilities of SAS. SuperReg provides a common interface for several tasks that are not easily accomplished with existing SAS features or require the use of multiple SAS procedures with different syntax rules. SuperReg makes it easy to:

- Automatically run t-tests using heteroskedasticity-consistent (HC, also known as White) standard errors and display OLS and HC t-statistics and p-values side-by-side.
- Automatically detect influential outliers. SuperReg includes a warning in the output if influence is detected based on a Cook's D with a p-value greater than 0.25, determined from the $F_{(p,n-p)}$ distribution where p is the number of linear parameters and n is the number of observations.

- Automatically detect a potentially problematic degree of multicollinearity. SuperReg includes a warning in the output if collinearity is detected based on a condition index greater than or equal to 100.
- Re-run a regression with specific observations excluded.
- Run a pooled OLS regression with one-way or two-way cluster-robust standard errors (sometimes called Rogers standard errors), a standard for panel data analysis.
- Run wild bootstraps of OLS or HC t-tests for greater robustness.
- Run wild cluster bootstraps on panel data with one-way clustering for greater robustness.
- Automatically generate year dummy variables and include them as fixed effects.

In Eventus 9.0, SuperReg always tests null hypotheses that use a value of zero for the respective coefficient. A future version will provide an option to specify the value for the null hypothesis.

4.2   Syntax

4.2.1   SuperReg statement
SuperReg runs by means of a single statement. There is no need to use the Eventus statement or other statements specific to Eventus software. The data needed for the regression must be in a SAS data set before running SuperReg.

The form of the SuperReg statement appears below. Brackets [] mark something that may be included or omitted; the brackets themselves are not to appear in the user's actual code. The SuperReg statement syntax is not case sensitive.

SuperReg InSAS=*SASdatasetname* [*options*]
        [*label:*] model *dependent = regressors*;

The model portion of the statement is used to specify the regression equation. The statement syntax is shown on two lines above for ease of reading only. Like other Eventus and SAS statements, the SuperReg statement may be all on one line or continued over two or more lines. Unlike SAS procedures that include a model statement, the model specification is an integral part of the SuperReg statement and must not be preceded by a semicolon.

SASdatasetname is the name of the data set containing the regression data. It can be a one-part name for a work data set or a two-part name for a saved data set.

[*label:*] denotes an optional model label, which must follow the requirements for SAS names and must be followed by a colon as shown, to be used in the output. If no label is desired, omit the colon as well. Do not include the brackets in actual code; they only mark optional parts of the statement.

4.2.2   Options and model specification modifiers
The following options are available for use in the *options* section of the SuperReg statement. If two or more options are used, they must be separated by at least one blank space and may be continued on

more than one line. The bootstrapping subsection also discusses modifiers used in the model portion of the SuperReg statement that are associated with the Bootstrap option.

4.2.2.1   Sample identification and limitation

ID=*variable* specifies a column name in the input data set used to uniquely identify the observations. The variable may be numeric or character.

Exclude=*id_value_list* selects observations to omit from the current estimation. This option is available only if ID=*variable* is also used. To omit only one observation, replace *id_value_list* by the observation's value of the ID variable, optionally enclosed in parentheses. To omit two or more observations, enclose the list in parentheses and separate the ID variable values by commas. Enclose each value of a character ID variable to be excluded in a pair of single quotes.

4.2.2.2   Date fixed effects

DateVar=*variable* indicates the column name of a date variable in the input data set to be used to create dummy variables when the MakeDummy= option is used (see below). The date variable must contain SAS date values. A SAS date value is an integer equal to the number of days (potentially negative) since January 1, 1960. SAS date values sometimes are created automatically by SAS when importing an Excel or other file containing dates. SAS date values also may be created explicitly by SAS programs.

MakeDummy=Year includes year fixed effects in the regression based on the variable specified in the DateVar option. Only year fixed effects can be created by the MakeDummy option in the Eventus 9.0 version of SuperReg.

4.2.2.3   Covariance matrix selection

HCCMethod=0|1|2|3 (where | separates alternatives of which one is to be chosen) selects the method used to calculate the heteroskedasticity-consistent covariance matrix when clustered standard errors are not used. The default in SAS 9.1.3 is HCCMethod=0, which selects the well known White (1980) estimator. The other choices are available only when running SuperReg under SAS 9.2 or greater. They select estimators introduced by MacKinnon and White (1985) that are designed to have better small sample properties. Long and Ervin (2000) conduct simulations of the OLS, White and MacKinnon-White covariance matrices. They conclude that MacKinnon-White estimator 3 best corrects for heteroskedasticity in small samples, but its advantage largely disappears starting in samples of 250 to 500 observations. In SAS 9.2, if HCCMethod is not specified, SuperReg uses method 3 if the variable (dependent or independent) with the fewest non-missing values has fewer than 300 non-missing observations, and method 0 otherwise.

Cluster=*variable* selects one-way clustered standard errors based on *variable* from the input data set.

Cluster=(*variable1*,*variable2*) selects two-way clustered standard errors based on *variable1* and *variable2* from the input data set.

4.2.2.4   Bootstrapping

Bootstrap selects wild bootstrapping to determine p-values of coefficient t-tests. If the Cluster option is also used, the bootstrap is a wild cluster bootstrap (see Cameron, Gelbach and Miller, 2008). Unlike the

event study functions of Eventus, SuperReg does not offer the nonparametric bootstrap, also called per-centile-t bootstrap or case bootstrap.

To exclude a subset of coefficients from bootstrapping, append (N) to the variable name(s) in the model portion of the SuperReg statement. For example, bootstrap model y = x1 x2(N) x3 would bootstrap the tests of x1 and x3 only. To exclude the test of the intercept from bootstrapping, include constant(N) on the right of the = sign, for example bootstrap model y = constant(N) x1 x2(N) would bootstrap the test of x1 only. It is not necessary to include constant in the model specification unless the user needs to apply a bootstrapping modifier to it.

To apply bootstrapping only to a subset of explanatory variables, append (B) to the variable name(s) in the model portion of the SuperReg statement. For example, model y = x1 x2(B) x3 would bootstrap the test of x2 only. Do not specify the Bootstrap option when using one or more (B) modifiers. To selectively bootstrap the intercept test, include constant(B) on the right of the = sign, for example model y = con-stant(B) x1 x2 would bootstrap the test of the intercept only. It is not necessary to include constant in the model specification unless the user needs to apply a bootstrapping modifier to it. Do not specify the Bootstrap option when using one or more (B) modifiers.

Iterations=*n,* where *n* is a positive integer, specifies the number of iterations (also called resamples, rep-lications or bootstraps). If this option is absent, SuperReg uses the default value of 999.

Seed=*n,* where *n* is a positive integer, specifies the random-number generator seed. Please see the SAS documentation of random number routines for an explanation of seeds. By default, SuperReg creates a seed for each run based on the time of day and the number of seconds past the minute. The seed is shown in the SAS log. Specifying the same seed in another run with the identical input file and other op-tions will produce the same bootstrap results.

Rademacher|Regina Wild bootstrapping requires an auxiliary distribution, from which pseudo-random drawings independent of the original data are generated and used to modify the residuals to create a resample. By default, SuperReg uses the Rademacher distribution to generate an auxiliary random vari-able. An alternative is to use a product of normal random variables proposed by Liu (1988); to use this in the wild bootstrap instead of the Rademacher distribution, specify the option Regina. The Rademacher option is never needed as it specifies the default method, but may be included for clarity if desired.

OLS selects the tests using the OLS covariance matrix as the tests to bootstrap. By default, the tests bootstrapped are the ones using the heteroskedasticity-consistent covariance matrix. The OLS option has no effect if the Cluster option is specified. When the Cluster and Bootstrap options are used in the same run, SuperReg always performs a wild cluster bootstrap.

4.2.2.5   *Number of tails and suppressing the intercept*
Tail=2|1|L|U selects the tailness of the alternative hypotheses in coefficient t-tests. Tail=2 selects two-tailed tests. Tail=1 selects "generic" one-tailed tests where each alternative hypothesis is assumed to point in the same direction as the calculated test statistic. Tail=L and Tail=U select the alternative hypo-theses to be lower and upper tailed respectively. One Tail= specification applies to every test in a given

estimation; it isn't possible to different tail specifications for different coefficients. The SuperReg default is Tail=2.

NoInt suppresses the constant term in the regression.

5 Miscellaneous improvements

5.1 Output file overwrite protection

When an output SAS data set name specified by the user already exists, the existing data set is not overwritten but instead is backed up, and the backup copy name is displayed in the SAS log.

When an output non-SAS file name already exists, the existing file is not overwritten. Instead, Eventus generates a new file name. The new file is created in the same folder as the file name specified by the user, and a message is written to the SAS log stating that the specified file already exists and will not be overwritten and giving the new file name.

5.2 CusiPerm option always up to date

In runs that use the CRSP database, the PERMNO-CUSIP table used by the CusiPerm option if missing or out of date, is created or update automatically. It is no longer necessary to run the PermnoUp statement manually, though this is still possible.

5.3 CusiPerm statement refurbished

The CusiPerm statement (distinct from the CusiPerm option of the Request and other statements), after years as an obsolescent holdover from earlier versions, now is potentially more useful for preparing request files for subsequent Eventus runs. CusiPerm now has two modes. The default is passthrough mode, in which the CusiPerm statement operates as in Eventus 8 and earlier. The new optional mode is rebuild mode, which is where the added usability is found. In rebuild mode, CusiPerm creates an output SAS data set, with six- or eight-character CUSIPs from the input file converted to PERMNOs, for use as a request file based on an input text file or SAS data set. The original CUSIPs and other data from the input request file are included in the output file. The following options apply only to rebuild mode: InSAS=, OutSAS=, DateFmt=, ID=, IDFmt=, Group=, GroupFmt=, GrWeight=, Est=, Short=, NDays=, NMonths=. These options work the same way as the corresponding Request statement and DateConv statement options.

To use the CusiPerm statement in the new rebuild mode, specify CusiPerm followed by any of the above options and ending with a semicolon (;). If the input request file is a text file and none of the above options is needed, add the word Rebuild after CusiPerm to cause the statement to operate in rebuild mode.

5.4 New specialty index builder for CRSP users

A new unified tool for building size-decile return indexes and market and decile volume indexes will be documented in the near future.

5.5   Direct your data sets to a folder by default

Earlier versions of Eventus internally created numerous temporary data sets in the SAS "default library". Unless the user specifies otherwise, SAS defines the default library as Work, a temporary location the contents of which are discarded when SAS terminates. SAS allows users to specify a different library — really a shortcut to a folder or directory on the computer or network — with the SAS system option User=. This has the potential advantage of automatically saving data sets when you close PC SAS or when your non-interactive SAS run finishes. Some users may have found the User= option impractical for Eventus runs because the data sets that Eventus created internally would be written to the specified library. Eventus 9 writes all its internal temporary SAS data sets to the Work library even if you set another library as the SAS default. To set a default location for the data sets you create deliberately, please see the SAS documentation of the User= system option.

5.6   Building size decile and volume indexes from CRSP data

The former SizBuild and Volume_Index_Build statements have been replaced by an integrated Specialty_Index_Build statement. The new builder constructs both equally weighted and value-weighted size-decile index portfolio returns from the user's copy of the CRSP database (not included in Eventus). The population used to build either size-decile or volume indexes can be limited in the same manner as in the former volume index builder, except that the argument of the XL= option now includes a fourth digit to indicate the inclusion or omission of Arca stocks.

The new statement is used as follows; the brackets are not to be part of the code but only indicate something that is not always included:

[libname evdata *etc.*;]
Eventus [Monthly];
 Specialty_index_build [*options*];

The libname statement can be used if desired to assign the SAS library reference EvData. If the library reference EvData exists and no output data set option (see table below) is used, the specialty index data sets will be placed in this library. Otherwise, if no output data set option is used, the data sets will be placed in the default SAS library, typically work. See SAS documentation for more background on libraries and libname statements.

The Monthly option of the Eventus statement, as in all applications of the statement, selects monthly as the input (and therefore output) return or volume frequency.

The Specialty_index_build statement, if no option is included, creates size (market capitalization) decile indexes using all stocks on CRSP that have a CRSP size-decile portfolio number assigned. The size-decile portfolio number field is available in both the CRSP stock database and the CRSP stock-and-indices database. The CRSP database reports the portfolio number as an annual field, so the membership of the portfolios that Specialty_index_build uses to create indexes is different for each year of data. If a stock has a missing portfolio number for a given year, its data are not used in calculating the decile indexes for that year. If a stock has a portfolio number for a given year but has missing data for some days or months in that year, its non-missing data are used in calculating the indexes.

The Specialty_index_build statement creates two sets of size-decile indexes in each run, one based on equal weighted decile portfolios and one based on value-weighted decile portfolios. The weight of each stock in a value-weighted portfolio each day or month is its market capitalization at the close of the previous trading day or month divided by the sum of all the market values of stocks in the portfolio. Equal weighted and value weighted indexes are placed in the same output data set using separate sets of rows distinguished by the value of column _index_weight_ ('E' for equal or 'V' for value).

In addition to the size-decile index data set, Specialty_index_build statement builds a portfolio-assignments data set. The size-decile and portfolio-assignments data sets are intended to be used together with the Eventus companion index feature, pointed to by the MyCompanionIdx and Port1DS options respectively.

The following example illustrates the creation of a set of size-decile return indexes using all stocks that have CRSP share codes 10 and 11.

```
libname EvData 'folder path and name';
Eventus;
 Specialty_index_build NF;
```

The following example illustrates the use in an event study of the value-weighted indexes created by the above code. The where= data set option is standard SAS syntax and is needed to limit the input to only the value-weighted index rows.

```
filename request 'request file path, name and extension';
Eventus MyCompanionIdx=EvData.Size_decile_return_D_1_0_0_1111(where=(_index_weight_='V'))
  MyCompanionLabel="Using Value-Weighted Size Decile Returns by Eventus"
  Port1DS=EvData.Size_decile_portnumD_1_0_0_1111;
 Request CusiPerm AutoDate Companion;
 EvtStudy MAR NoMM;
```

When the Volume option (see table) is in effect, the Specialty_index_build statement creates two types of relative volume index for each type of portfolio weight: log-transformed and non-log-transformed, distinguished by the value of column _index_log_ ('N' for not logged or 'Y' for logged). Log-transformed relative volume is the natural log of (relative volume + 0.000255). The equal weighted log-transformed index is the simple mean of individual log-transformed relative volume. The value-weighted log-transformed index is computed by applying the above log transformation to the value-weighted mean of non-log-transformed relative volumes.

When you specify the Volume option, the Specialty_index_build statement creates four market-wide index series (equal and value-weighted, log-transformed and non-log-transformed as described above) in a separate data set in addition to the size-decile volume indexes. The market-wide data set is intended for use with the VolumeIndex option of the Eventus statement.

The following options are available for the Specialty_index_build statement. More than one option (separated by blanks) may be used at the same time. See section 1.1.1 for a brief explanation of SAS libref.membername data set naming.

To do this:	Add this option to the Specialty_index_build statement
Select relative volume (volume divided by shares outstanding) indexes as the type to create	Volume
Select return indexes as the type to create	None (that is, simply omit the Volume option, but other options may be used)
Limit the stocks used in the indexes to CRSP share codes 10 and 11 (common stocks excluding ADRs, foreign stocks, funds and investment trusts; see CRSP documentation for exact definitions of these codes)	NF
Limit the stocks used in the indexes to a set of stock markets based on the CRSP stock exchange code in effect each date	XL=bbbb where b is a binary digit (0 or 1) to omit (0) or select (1) a market. Any sequence of four binary digits is allowed. The four positions in order omit or select the following respective markets: NYSE AMEX Nasdaq Arca
Limit Nasdaq stocks to Global Market and former National Market only	NM (and omit SC)
Limit Nasdaq stocks to Capital Market and former Small Cap Market only	SC (and omit NM)
Prevent creation of the portfolio assignments data set (needed for use with the companion portfolio feature of Eventus)	NoAssigns
Specify the output data set for the size-decile indexes	OutSAS_decile_TS=*libref.membername*
Specify the output data set for the size-decile portfolio assignments	OutSAS_decile_assign=*libref.membername*
Specify the output data set for the market-wide volume indexes	OutSAS_VolMarket=*libref.membername*

5.7   Cleaner SAS log, clearer messages

Eventus 9 greatly reduces the number of lines created in the SAS log window or *.log file relative to previous versions and produces more informative error and warning messages when necessary.

5.8   CRSP stock-only data 2009 compatibility

Some organizations subscribe to CRSP stock-and-indices and others subscribe to "stock only". The stock-only database version isn't completely without indices. It includes equal and value-weighted indices of a CRSP market universe. For many years, this universe consisted of stocks meeting certain criteria (for ex-

ample, no ADRs, REITs, closed-end funds etc.) traded on the NYSE, AMEX and Nasdaq. Starting with database editions that include two or more months of 2009 data, CRSP stock-only subscribers no longer receive the NYSE-AMEX-Nasdaq indices, but instead receive NYSE-AMEX-Nasdaq-Arca indices. As the index codes in the database differ between the two index series, this is a database format change that is incompatible with Eventus 8. This change does not affect CRSP stock-and-indices subscribers. Eventus 9 is compatible with the newest CRSP data as well as recent years' editions, both stock-only and stock-and-indices versions.

With the stock-and-indices version of the CRSP database, Eventus 9 continues to use the NYSE-AMEX-Nasdaq index series by default. To use the NYSE-AMEX-Nasdaq-Arca indices, specify AllMktIdx on the Request statement. This new option has no effect if used with a CRSP stock-only database containing at least two months of 2009 data, where the four-market indices are already the default. Using the AllMktIdx option with a CRSP database that does not contain the new four-market indices will cause the Eventus run to fail with error messages.

The AllMktIdx option does not affect size- or risk-decile portfolios, i.e., it has no effect when the SizeIndx, BetaIndx or StdIndx option is also used. The AllMktIdx option, when available, does affect the market index used with the Fama-French three- or four-factor model or a custom factor model that incorporates the CRSP market index, but does not affect the SMB, HML, UMD or custom factors themselves.

6   Usage tip for Eventus for Windows

After you install Eventus on your PC, the Start or main Windows menu includes a folder for Eventus. The folder includes an item "Check for Eventus 9 Update." We recommend using this updater monthly and just before starting Eventus runs for a new research project. Doing so will ensure that you have the latest problem fixes and usage enhancements. The updater may also install new sample programs or documentation updates.

7   Help and support

Please register for our support web site, support.eventstudy.com. After completing the simple one-time registration process, you will have access to our user forums, helpful tips and announcements. Users who register an e-mail address associated with a licensed institution can submit support requests through the web site or by e-mail to support@eventstudy.com.

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