Seasonal Adjustment Interface DEMETRA for Tramo/Seats and X-12-Arima (Release Version 1.4)

Training Course

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Demetra — **by Eurostat, the Statistical Office of the European Communities**

Based on:

Tramo (Mar 1999), Seats (May 1998) — **by Víctor Gómez and Agustín Maravall**

X-12-Arima (Release Version 0.2.5) — **by the US Bureau of Census**

Contents

Chapter 1: Generalities

Introduction

Eurostat has compared carefully several methods for Seasonal Adjustment (DAINTIES, SABL, BV4, X-11-ARIMA/88, X-11 UK, X-12-ARIMA, TRAMO/SEATS).
It has decided to recommend and use in the future two SA methods:

- **TRAMO/SEATS**, an ARIMA model-based method, written by A.MARAVALL and V.GÓMEZ
- **X-12-ARIMA** of the US Bureau of the Census

It was decided to implement these two methods in a single interface "DEMETRA" used by units in charge of the statistical production.

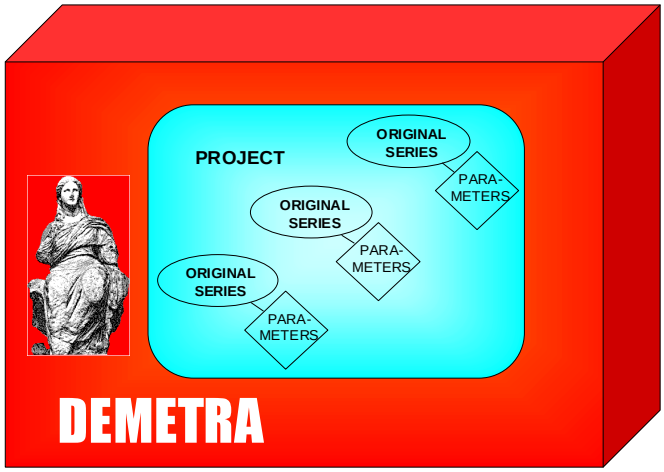
DEMETRA is developed first for Eurostat's internal needs and those of statistical organisations that encompass several aspects:

It should ease access of non-specialists to TRAMO, SEATS and X-12-ARIMA and improve largely their user-friendliness. However, it should not just consist of nice window representations for the input of the parameters and for some output. DEMETRA is a tool for **statistical production** in a large-scale environment imposing a recognised seasonal adjustment policy. It automatically finds difficult time series in huge data sets and assists the user in their treatment**.** Additionally, it allows **detailed analysis** on single time series. The interface only uses the statistical algorithms included in the SA methods X-12-ARIMA and TRAMO/SEATS. It is a fully menu driven package, using only general statistical vocabulary (no keywords of the primary packages (X-12-ARIMA and TRAMO/SEATS) for parameters, models, functions) except for very advanced usage.

DEMETRA includes an I/O interface with FAME databases, formatted ASCII files, MS-EXCEL files, and SAS databases. An access to the ORACLE databases of Eurostat is computed and internally available by special request. This ORACLE access has taken under consideration the special format of the Eurostat databases. The "namelist" object of FAME can be used for selecting huge sets of time series. DEMETRA also defines a special format to store seasonal adjustment parameters in the I/O files (databases).


Demeter and Persephone from the Parthenon

What is a DEMETRA project?



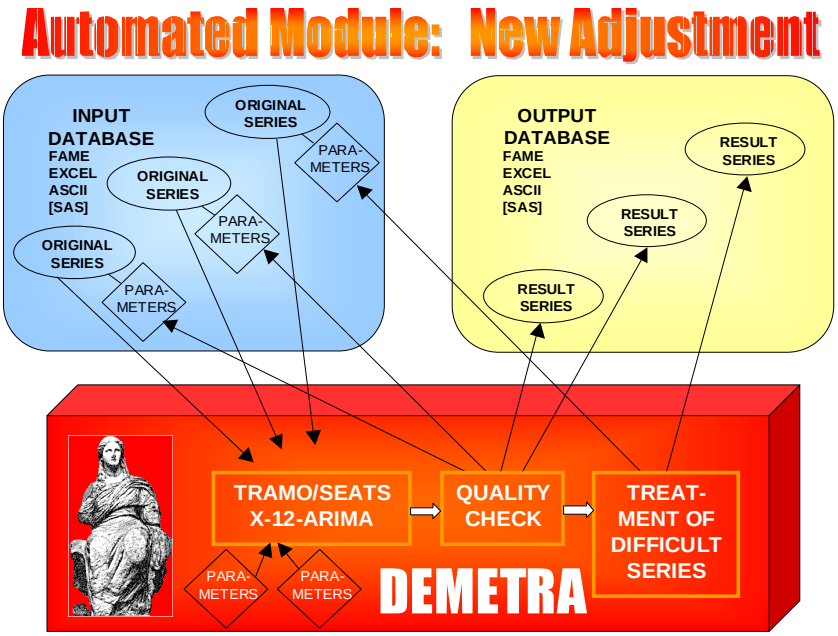
DEMETRA document related to one of the modules (automated or detailed analysis) and containing all the original time series, its models and result series, and options for the processing of the time series

Two modules for seasonal adjustment and trend estimation

The main task of DEMETRA is to mimic the usual work of seasonal adjustment by a producer of statistics. Hence, DEMETRA contains two main modules: an **automated module** for seasonal adjustment and trend estimation and a module for **detailed analysis** of single time series.

The **automated module** is designed for a fully automatic seasonal adjustment of lists from one up to a huge amount of time series. It should be used in the following way:

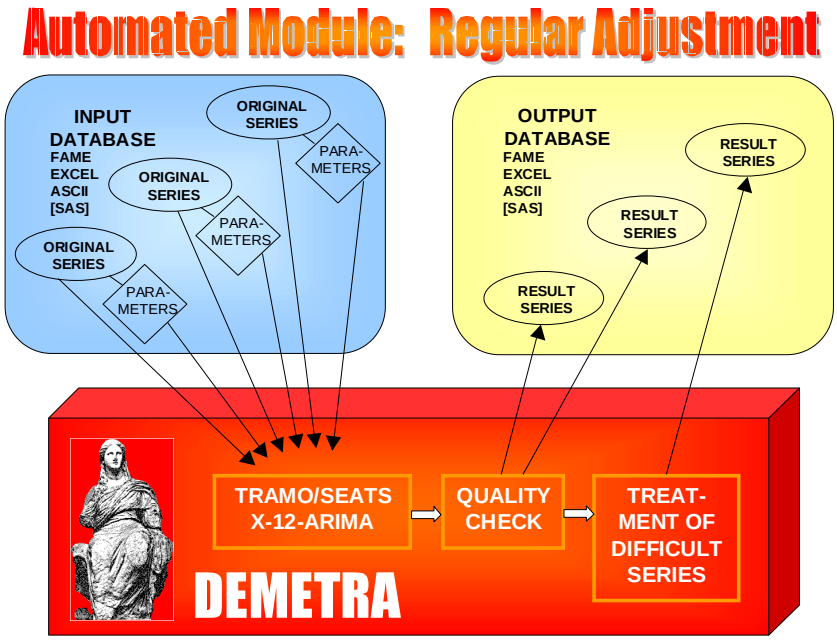
- Run a fully automatic or customised modelling procedure (with a low periodicity, e.g. every year for monthly data) to calculate and fix the modelling parameters specifically to the series.



In an automatic run (statistical tool 3: New automatic seasonal adjustment, see page 13), the time series will be tested for log-transformation, for corrections of special effects (trading day and Easter effects) and outliers, and for the decomposition specification. The ARIMA model will be newly identified/selected and estimated.

In an customised run (statistical tool 4: New customised seasonal adjustment, see page 14), the automatic options as mentioned here above can be modified or complemented.

- Apply the modelling parameters that were previously calculated and fixed, to the updated original time series in a regular adjustment procedure (with the time series periodicity, e.g. every month for monthly data).



Once you have determined and memorised the models for your time series use statistical tool 1: Previous modelling settings (see page 12) or statistical tool 2: Previous modelling settings with re-estimation of ARIMA and regression coefficients (see page 12) when the series were updated.

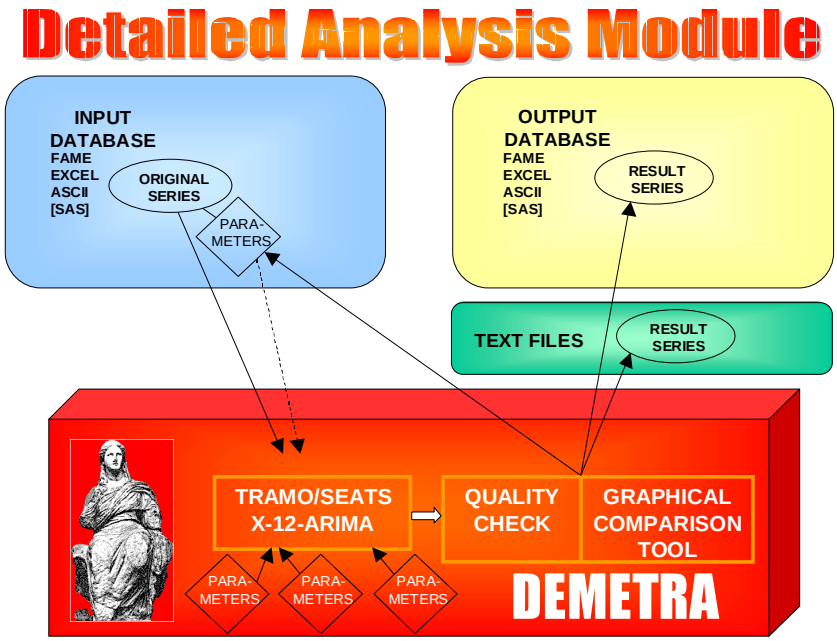
Practical experiences have shown that tool 2 often provides better results regarding accuracy and long-term revision behaviour. However, policies in some statistical institutions prefer minimal revisions over the year that is assumed by tool 1.

DEMETRA will for both cases:

- get the time series stored in a database,
- apply to each series a given set of parameters that is consistent with what was done before or apply customised or default parameters for an new automatic adjustment,
- run the SA for the whole set of series,
- test if the results are satisfactory and automatically detects difficult time series,
- store the satisfactory results in the database.
- provide a complete table listing all time series with the results obtained (models, statistics, savings, error messages).

For series facing some difficulties, a thorough assisted examination is then provided, using alternative methods and graphs.
For more details on the Automated module, see page 11.

The **module for detailed analysis** allows in-deep examinations of the seasonal behaviour of single time series. User-friendly graphs and tables assist the user in the examination process. This is a useful tool for analysing very difficult time series. The user can take advantage of nearly the whole capacity of the SA-packages X-12-ARIMA and TRAMO/SEATS: DEMETRA provides access to almost all their options and to all of their output including text output, data output (time series), diagnostics and graphs. The modelling specifications and diagnostic statistics can be viewed with different degrees of detail (e.g. brief overview, detailed overview, full).



DEMETRA manages several sets of parameters (called "models") together with the corresponding result series (e.g. seasonally adjusted series, trend) for one unadjusted series and compares the variants through graphs and tables.

The interface also provides the possibility for saving the result series together with the corresponding set of the parameters into the production databases, data files or text files and of modelling specifications and diagnostics into a text file.

Several specific tables are built-in to easily compare different variants:
- table of results of pre-adjustment and decomposition (transformation chosen, estimated/chosen models...)
- tables of quality indicators.

For more details on the Module for detailed analysis of single time series, see page 32.

Platforms accessed

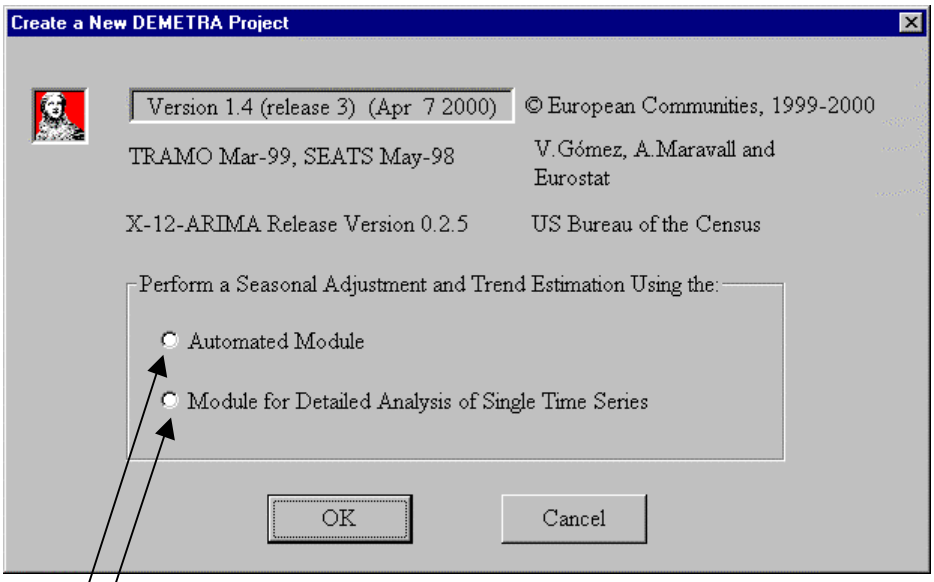
DEMETRA is a client-server application. The main programme of DEMETRA is a client programme providing a graphical user interface. It runs on Windows NT, 98 or 95 operating systems.
If you want to access FAME databases on machines with a Windows NT or UNIX operating system, you will need to run the additional server programme "DEMETRA FAME server" on each of these machines (the FAME programme and databases must be installed there).
DEMETRA also includes an I/O interface with MS-EXCEL, SAS and formatted ASCII files.
An access to the ORACLE databases of Eurostat is computed and internally available by special request. This ORACLE access has taken under consideration the special format of the Eurostat databases.

Some more definitions

SA-METHOD: seasonal adjustment package Tramo, Seats or X-12-Arima
MODEL: set of parameters (also called SAIP) defining all the input options to the SA-methods, the output to be produced and its saving options; to be distinguished from ARIMA model.
RESULT TIME SERIES: the series that can be produced by the SA-methods, like the seasonally adjusted series or the trend series.

Chapter 2: Creation of a project

Choice of the DEMETRA module



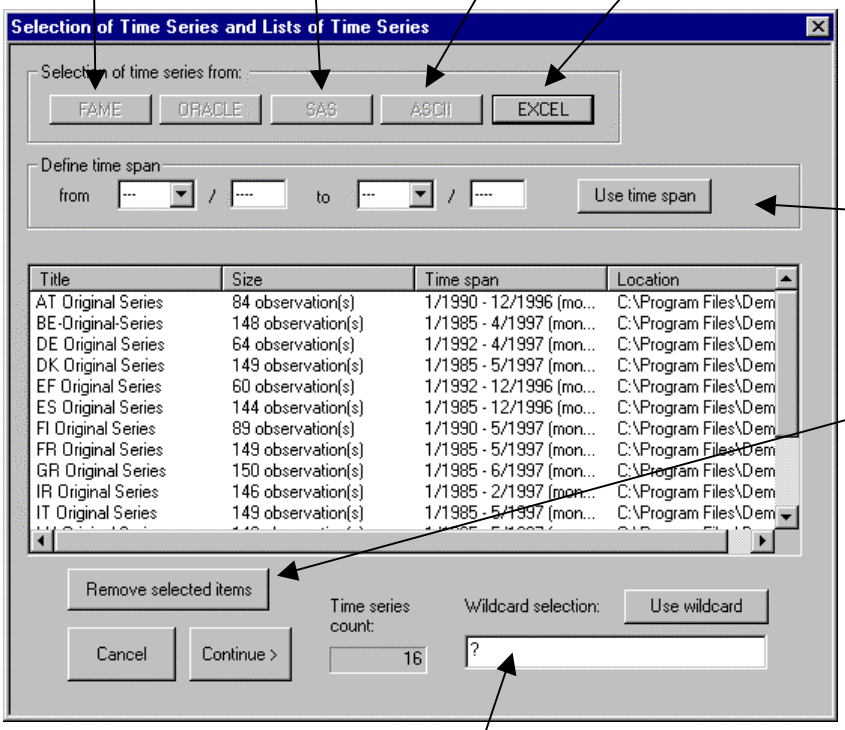
- **Automated module**: fully automatic seasonal adjustment of large-scale sets of time series time series or easier seasonal adjustment for inexperienced users
- **Detailed analysis module**: full accessibility to all options of the SA-methods and more comparison tables and graphs

Selection of time series for input (in both modules)

from **FAME** databases, **SAS** databases, formatted **ASCII** files and **MS-EXCEL** worksheets.

Remark: In one Demetra project, you can only use one type of database. Once you have selected time series e.g. from a FAME database, you will not be able to add other time series from an ASCII file, from an MS-EXCEL worksheet or from a SAS database and vice versa.

Attention: Only one single time series can be treated in a detailed analysis project.



To define a sub-range of the time span to which all chosen series will be limited, enter a personalised starting period/year and/or ending period/year and clock at the "**Use time span**" button. However, you can not change the periodicity of any time series.

The "**Remove selected items**" button allows to remove the highlighted time series from the list of selected series.

While loading the time series, DEMETRA automatically searches for the corresponding sets of stored parameters (if they exist) and loads them too.

Input from ASCII files, MS-EXCEL worksheets and SAS databases

A possibility to easily select sub-sets of time series in an ASCII text file, an EXCEL file or a SAS database is given by the **wildcard selection** option: Type a wildcard name by using the letters that are the same in all time series to be selected and press the "**Use wildcard**" button. Letters that can be different from one time series to another must be replaced by the symbol '^'. Any chain of letters after a certain position in the time series names can be replaced by ending the wildcard name at this position with the question mark '?'.

Examples for wildcard names:
An Ascii text file contains the following time series: ABC, ABCDEF, ABCXYZ and XYZDXF.
The wildcard name '*ABC*^^^' will select ABCDEF and ABCXYZ.
The wildcard name '^^^*D*^*F*' will select ABCDEF and XYZDXF.
The wildcard name '*ABC*?' will select ABC, ABCDEF and ABCXYZ.

Tip: To easily copy a long name of a time series from the series list to the wildcard edit box just move the mouse over the time series name and click on the right mouse button.

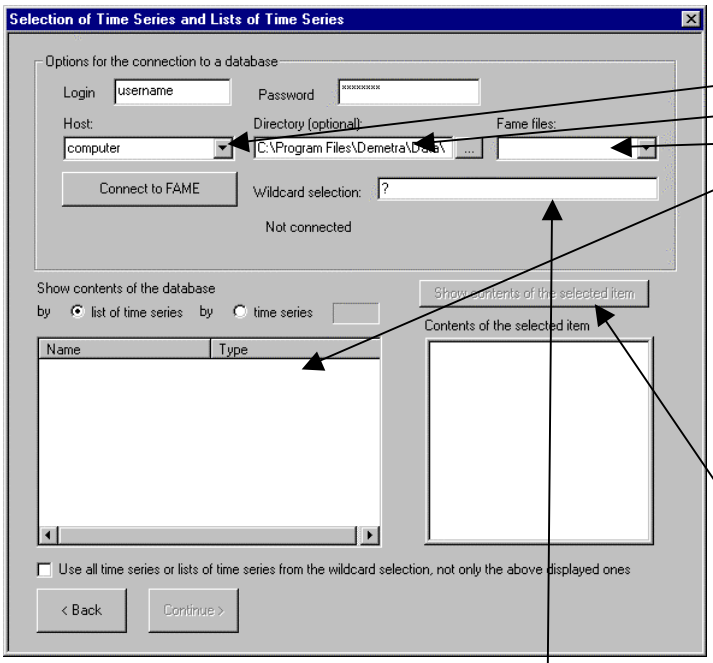
For more details on the Format of ASCII data files (input), see page 41.
For more details on the Format of MS-EXCEL files (input and output), see page 42.

Dialog for the input from FAME databases

Selection of:
- **single** time series or
- **lists** of time series (FAME namelist option)

in FAME databases on:
- your **local PC** (if FAME is there installed) or
- any **remote machine** (if FAME is there installed).

Remark: You can not select both FAME types (single time series and lists of time series) at the same time in one project. If you add a different type of input to your project, previously selected items will automatically be discarded. However, it is possible to select time series (respectively lists of time series) from different databases in one project.



The dialog provides edit boxes for the entering of the
- **(remote or local) host**,
- **directory**,
- **database**, and of any subset of the
- **time series**.

(For UNIX servers a
- **login** and a
- **password** are needed)

Note: All UNIX connection parameters are CASEsensitive. Take care with CAPITEL or small letters.

To verify your selection use the button "**Show contents of a selected item**" that allows viewing the data of a time series or the list of time series in a Fame namelist.

Another possibility to easily select large sets of time series is given by the **wildcard selection** option that just works as its equivalent function in FAME. Type a wildcard name by using the letters that are the same in all time series to be selected and press the "**Connect to FAME**" button. Letters that can be different from one time series to another must be replaced by the symbol '**^**'. Any chain of letters after a certain position in the time series names can be replaced by ending the wildcard name at this position with the question mark '?'.

Examples for wildcard names:
A Fame database contains the following time series: ABC, ABCDEF, ABCXYZ and XYZDXF.
The wildcard name '*ABC^^^*' will select ABCDEF and ABCXYZ.
The wildcard name '*^^^D^F*' will select ABCDEF and XYZDXF.
The wildcard name '*ABC?*' will select ABC, ABCDEF and ABCXYZ.

Tip: To easily copy a long name of a time series from the series list to the wildcard edit box just move the mouse over the time series name and click on the right mouse button.

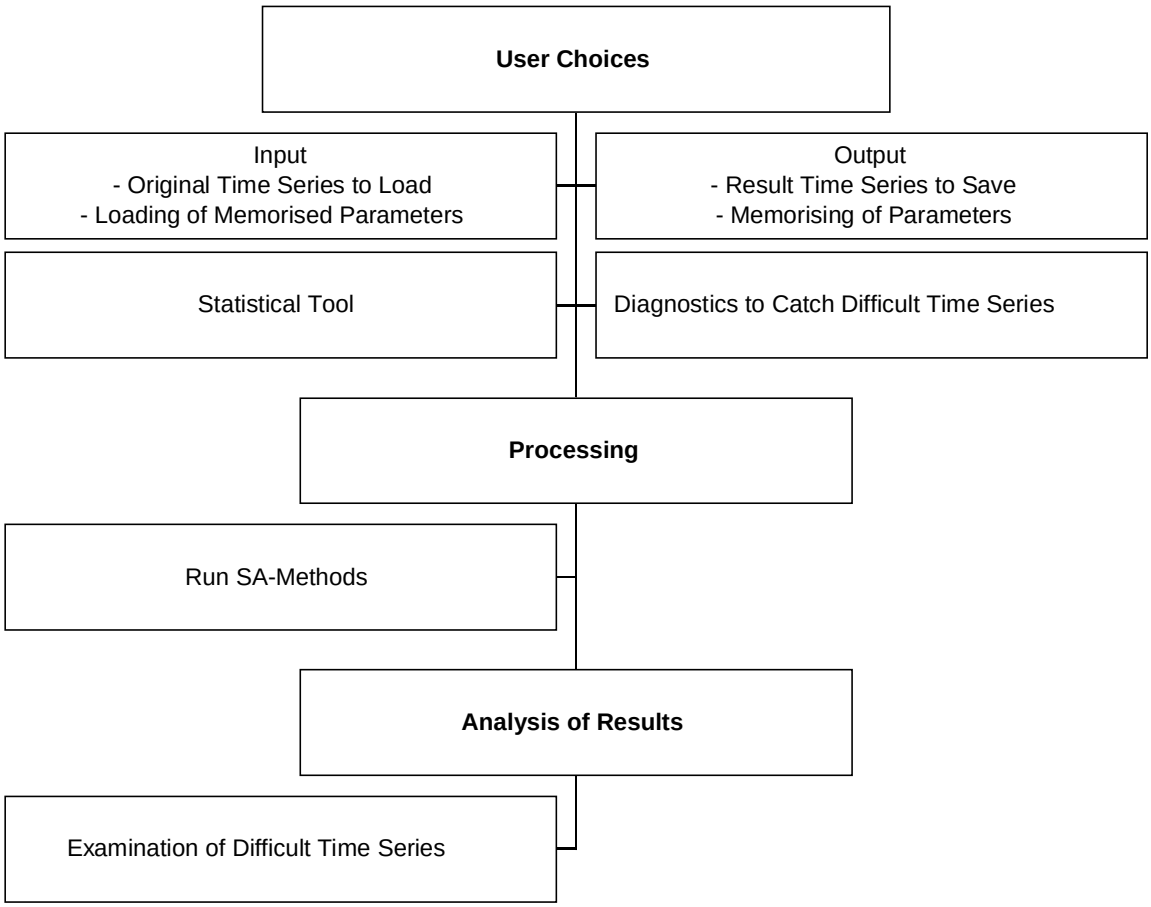
Accept your choice:

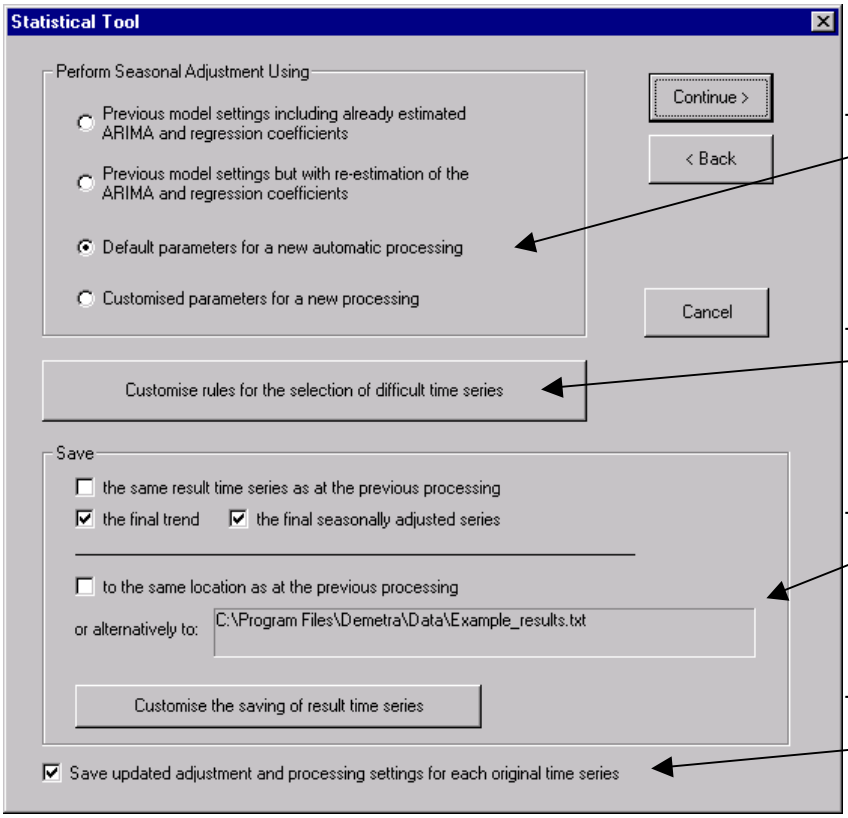
A maximum number of 100 time series or namelists can be shown in the series view. In this view, highlight all the items (time series or namelists) you want to treat with Demetra and accept your choice by clicking on "**Continue**" (that brings you back to the former screen showing your selection). If your (wildcard) selection is greater than 100 items, than check the box "**Use all time series from the**

wildcard selection, not only the above displayed ones" on the bottom of the screen. This will disable the series view and accept the complete selection (that may be larger than 100 items) when you click on the "**Continue**" button.

For more details on the Format for the storing of parameters in FAME databases, see page 40.

Automated module: Overview





- Choice of one of four **statistical tools**, which correspond to different practices of monthly seasonal adjustment

- Customisation of **diagnostic criteria** for the detection of difficult time series

- Specifications for the **type and naming of results** to be saved and their **saving place**

- check box "**Save updated adjustment and processing settings for each original time series**"

Automated module: Statistical tools

Note: Statistical tools 1 and 2 suppose that a set of parameters for each selected time series was previously defined and memorised in the database. Only stored parameters are transmitted to the SA-methods. For all other parameters DEMETRA uses the default modalities.

Tool 1: SA using the previous modelling settings including already estimated ARIMA and regression coefficients

Uses all options for the adjustment (pre-adjustment and type of decomposition, ARIMA and regression model, coefficients, etc.) and for the storing of the results that were kept from the previous automatic/customised SA of these series (or that were manually set). The ARIMA- and regression coefficients are not re-estimated. Thus, only new observations and new outliers can give rise to revisions.
The tool updates the result time series (e.g. the seasonally adjusted series and the trend series as defined in the previous automatic/customised SA).

Tool 2: SA using the previous modelling settings but with re-estimation of the ARIMA and regression coefficients

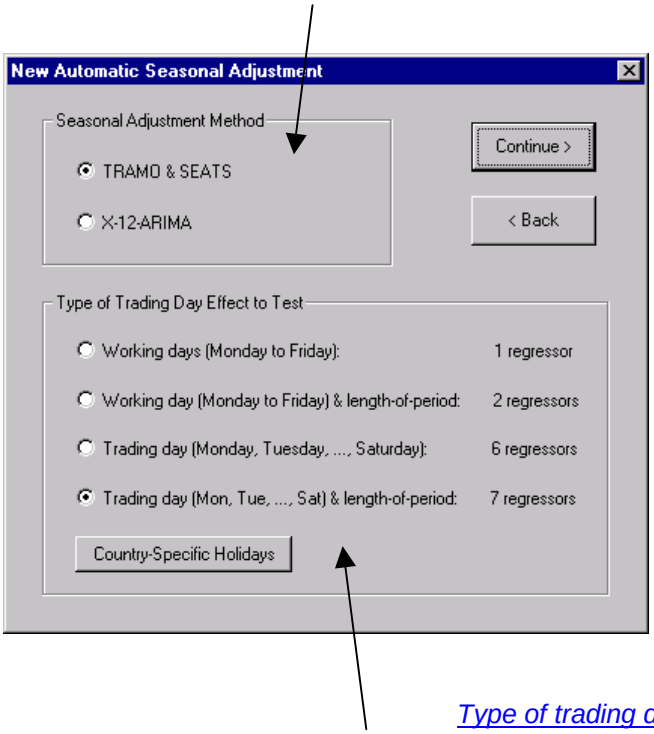
Same as the above one, except that the previous coefficients of the ARIMA and regression models are re-estimated (but the models are not re-identified!), both for the pre-adjustment and (if used) for the decomposition. Outliers in the new observations are re-identified and (re-)estimated.

Tool 3: New automatic seasonal adjustment

Choice of the SA-method: TRAMO/SEATS or X-12-ARIMA

For both of the choices, DEMETRA defines a set of default parameters for a new adjustment that includes:

- pretests for a logarithm transformation (multiplicative/additive modelling)
- a mean correction (if necessary)
- a new ARIMA model identification/selection and estimation
- pre-tests for Easter and one of 4 different trading day effects (including country-specific holidays)
- an automatic detection and correction for outliers over the whole time series length
- an interpolation of missing observations
- an ARIMA forecast at the end of the series
- an automatic decomposition.



Tool 3 ignores all previous modelling settings and readjust all the original time series by a **unique set** of default modelling parameters for a new completely automatic seasonal adjustment of all time series in the processed list.

The new parameter modalities resulting from the tests and estimations and specific to each time series are returned from the SA-methods to DEMETRA. The parameters necessary for a next run (using statistical tools 1 or 2) will be stored in the database.

Type of trading day effect

- Working day effect: There are no differences in the economical activity between the working days (Monday to Friday) but between these and non-working days (Saturday, Sunday). Hence, the varying number of these days is considered.
- Working day and length-of-period effect: As before, but also the total number of days per period is considered.
- Trading day effect: There are differences in the economical activity between all days of the week. Hence, the varying number of these days is considered.
- Trading day and length-of-period effect: As before, but also the total number of days per period is considered.

The corresponding regression variables are automatically created using the calendar for the years from 1901 to 2099. **Specific holidays** (e.g. depending on regions or economical activities like banking) may be added by the user.

Note: Since TRAMO/SEATS and X-12-ARIMA do not decide between these types of trading day effects, the user must do this choice depending on the mean time series length and on the user's knowledge about the type of time series (e.g. trade, employment, production index, accounts, etc.). In general, very short time series should rather be adjusted with few trading day variables (1 or 2), whereas longer time series may be better adjusted using 6 or 7 trading day regressors. In the case of a doubt try several options and decide yourself for the best one (e.g. using the number of difficult time series found or the goodness of the diagnostic statistics for each trial).

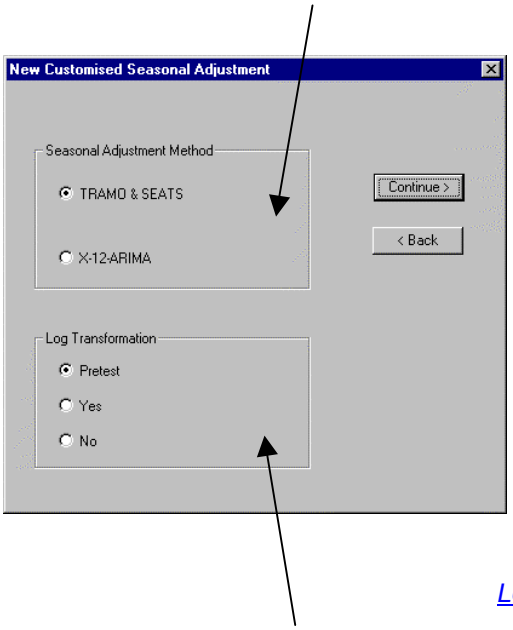
Note: If your series are stock series then do not use this statistical tool 3. Use instead tool 4 (New customised seasonal adjustment) and switch off the trading day correction in the dialog box "Trading Day and Easter Effect", because the trading day variable for stock series (of X-12-ARIMA) can not be accessed from the automated module. Single stock series can be adjusted for the trading stock effect using X-12-ARIMA in the detailed analysis module.

Tool 4: Customised seasonal adjustment

Choice of the SA-method: TRAMO/SEATS or X-12-ARIMA

For both of the choices, DEMETRA proposes a set of default parameters for a new adjustment that may be changed in a afterwards following suite of dialog boxes:

- pretests for a logarithm transformation (multiplicative/additive modelling)
- a mean correction (if necessary)
- a new ARIMA model identification/selection and estimation
- pre-tests for Easter and one of 4 different trading day effects (including country-specific holidays)
- an automatic detection and correction for outliers over the whole time series length
- an interpolation of missing observations
- an ARIMA forecast at the end of the series
- an automatic decomposition.



Tool 4 does the same as tool 3 above, but the user can modify or complement the automatic parameters. The modifications to the parameters are the same for all time series in the processed list.

Log transformation

Transformations can be appropriate if the amplitude of the seasonal fluctuations of the series are correlated to the level of the series. This indicates a multiplicative relationship between the components of the series that can be logarithmically transformed to obtain an additive structure necessary for the decomposition.

- Pre-test: The programme tests for the necessity of a logarithm transformation of the original series (TRAMO: based on a trimmed range-mean regression, complemented with the BIC values, X-12-ARIMA: based on the AICC values). No transformation is performed if a original series contains zeros or negative values.
- Yes: The logarithm transformation is performed if the original series does not contain zeros or negative values.
- No: The logarithm transformation is not performed.

Remark: the X-12-ARIMA options for defining other types of transformation can not be accessed from the automated module. Use the detailed analysis module for more advanced parameter settings.

Trading day correction and length-of-period adjustment

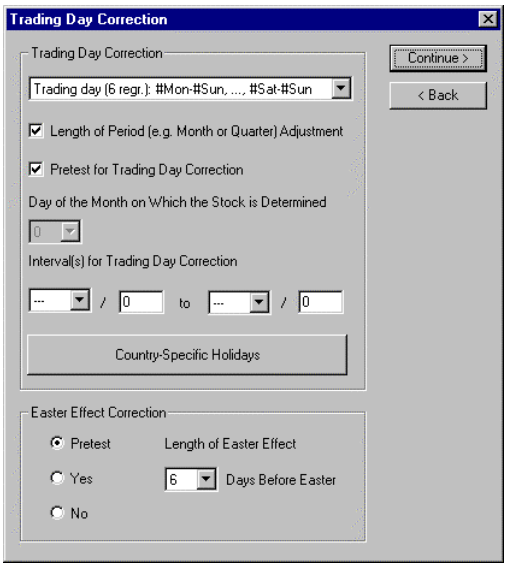
Many economical activities are strongly influenced by calendar effects like varying number of trading days and holidays in each recorded period. In order to improve the seasonal modelling and the trend estimation, such effects should be eliminated before the decomposition.
Different trading day effects are possible:

- Trading flow effect: Only for stock series.
- Working day effect: There are no differences in the economical activity between the working days (Monday to Friday) but between these and non-working days (Saturday, Sunday). Hence, the varying number of these days is considered. One regression variable is automatically created.
- Working day combined with length-of-period effect: As before, but also the total number of days per period is considered. Two regression variables are automatically created.
- Trading day effect: There are differences in the economical activity between all days of the week. Hence, the varying number of these days is considered. Six regression variables are automatically created.
- Trading day combined with length-of-period effect: As before, but also the total number of days per period is considered. Seven regression variables are automatically created.
- Flow effect (stock effect): (only X-12-ARIMA) Use this option only in the case that your series are stock series. It means that the series values are registered at a certain date in each calendar month. If this option is chosen you must also enter the day of the month on which the value is registered.

The corresponding regression variables are automatically created for the calendar of the years from 1901 to 2099. Specific holidays (e.g. depending on regions or economical activities like banking) may be added by the user.

- Pre-test: The programme tests for the necessity of a correction for the specified trading day (or working day) effects in the original series (TRAMO: by running a regression on the Airline model, X-12-ARIMA: based on the AICC values) using the specified type of trading day effect.
- Interval for Trading Day Correction: You can define a sub-interval to which the trading day correction will be limited. This might be useful if the time series behaviour or real working day rhythms changed. Often, not only trading day effects change, and it should rather be considered to cut the series into different sub-series and to adjust each part separately (of course only if the series are long enough).

  Remark: the X-12-ARIMA option for defining two trading day patterns can not be accessed from the automated module. Use the detailed analysis module for more advanced parameter settings.



Note: Since TRAMO/SEATS and X-12-ARIMA do not decide between the different types of trading day effects, the user must do this choice depending on the mean time series length and on the user's knowledge about the type of time series (e.g. trade, employment, production index, accounts, etc.).
In general, very short time series should rather be adjusted with few trading day variables (1 or 2), whereas longer time series may be better adjusted using 6 or 7 trading day regressors. In the case of a doubt try several options and decide yourself for the best one (e.g. using the number of difficult time series found or the goodness of the diagnostic statistics for each trial).

Easter effect correction

Economical activities can be influenced by the varying number of Easter preceding days (with higher economical activities) that fall in either of the months March and April. In order to improve the seasonal modelling and the trend estimation, such an effect should be eliminated before the decomposition. The number of Easter affected days per year may be adapted to the type of time series if the user possesses more detailed information on the economical background. However, a default value that results from many practical experiences is given.

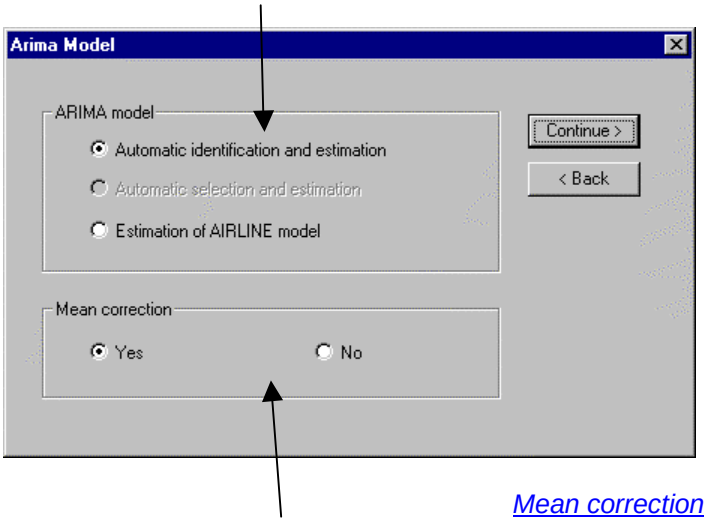
- Pre-test: The programme tests for the necessity of a correction for the Easter effect in the original series (TRAMO: by running a regression on the Airline model, X-12-ARIMA: based on the AICC values).
- Yes: The correction for the Easter effects is performed.
- No: The correction for the Easter effects is not performed.

The corresponding regression variable is automatically created by the programme that incorporates the calendar for the years from 1901 to 2099.

ARIMA model

An ARIMA model is identified (TRAMO/SEATS) or selected from a list of default models (X-12-ARIMA) and estimated for each time series in order to perform the forecast and (for Tramo/Seats) also the decomposition on the forecasted time series. Alternatively, no identification/selection is done, simply the AIRLINE model (0 1 1)(0 1 1) is estimated. Of course, one expects much better results using specific models adapted to each of the time series. However, under some circumstances the user might want to use the robust AIRLINE model what highly speeds up computer time. In general, very short time series can often sufficiently be well modelled with the AIRLINE model.

- Automatic identification (TRAMO) or selection (X-12-ARIMA) of a time series specific ARIMA model and its estimation
- Estimation of the robust AIRLINE model

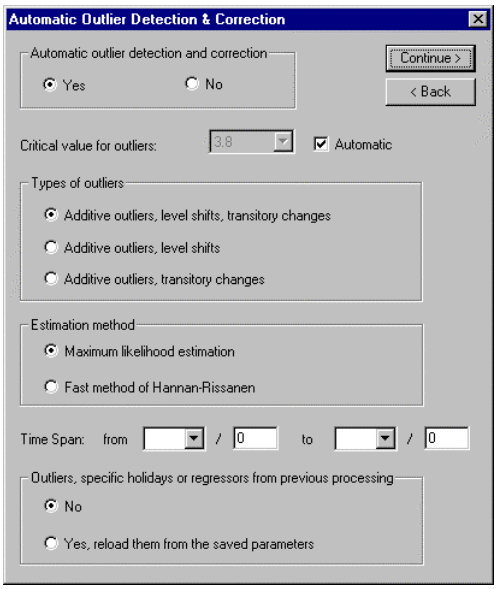


Mean correction

The residuals of the ARIMA model are supposed to follow a normal distribution that includes a mean of zero. Hence, a preceding mean correction may be adequate. TRAMO will anyway set this option to "No" if the mean correction is not necessary.

- Yes: Perform a mean correction (for TRAMO: only if necessary)
- No: Do not perform a mean correction

Automatic outlier detection and correction



The programme has a facility for automatically detecting outliers and for removing their effect. Outliers are "historically unexpected" values (data irregularities) in the time series that result either from real extraordinary economic effects or from the modelling: some few values may not "follow" the ARIMA model chosen and are therefore excluded from the modelling. Unfortunately, often these real extraordinary economic effects are unknown, and the corresponding time series values are often only detected because these fall out of the structure (modelled with the ARIMA technique) contained in the other values.

You can switch on or off the automatic outlier detection and correction using:
- Yes
- No

The outlier detection procedure can be customised for different parameters.
The **critical value** determines how strong the outlier must break out in order to be considered and varies from 2.8 (high sensitivity) to 4.1 (low sensitivity). The default (automatic) value is determined by the length of each time series: Shorter the series lower the critical value and vice-versa. Since the outlier detection procedures of TRAMO and X-12-ARIMA are not identical, the default (automatic) values are different too. The critical value may be chosen smaller to increase the number of outliers and thus to improve the residual characteristics of the ARIMA model. It may be chosen higher to reduce the number of outliers in the case that more than 5% of the number of observations are found to be outliers. However, choosing the critical value requires both judgement and experience.

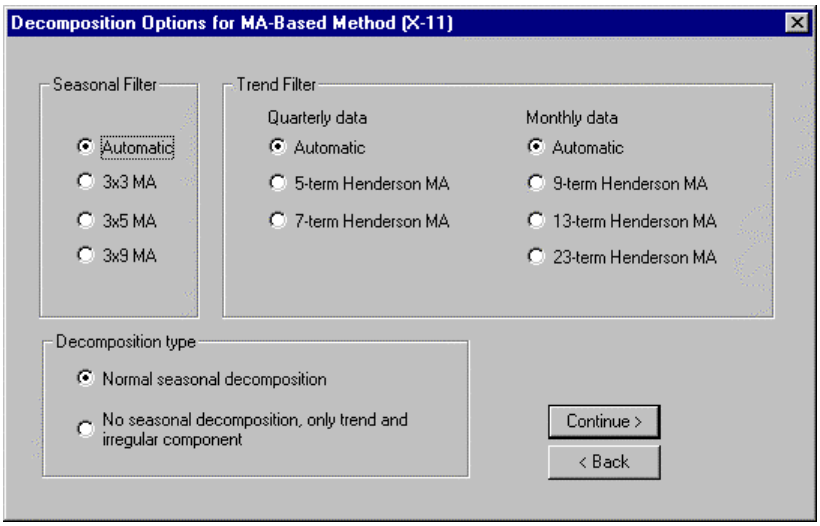
Different **types of outliers** are considered in the context of seasonal adjustment: additive outliers (AO), transitory change (TC) and level shift (LS). An additive outlier is able to catch a single point jump in the data, a temporary change a single point jump followed by a smooth return to the original path, and a level shift a permanent change in the level of the series. The user may limit the detection to 2 of the 3 outlier types (always including additive outliers).

The **outlier estimation methods** differ between TRAMO and X-12-Arima. The first one alternatively uses the maximum-likelihood estimation (better results, slower) or the fast method of Hannan-Rissanen. X-12-ARIMA offers also 2 procedures: "add one by one" (The outlier with the highest/insignificant t-statistic is added/removed at one time and the ARIMA model estimated and so on.) and "add all outliers together" (All the significant/insignificant outliers are added/removed at once and the ARIMA model estimated and so on.). The first method generally takes more computation time than the second whereas the second method can easily reach the memory limits by adding to many outliers. Outlier detection results can vary depending on the ARIMA model: observations are classified as outliers because the ARIMA model fits them less well than most of the other observations.

A **time span** for the outlier detection and correction can be specified. In this case, only the time points

of each series falling into this interval are considered in the procedure.
The option for **outliers, specific holidays or regressors from previous processing** allows to include e.g. outliers suspected at specific, known time points by defining them in the series-specific parameter item in the database and using the option for (re-)loading them from the saved parameters. Specific holiday and other user-defined regressors may the specified in the same way. This option can also be used, if the annual automated re-adjustment should consider previous outlier and regressors settings.

Decomposition options for MA-based method X-11 (decomposition part of X-12-ARIMA):



The seasonal and trend moving averages (also called "filters") used to estimate the seasonal factors and the final trend-cycle can be controlled:

The user can choose between the 3x3, 3x5 and 3x9 **seasonal filter** or the automatic option that invokes the seasonal filter selection procedure of X-11-ARIMA/88 based on the global moving seasonality ratio. That ratio is computed on preliminary estimates of the irregular component and of the seasonal. Roughly, large values point to a relative stability of the seasonality and suggest the use of a long seasonal moving average; on the contrary small ratios indicate a relatively unstable seasonality leading to the use of short seasonal moving filters.

The available **trend filter** choices depend on the periodicity of the time series: quarterly data can be adjusted with the 5- or 7-term Henderson trend filter, and monthly data with the 9-, 13- or 23-term Henderson trend filter. In both cases, an automatic option is available that chooses the filter based on the characteristics of the data (global irregular-cycle-ratio).
Broadly speaking, long filters (high numbers) are adequate for stable seasonal respectively trend movements in the time series while short filters (low numbers) are more appropriate for unstable, fast evolving patterns.

Two **types of decomposition** can be performed:
- the normal decomposition into trend-cycle, seasonal factors/component and the irregular factors/component. Trend-cycle and irregular factors/component build together the seasonally adjusted series.
- the reduced decomposition without seasonal adjustment: only the trend-cycle is computed leaving apart the irregular factors/component.

Correction for level-bias:

The programme can correct for the bias that may occur in multiplicative decomposition when the period-to-period changes are relatively large when compared to the overall mean. This bias implies an underestimation of the seasonally adjusted series and of the trend in levels, caused by the fact that geometric means underestimate arithmetic means. 3 choices for the **bias correction** are available:

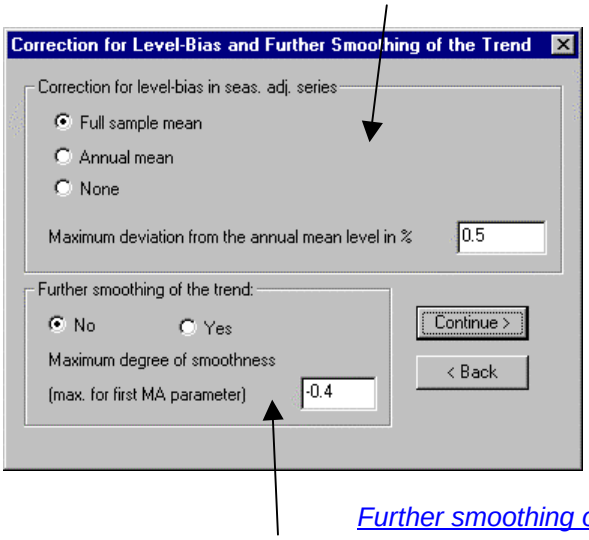
- Full sample mean: A correction is made for the overall bias for the full length of the series and the

forecasting period (only with TRAMO/SEATS and only for logarithm transformed series)

- Annual mean: For TRAMO/SEATS, a correction is made so that, for every year (including the forecasting period), the annual average of the original series equals the annual average of the seasonally adjusted series, and also (very approximately) equals the annual average of the trend. For X-12-ARIMA, the seasonally adjusted series will be modified to force the annual totals of the seasonally adjusted series and the original series be the same. The difference between the annual totals is distributed over the seasonally adjusted values in a way that approximately preserves the period-to-period movements of the original series.

  Remark: The bias correction procedure is not recommended if the seasonal pattern is changing or if trading day adjustment is performed.

For TRAMO/SEATS only: When the average value of the differences (in absolute value) between the annual means of the original and seasonally adjusted series is larger than the **maximum deviation**, the bias correction for annual means is automatically enforced. The maximum deviation to enter is expressed in percent points of the level of the series.



Further smoothing of the trend for SEATS:

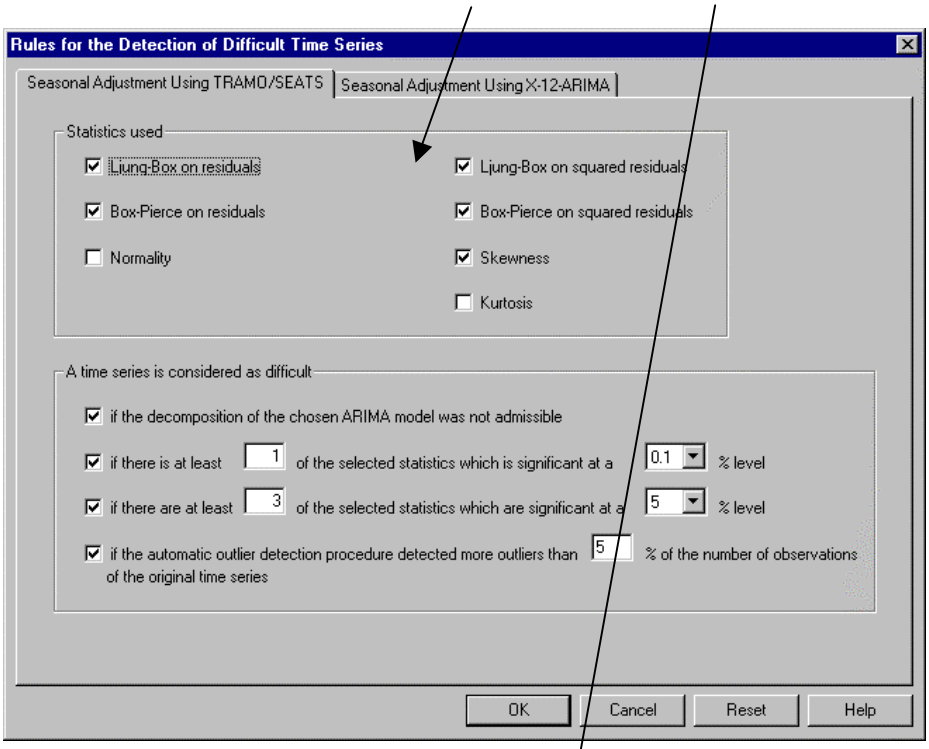
For the AIRLINE model, a facility has been introduced into SEATS to obtain a smoother trend without significantly affecting the seasonally adjusted series. This is done by simply decreasing the value of the first coefficient of the moving average (MA) factor in the ARIMA model.

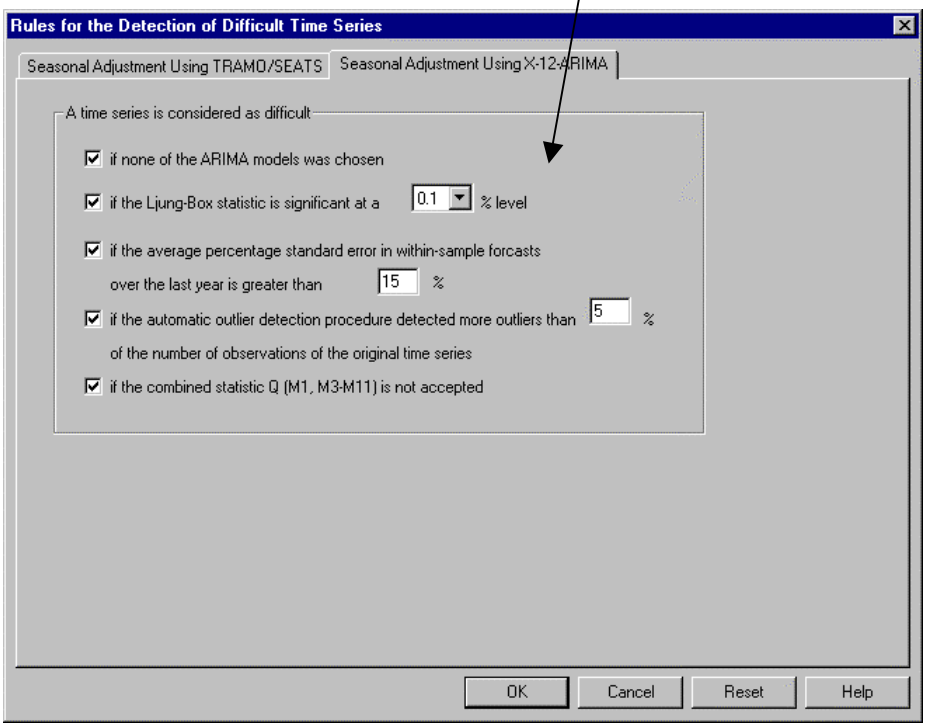
- Yes: The trend is further smoothed if necessary. When the first MA coefficient is larger than the maximum value ("degree of smoothness"), it is replaced by this maximum value. If the first MA coefficient is smaller than or equal to the maximum value, nothing is done since the trend is already smooth enough.
- No: No further smoothing is done.

Automated module: Customise rules for the selection of difficult time series

Customise:
- the diagnostic statistics used to control the quality of adjustment and to create the list of difficult time series,
- and their significance levels,
- the number of outliers which will be accepted

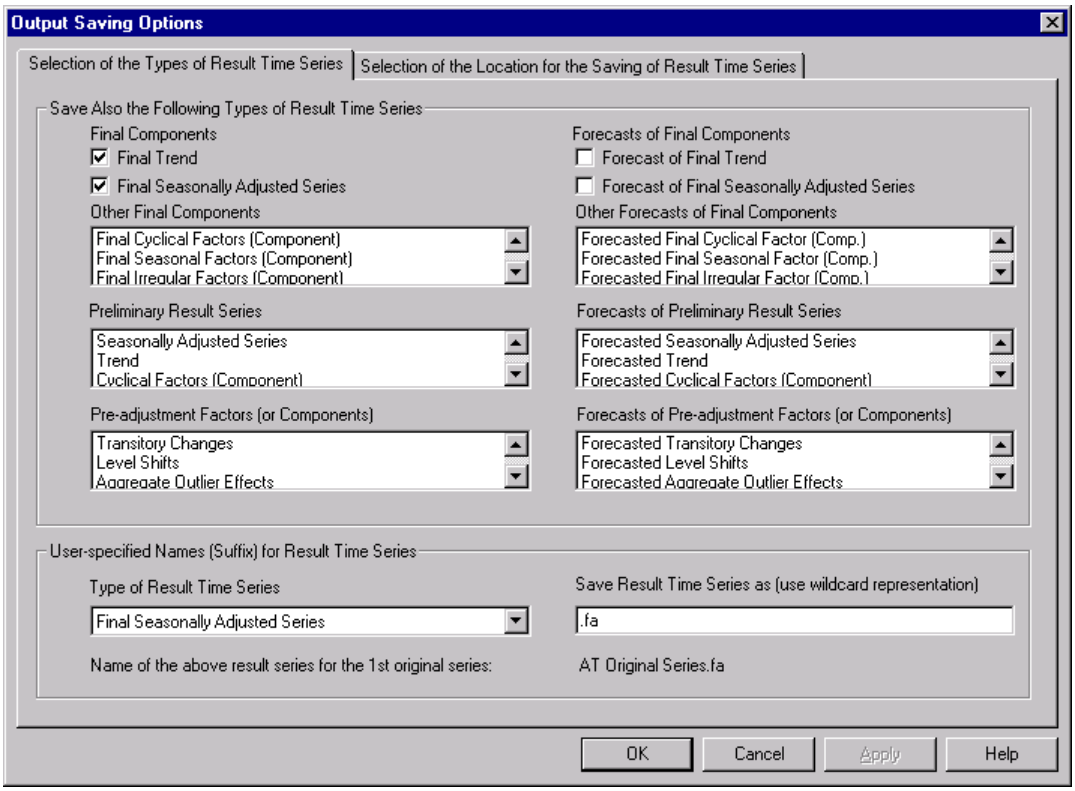
Diagnostics for the SA-methods Tramo and Seats and X-12-Arima:





Automated module: Customise the saving of result time series

Types and names of result series



Note: You can select more than one list-box item (result time series) at a time. The SHIFT and CTRL keys can be used together with the mouse to select and deselect items, including non-adjacent items. Clicking or double-clicking an unselected item selects it. Clicking or double-clicking a selected item deselects it.
Attention: The selection of a result time series does not mean that this series will necessarily be saved to the database/file. The SA-methods Tramo/Seats and X-12-Arima only produce the results that correspond to the regression- and ARIMA-model used (factors or components that represent the effects/terms included in the model). Only these results can be saved to the database/data file. Missing results are therefore not an error of Demetra.

At the bottom of the dialog, an edit box is provided for **customising the suffixes of the names of the result time series** used for the saving. First choose the type of result time series in the left combo box, then modify the corresponding suffix that are proposed to you using the right edit box. The default construction rule of the names consists in adding a default suffix to the name of the original time series. See the user manual for a list of default suffixes. To give you an idea how the name will look like, an example is shown below the edit box using the first original time series and the currently selected type of result time series.

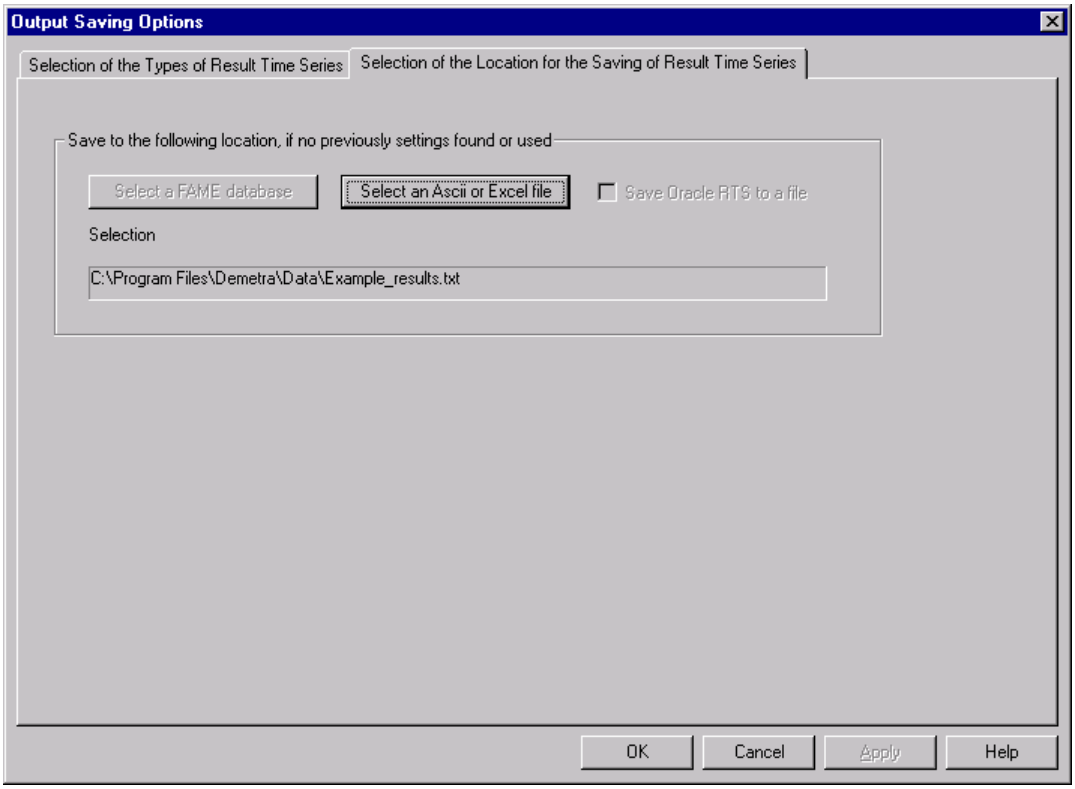
Tip: Starting the customised suffix by "#" means deleting letters at the end of the name of the original time series before adding the suffix. This can be useful if a suffix specifying an original series should be replaced by a suffix specifying a result time series.
Remark: The default respectively user-defined names of the result time series as shown in this dialog are not applied in the case if suffixes (memorised in a previous run) are found in parameter list in the database.
Example:
- name of the original series: "MYSERIES.ORIG", default suffix of trend series: ".ft", resulting name of the trend series: "MYSERIES.ORIG.ft"
- name of the original series: "MYSERIES.ORIG", user-defined suffix of trend series: "####TREND", resulting name of the trend series: "MYSERIES.TREND"

Location and name of result databases/files

Browse the location (host, directory) and name of databases/files into that the result time series are to be saved. The type of the result databases/files (FAME, ASCII, EXCEL, SAS, ORACLE) depends on the type of the input database/file. It can therefore not be chosen by the user. By default, DEMETRA proposes the following result database/file...

- ... for FAME: the database that is used for the input (see page 9: Selection of time series for input),
- ... for MS-EXCEL: the file that is used for the input (but with different result sheets named "Demetra_Results (.xx)", xx representing the default time series extension) and
- ... for ASCII: a new text file whose name is constructed by the name of the input data file extended by the letters "_results".
- ... for SAS: new SAS databases whose names are constructed from the first 4 to 6 characters of the name of the input data file extended a specific suffix "_?" based on the type of result.

Remark: The (default respectively user-defined choice for the) location of the result time series as shown in this dialog are not applied in the case when "saving information" (memorised in a previous run) are found in the parameter list in the input database/file, and when the corresponding check box (titled "Save to the same location as at the previous processing") in the last dialog "Statistical Tool" is clicked.

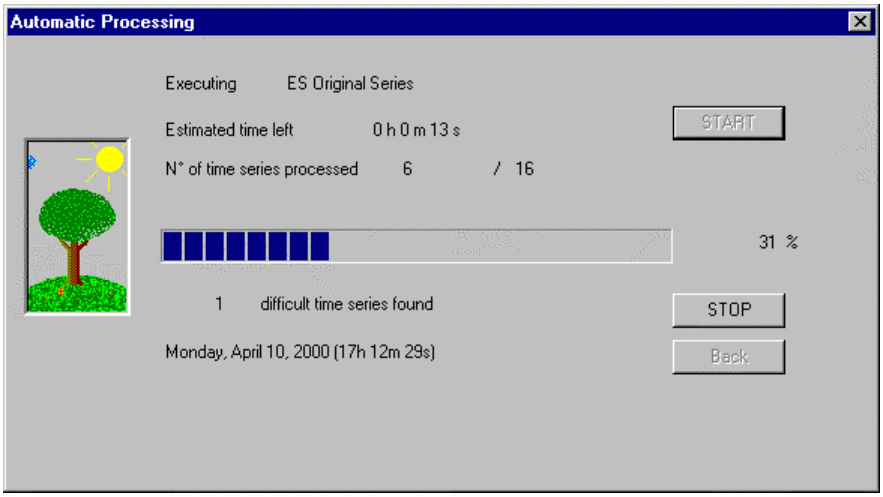


Automated module: Saving of parameters

The user can decide whether the sets of parameters specific to each time series (model) should be saved to the database using the check box "**Save updated adjustment and processing settings for each original time series**". The models include e.g. the SA-method and their input parameters, and the types, names and location of the result time series.
This saving is necessary if statistical tools 1 or 2 are used in a later run, since these tools need the stored parameters.

Chapter 3:
Processing and result analysis in the automated module

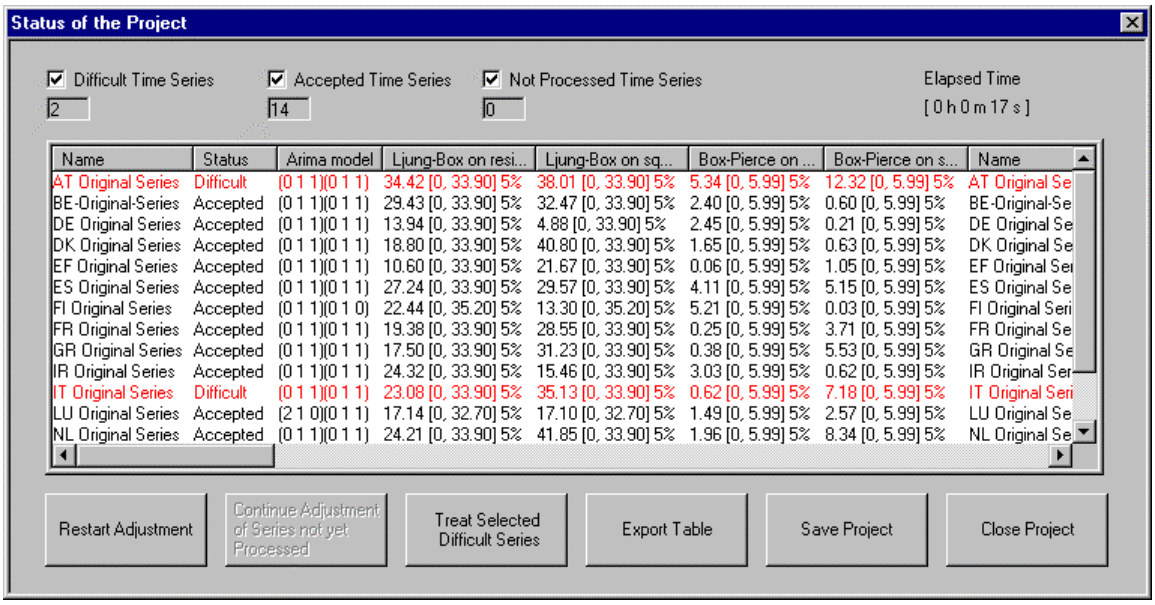
Dialog "Automatic Processing" of SA-methods



DEMETRA controls the execution of the SA-methods. Errors and warnings are reported to the file **demetra.log**. The processing of each time series by the SA-methods is not interactive. However, the user is permanently informed about the progress in the execution of all series and **stop**, **continue** or **cancel** the processing at any time (after the SA-method has returned from the execution of one series).

During the processing, the diagnostic statistics of each time series are automatically computed and checked and difficult time series detected. If the diagnostic statistics are not significant then the adjustment is accepted and the **result time series** and the **corresponding set of parameters** are saved directly to the databases or data files. For the difficult series, no result time series or parameters are immediately saved to the database.

Table: Status of the project



While processing the original time series, a table is created that contains the most important information on the time series and that is shown in the dialog "Status of the Project" after the processing has finished.

Number of difficult time series: see below for the explanation of this type of time series
Number of accepted time series: see below for the explanation of this type of time series
Number of not processed time series: see below for the explanation of this type of time series

> *Note: The time series of the different types are only shown in table if the corresponding check boxes are clicked. If you can not see any time series in the table verify that the check boxes are clicked.*

Buttons at the bottom of the dialog:

Restart Adjustment: This option reloads from the databases all original time series contained in the project and the corresponding parameter sets. It allows you to re-use the projects for the regular (e.g. monthly/quarterly) adjustments without reselecting the time series.
Continue Adjustment of Series not yet Processed: If you had interrupted the Automatic processing of all time series and some series are still not processed, you can use this option to continue at the point where you had stopped before.
Treat Selected Difficult Series: This option invokes the procedure for the assisted treatment of difficult time series. If the automatic processing detected series that could not be adjusted with satisfaction (significant/bad diagnostic statistics) then these series are marked as difficult. To enable the option for their treatment you need to have selected at least one difficult series. Do this by mouse-clicking and using the CTRL or SHIFT key. You can select any subset of time series within the list of difficult time series.
Export table: It can be useful to have all the information contained in the table of the Status of the Project in another format or saved to a special database for filing reasons. This option writes the information for all the series contained in the table to a text file named by the user. It is a simple tab-separated ASCII file. It can easily imported e.g. in MS-EXCEL. The information is added to the file if it is not empty. If the file does not exist it is created.
Save Project: The complete project is stored in a Demetra project file named by the user that can be re-opened at a later point in time. This option also facilitates the re-using of the project in regular (e.g. monthly) adjustments.
Close Project: To stop the treatment and close the current project, use this option. The complete project is stored in a Demetra project file named by the user that can be re-opened at a later point in time. This option also facilitates the re-using of the project in regular (e.g. monthly) adjustments.

Use  to reopen previously saved and closed projects.

Following information is given in the table (columns):

Name of original time series: as loaded from the database/data file

Status:
- "Not processed (Error message)": The time series has not yet been processed or the programme was not able to perform the adjustment. Possible reason can be e.g. the incorrect time series length.
- "Accepted": The time series has been successfully processed, the diagnostic statistics are not significant or the user accepted the adjustment. The result time series and the corresponding set of parameters are already saved to the databases or data files. No further user action is needed either possible for these time series (except restarting the adjustment after an update of the series).
- "Difficult": The time series has been processed, but the diagnostic statistics are significant. Neither result time series nor the corresponding parameters are saved to the databases or data files. Further user action is needed to find an acceptable model. To start the assisted treatment of difficult time series click on the time series to select them (use the "Ctrl" or "Shift" key to select several difficult time series) and click the button "Treat Selected Difficult Series".
- "Detailed analysis": Former difficult time series get this status if the user had chosen the corresponding option in the procedure for the assisted treatment of difficult time series. The future use of this status is that the series can be better treated in the detailed analysis module to find an acceptable model. For the moment, the direct transfer of difficult time series to the detailed analysis module is not available. No further user action is possible for these time series (except restarting the adjustment after an update of the series).
- "Rejected": Former difficult time series get this status if the user had chosen the corresponding option in the procedure for the assisted treatment of difficult time series. The user is supposed to treat the series in a different manner outside DEMETRA: e.g. the series structure may contain an important break that need the cutting of the series into different parts and their separate adjustment. No further direct user action is possible for these time series (except restarting the adjustment after an update of the series).

  Tip: To easily select a large amount of difficult time series, unclick all types of time series at the top of the dialog box except the check box for difficult time series. Then, only difficult time series are shown in the table and one can select them all together using the key combination "Shift" + "End" + "Down".

ARIMA model: short write form for the orders (zeros or positive values) of the computed and applied seasonal ARIMA model "(#AR #I #MA)(#SAR #SI #SMA)", e.g. the Airline model can be written as "(0 1 1)(0 1 1)"
- #AR: order of the regular autoregressive factor
- #I: order of the regular differentiation
- #MA: order of the regular moving average factor
- #SAR: order of the seasonal autoregressive factor
- #SI: order of the seasonal differentiation
- #SMA: order of the seasonal moving average factor

Higher the order more complicate is the model. High model orders may signify non-parsimonious models, lead to highly correlated coefficient estimators, and penalise forecast accuracy. Model orders over (3 2 3)(2 1 2) would be certainly inappropriate. The Airline model (0 1 1)(0 1 1) is a simple, robust and very common model.

Note: If the seasonal part only contains zeros (x x x)(0 0 0), a non-seasonal model is used. If SEATS uses such a model no seasonal factors/component and seasonally adjusted series are computed. In fact, the seasonally adjusted series is equal to the original series.

Diagnostic Statistics:
Ljung-Box on residuals: diagnostic statistic based on the ARIMA residuals in the form "#A [#B, #C] #D", e.g. "26.81 [0, 33.90] 5%"
- #A: statistic

- #B: lower confidence limit
- #C: upper confidence limit
- #D: confidence level in %

A statistic outside the confidence interval (limited by both confidence limits) signifies that there is evidence of autocorrelations in the residuals (of the ARIMA model fitting). A linear structure is left in the residuals.

Ljung-Box on squared residuals: format as the former statistic
A statistic outside the confidence interval signifies that there is evidence of autocorrelations in the squared residuals (of the ARIMA model fitting). A non-linear structure is left in the residuals.

Box-Pierce on residuals: format as the former statistic (only for TRAMO/SEATS)
A statistic outside the confidence interval signifies that there is evidence of autocorrelations in the residuals (of the ARIMA model fitting) at seasonal lags. A linear seasonal structure is left in the residuals.

Box-Pierce on squared residuals: format as the former statistic (only for TRAMO/SEATS)
A statistic outside the confidence interval signifies that there is evidence of autocorrelations in the squared residuals (of the ARIMA model fitting) at seasonal lags. A non-linear seasonal structure is left in the residuals.

Normality: format as the former statistic (only for TRAMO/SEATS)
A statistic outside the confidence interval signifies that the distribution of the residuals (of the ARIMA model fitting) shows asymmetry and/or kurtosis pattern inconsistent with the normal distribution.

Skewness: format as the former statistic (only for TRAMO/SEATS)
A statistic outside the confidence interval signifies that there is evidence of skewness in the residuals (of the ARIMA model fitting). The residuals are asymmetrically distributed (3rd central moment).

Kurtosis: format as the former statistic
A statistic outside the confidence interval signifies that there is evidence of kurtosis (4th central moment) in the residuals (of the ARIMA model fitting).

ARIMA forecast error: format as the former statistic (only for X-12-ARIMA)
A significant size of the ARIMA forecast errors signifies that the forecasts vary too much around the true values. The ARIMA model can not fit the time series well.

Percentage of outliers: format as the former statistic
A high number of outliers signifies either that there is a problem related to a weak stability of the process, or that there is a problem with the reliability of the data. The ARIMA model can not fit all of the observations.

Combined statistic Q: format as the former statistic (only for X-12-ARIMA)
A significant combined statistic Q (M1, M3-M11) means that some of these X-12-Arima quality assessment statistics Mx concerning the decomposition are outside the acceptance region.

Time span (n° of observations):
The period, year of the first and the last observation and the total number of observations are given.

Transformation:

- Logarithm: The logarithm transformation is performed.
- None: No transformation is performed.
- Test for log-transformation: The programme tests for the necessity of a logarithm transformation of the original series (TRAMO: based on a trimmed range-mean regression, complemented with the BIC values, X-12-ARIMA: based on the AICC values). No transformation is performed if a original series contains zeros or negative values.
- Square root transformation: The square root transformation is performed.
- Inverse transformation: The inverse transformation is performed.
- Logistic transformation: The logistic transformation is performed.
- Power transformation: A transformation is performed according to the inputted power value.

Mean correction:
- Yes: A mean correction is performed.
- None: A mean correction is not performed.

Trading day effect:
- No: A trading day correction is not performed.
- 1 regressor: A working day correction is performed: There are no differences in the economical activity between the working days (Monday to Friday) but between these and non-working days (Saturday, Sunday). The varying number of these days is considered.
- 2 regressors: A working day and length-of-period correction are performed: There are no differences in the economical activity between the working days (Monday to Friday) but between these and non-working days (Saturday, Sunday). The varying number of these days and also the total number of days per period are considered.
- 6 regressors: A trading day correction is performed: There are differences in the economical activity between all days of the week. The varying number of these days is considered.
- 7 regressors: A trading day correction and length-of-period are performed: There are differences in the economical activity between all days of the week. The varying number of these days and also the total number of days per period are considered.
- 6 stock-effect regressors (only for X-12-ARIMA): A stock trading day correction is performed: There are differences in the economical stock activity between all days of the week. The weekday (Monday, Tuesday, ..., or Sunday) of the concerned day of the month (e.g. the last day of the month) is considered.

Easter effect:
- Yes (#A day(s)): The correction for the Easter effects is performed. #A days before Easter are considered in the Easter effect regression variable.
- No: The correction for the Easter effects is not performed.

Outliers:
Outliers are "historically unexpected" values (data irregularities) in the time series that result either from real extraordinary economic effects or from the modelling: some few values may not "follow" the ARIMA model chosen and are therefore excluded from the modelling. Unfortunately, often these real extraordinary economic effects are unknown, and the corresponding time series values are often only detected because they fall out of the structure (modelled with the ARIMA technique) contained in the other values.
- "#A: #B1 #C1(#D1), #B2 #C2(#D2), #B3 #C3(#D3), ...":
  #A is the number of outliers, the #B's, #C's and #D's are the type, date and observation number of each outlier. #B can have the entries "AO" (additive outlier), "LS" (level shift), "TC" (transitory change or also known as temporary change), "RP" (ramp effect) or "IO" (innovational outlier). An additive outlier is able to catch a single point jump in the data, a temporary change and a ramp effect is a single point jump followed by a smooth return to the original path, and a level shift is a permanent change in the level of the series. Since innovational outlier (especially at the beginning of the series) may have very drastic effects on the level of the series, they should not be considered.
- None: A correction for outliers is not performed or no outliers were found.

Missing observations:
- None: There is no missing observation.
- "#A: #B1 (#C1), #B2 (#C2), #B3 (#C3), ...":
  #A is the number of missing observations, the #B's and #C's are the date and observation number of each missing observation.

Other regression effects:
- None: There are no other regression effects.
- "#A Regressor(s)": #A is the number of user-defined (fixed) regression effects (variables).

ARIMA decomposition: (only for TRAMO/SEATS)
- None: SEATS is not used. No seasonal decomposition is performed.
- Exact: SEATS used the ARIMA model provided by TRAMO for the decomposition. Hence, the models for the pre-adjustment and for the decomposition are the same.
- Seasonal component made zero: SEATS eliminated the seasonal part of the ARIMA model

provided by TRAMO because the seasonality is not strong enough for decomposition. Hence, the models for the pre-adjustment and for the decomposition are not the same. The decomposition is limited to the estimation of the trend and of the irregular factors/component. No seasonally adjusted series is computed since it is equal to the original time series. However, the results are normally not impaired by this change.

- Approximated: SEATS changed the ARIMA model provided by TRAMO because e.g. the decomposition of this model was not admissible. Hence, the models for the pre-adjustment and for the decomposition are not the same. However, the results are normally not impaired by this change.
- Not admissible: The SEATS decomposition of the ARIMA model provided by TRAMO was not admissible. The parameter settings forced SEATS not to try to find an adequate model to replace the former one. Hence, no decomposition was done. By default, the series is considered as difficult. To overcome this problem, use the DEMETRA defaults as parameter settings (it forces Seats to find an adequate replacing ARIMA model). Or, if you use the statistical tool 1 or 2 loading previous modelling settings, manually define a decomposable ARIMA model in the series-specific parameter item in the database.

X-11 decomposition: (only for X-12-ARIMA)

- With ARIMA forecasts: X-12-Arima could use or successfully select an ARIMA model for the time series and use it to compute forecasts that are added to the time series before the decomposition. This noticeably improves the decomposition quality at the recent end of the series since ("more") symmetric filters are used.
- Without ARIMA forecasts: The automatic ARIMA model selection procedure did not find an acceptable model for the time series in the list. Reasons are the failing of at least one of the tests for an evidence of non-seasonal overdifferencing, for the size of the average absolute percentage error in within-sample forecasts, and for the Ljung-Box Q chi-square probability for each model. This may noticeably harm the decomposition quality at the recent end of the series since asymmetric filters are used.

X-11 seasonal filter: (only for X-12-ARIMA)

- 3x*X* MA: X-12-ARIMA used a 3x*X* moving average (MA, also called seasonal "filter") whereby *X* can be one of the numbers 1, 3, 5, 9 or 15. 3x*X* MA means that an 3-term simple average is taken of a sequence of consecutive *X*-term simple averages. The same MA is applied to all calendar periods (e.g. months or quarters). Broadly speaking, long filters (high numbers *X*) are adequate for stable seasonal movements in the time series while short filters (low numbers *X*) are more appropriate for unstable, fast evolving patterns.
- Stable: X-12-ARIMA used a stable seasonal filter: A single seasonal factor for each calendar period (e.g. months or quarters) is generated by calculating the simple average of all values for each period (taken after detrending and outlier adjustment). The stable filter is applied to all calendar periods (e.g. months or quarters).
- X-11 default: A 3x3 moving average is used to calculate the initial seasonal factors in each iteration, and a 3x5 moving average to calculate the final seasonal factors. This seasonal filter is applied to all calendar periods (e.g. months or quarters).
- Depending on period: The user specified in the parameter item that was loaded with the time series, different seasonal filters for different calendar periods (e.g. months or quarters).

X-11 trend filter: (only for X-12-ARIMA)

In the case of X-12-ARIMA, the programme gives more detailed information on the trend filter used. The filter might be fixed in advance (by choosing the appropriate option while defining a customised project) or selected by X-12-Arima based on statistical characteristics of the data.

- *X*-term Henderson MA: X-12-ARIMA used a *X*-term Henderson moving average for the detrending whereby *X* can be any odd numbers from 3 to 101.

Broadly speaking, long filters (high numbers *X*) are adequate for stable trend movements in the time series while short filters (low numbers *X*) are more appropriate for unstable, fast evolving patterns.

Seasonality:

This item gives more information on the seasonal structure of the time series or the type of ARIMA model (seasonal/non-seasonal) used for the adjustment. This is an indication if seasonal adjustment is adequate or actually performed.

- Seasonal model used: A seasonal ARIMA model was automatically identified by TRAMO/SEATS. If SEATS was used it did accept the seasonal model and actually perform a seasonal adjustment.

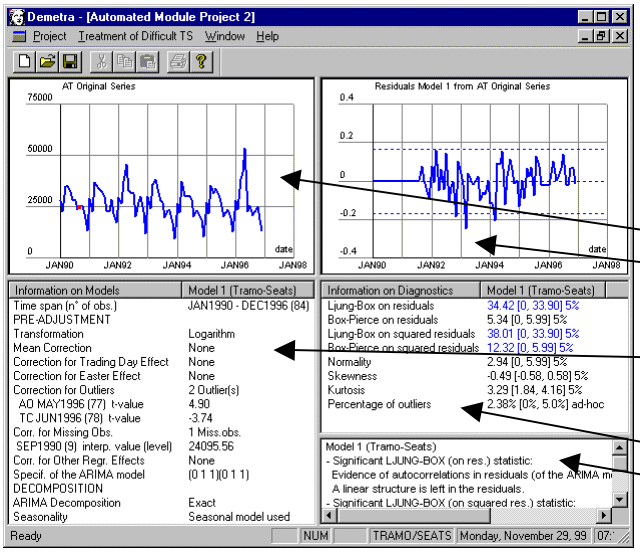
- Non-seasonal model used: A non-seasonal ARIMA model was automatically identified by TRAMO/SEATS, or imposed by SEATS that could not identify significant seasonality in the time series. A seasonal adjustment was NOT performed. If no other adjustments are performed (e.g. calendar adjustment), the seasonally adjusted series would be the same as the original time series, and is therefore not computed and saved to the database.
- Seasonal model imposed: A seasonal ARIMA model was imposed by the user or by the modelling settings saved in the databases. If SEATS was used it did accept the seasonal model and actually perform a seasonal adjustment.
- Non-seasonal model imposed: A non-seasonal ARIMA model was imposed by the user or by the modelling settings saved in the databases. A seasonal adjustment was NOT performed. If no other adjustments are performed (e.g. calendar adjustment), the seasonally adjusted series would be the same as the original time series, and is therefore not computed and saved to the database.
- To be checked: The seasonal adjustment procedure did not yet get to the normal end.
- Significant: X-12-ARIMA identified significant seasonality in the series. A seasonal adjustment is recommended.
- Probably present: X-12-ARIMA identified some uncertain seasonality in the series. A seasonal adjustment is might be recommended.
- Not significant: X-12-ARIMA did not identify significant seasonality in the series. Even though a seasonal adjustment was not recommended or useful, the seasonal adjustment was performed (if so specified). If a pre-adjustment (correction of calendar-effects, outlier correction) is performed, a non-seasonal RegARIMA model should be considered.

Input location:
This indicates the place (computer, directory, database) where the original time series was taken from. The database extension indicates the database type (e.g. db: FAME, xls: MS-EXCEL, txt: ASCII).

Output location:
This indicates the place (computer, directory, database) where the result time series were saved to. The database extension indicates the database type (e.g. db: FAME, xls: MS-EXCEL, txt: ASCII).

Result time series saved:
This indicates the already saved result time series. If this field is empty, no results have been saved yet during the current adjustment. The list contains the type of the results (e.g. fa: final seasonally adjusted time series, ft: final trend series) and the series-specific name of the series as used for the saving.

Assisted treatment of difficult time series

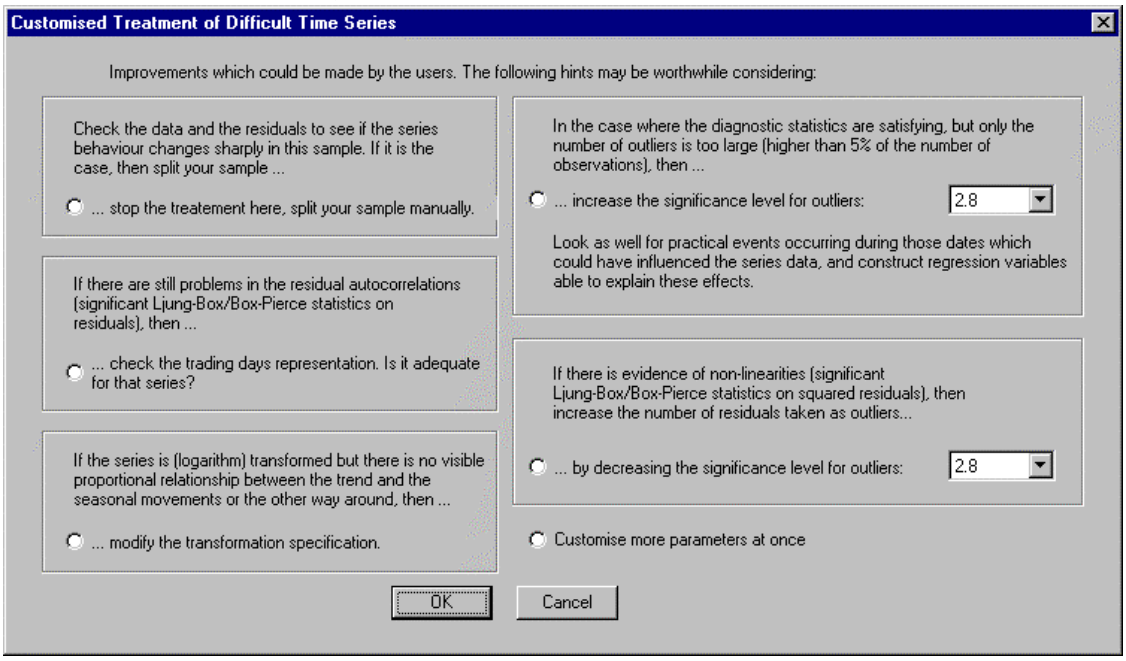


The processing of all the selected difficult time series is performed one by one. Up to two new modelling sets can be created that should perform an adjustment with satisfying diagnostic statistics.

Graph of the original time series
Graph of residuals available for each model on simple click on the corresponding column headers
Table of modelling specifications for each model: "Model *x* (*method*)" with *x*=1,2,3 and *method*=Tramo/Seats,X-12-Arima
Table of diagnostics for each model
Text message for each model referring to significant diagnostic statistics with conclusion.

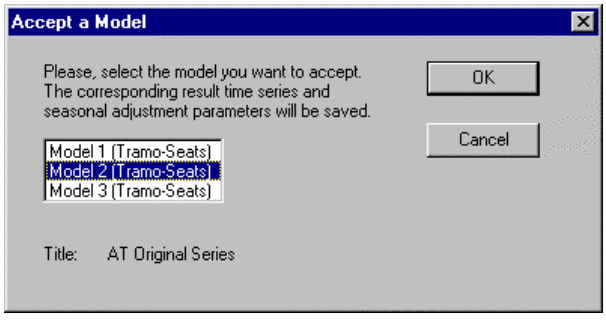
The interface works in the following way: Using the **pull-down** menu you can create a new modelling set to perform a new automatic processing or a new customised seasonal adjustment.

- The "**automatic processing**" option results in running the same seasonal adjustment method (TRAMO/SEATS or X-12-ARIMA) as used in modelling set 1. However, it uses the most automatic options of statistical tool 3 (New automatic seasonal adjustment (see page 13) with test for trading day and length-of-month adjustment - 7 regressors) that are independent of any other previously set parameters.
- If you choose the "**customised adjustment**" option, DEMETRA recommends taking one of the following actions:



Taking any of the actions listed above, then DEMETRA re-runs the seasonal adjustment method (TRAMO/SEATS or X-12-ARIMA) as used in modelling set 1. It uses the automatic processing options of statistical tool 3 (New automatic seasonal adjustment (see page 13)) plus the modified parameters (e.g. for trading day correction, logarithm transformation or the critical value for outliers, see statistical tool 4 (New customised seasonal adjustment (see page 14)).
The model obtained from the new adjustment is called "Model 2 (*method*)". The new residual graphs, specification and diagnostic results of "Model 2 (*method*)" are displayed together with "Model 1 (*method*)". One can define up to 3 different models per difficult time series but use the automatic processing option only once.

- If a new model for a series passes the diagnostic tests, then the user can **accept this model** and the interface saves the output (result time series) and the corresponding new set of parameters directly into the databases or data files. The series is removed from the list of difficult series. The modelling set accepted by the user is shown later in the table of the Status of the Project.



Remarks:

If ASCII files are used, all information (new parameters together with the original time series, all result time series) are saved to the same result ASCII file.

By default, the new parameters are only saved in the case if statistical tool 3 or 4 (new automatic or new customised adjustment) were used.

The final seasonally adjusted and the final trend series are saved (by default) if not differently specified.

Interpretation of significant diagnostic statistics

Diagnostic statistic	***Kind of problem in time series***
Ljung-Box test on residuals	*Evidence of autocorrelations in residuals (of the ARIMA model fitting). A linear structure is left in the residuals.*
Box-Pierce test on auto-correlations of residuals at seasonal lags	*Evidence of autocorrelations in residuals (of the ARIMA model fitting) at seasonal lags. A linear seasonal structure is left in the residuals.*
Ljung-Box test on squared residuals	*Evidence of autocorrelations in squared residuals (of the ARIMA model fitting). A non-linear structure is left in the residuals.*
Box-Pierce test on auto-correlations of squared residuals at seasonal lags	*Evidence of autocorrelations in squared residuals (of the ARIMA model fitting) at seasonal lags. A non-linear seasonal structure is left in the residuals.*
Normality test on residuals	*The distribution of residuals (of the ARIMA model fitting) shows asymmetry and/or kurtosis pattern inconsistent with the normal distribution.*
Skewness	*Evidence of skewness in residuals (of the ARIMA model fitting). The residuals are asymmetrically distributed (3rd central moment).*
Kurtosis	*Evidence of kurtosis (4th central moment) in residuals (of the ARIMA model fitting).*
Size of errors in out-of-sample forecasts	*The out-of-sample forecasts vary too much around the true values. The chosen ARIMA model cannot fit the time series well. Since the forecasts will be used for the decomposition of the time series, a satisfactory accuracy cannot be assured on the actual end of the components.*
Number of outliers	*High number of outliers found. Either there is a problem related to a weak stability of the process, or there is a problem with the reliability of the data. The chosen ARIMA model cannot fit all of the observations.*
Number of outliers on a particular period	*Evidence of an anomaly on a particular period. An index variable should be built to catch it*
All candidate ARIMA models rejected	*No model with acceptable forecast errors, Ljung-Box Q statistic and no sign of overdifferencing could be found. The decomposition is done without ARIMA forecasts.*
Significant combined statistic Q (M1, M3-M11	*Some of the X-12-Arima quality assessment statistics M concerning the decomposition are outside the acceptance region.*

Chapter 4:
Use of the detailed analysis module

General Overview

The module for detailed analysis is build with the aim to allow in-depth comparisons of different variants (sets) of seasonal adjustment parameters and adjustment methods for single series of particular interest.

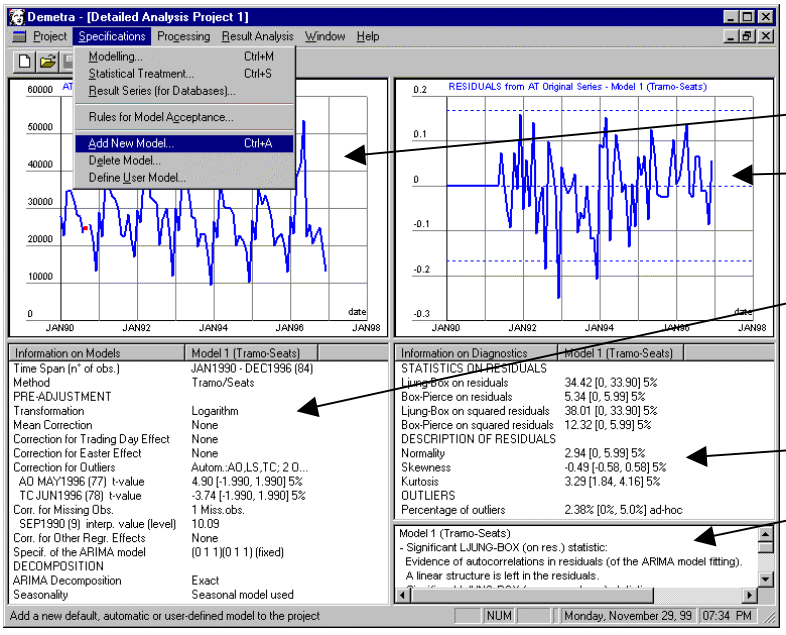
Features

-
- in-deep examinations of the seasonal behaviour of single time series using user-friendly graphs and tables
- useful tool for analysing time series with a behaviour very difficult to modelise
- nearly the whole capacity of the SA-methods: access to most of their options and to all their output including text output, data output (time series), diagnostics and graphs
- modelling specifications and diagnostic statistics from the SA-methods with 3 degrees of detail (brief list, most important specifications, and complete list)
- possibility for saving the result time series and the corresponding set of the parameters into the production databases, data files or text files, and to export modelling specifications and diagnostic statistics into a text file (which can easily be imported into MS Excel)

Attention: Only one single time series can be treated in one detailed analysis project.

Structuring

The main project view is divided into 5 sub-windows:



- **Graph of the original time series**
- **Graph of residuals or other result time series** produced by the seasonal adjustment methods (if available)
- **Table of modelling specifications** for each modelling set (modelling specifications/statistical treatment)
- **Table of diagnostics** for each modelling set
- **Text message** referring to significant diagnostic statistics for each modelling set with conclusion
-

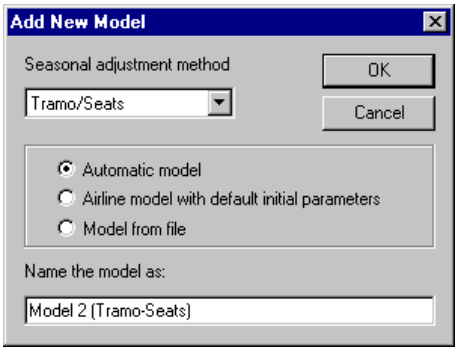
Note: To see relevant data in these windows (except the graph of the original time series), at least one model need to be created.

In-build functions

Add/delete/save models

Models (sets of modelling/seasonal adjustment parameters) can contain different modalities for the parameters of one SA-method or they can contain comparable settings for different SA-methods.

Pulldown menus: Specifications – Add New Model...
Specifications – Delete Model...
Specifications – Define User Model...

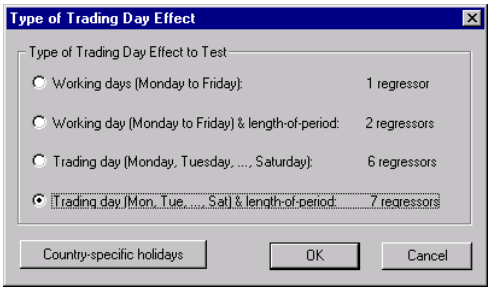


You can **add** a model
- with parameters for a fully automatic seasonal adjustment (3rd statistical tool: "Default parameters for a new automatic processing"): "Automatic model"
- with the simple and robust AIRLINE specification with default initial coefficients (original TRAMO/SEATS or X-12-ARIMA defaults): "Airline model with default initial parameters"
- or with user defined parameters (that must have been previously saved in a model file). In the first two options, you need to specify the seasonal adjustment method to be used: "Model from File"

DEMETRA now provides the possibility to give the new model a customised name. It will be used wherever the model is mentioned.

Tip: You can change the name of a model later if you click in the columns of the modelling sets in the tables for "Information on Models" or "Information on Diagnostics".

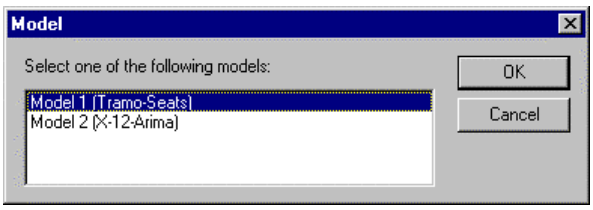
In the case of the choice of the "Automatic model" the following selection needs to be done:



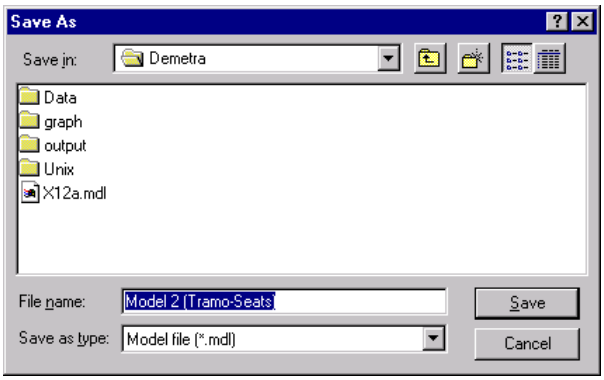
Since the SA-methods do not decide between the types of trading day effects, the user must do this choice depending on the mean time series length and on the user's knowledge about the type of time series (e.g. trade, employment, production index, accounts, etc.).
In general, very short time series should rather be adjusted with few trading day regressors (1 or 2), whereas longer time series may be better adjusted using 6 or 7 trading day regressors. In the case of a doubt, try several options and decide yourself for the best one (e.g. using the goodness of the diagnostic statistics for each trial)
.

4 different trading day effects are possible:
- Working day effect: There are no differences in the economical activity between the working days (Monday to Friday) but between these and non-working days (Saturday, Sunday). Hence, the varying number of these days is considered.
- Working day and length-of-period effect: As before, but also the total number of days per period is considered.
- Trading day effect: There are differences in the economical activity between all days of the week. Hence, the varying number of these days is considered.
- Trading day and length-of-period effect: As before, but also the total number of days per period is considered.

The corresponding regression variables are automatically created by the programme that incorporates the calendar for the years from 1901 to 2099. Specific holidays (e.g. depending on regions or economical activities like banking) may be added by the user.



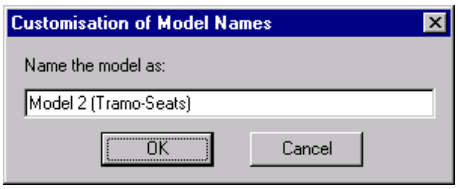
You can **delete** any previously added models from the workspace. All results and outputs of these models will be destroyed.



Save your models that can be useful for other time series or later adjustments to a special model file. For that use the function "Define User Model". Models stored in this way can be re-loaded in the "Add New Model" dialog box using the option "Model from file". Parameters depending on time series characteristics (e.g. time series length) are ignored.

Remarks: If DEMETRA finds during the time series loading process a previously-stored parameter set, it creates a new model in the project and shows the modelling specifications. If no parameter set was found, the user is asked to add a new initial model.
A model is always associated to one fixed SA-method: either TRAMO/SEATS or X-12-ARIMA.

Customise model names



This dialog box (invoked by a right mouse click inside the different columns of the tables for "Information on Models" or "Information on Diagnostics") let you customise the name of the corresponding modelling set. The new name will be used wherever the model is mentioned.

Modify specifications for modelling or statistical treatment of single models

Pulldown menus: Specifications – Modelling...
Specifications – Statistical Treatment...

Demetra allows modifications of the specifications of the "**Modelling...**" and "**Statistical Treatment...**" of one of the models already created. Select the model for which you want to change some parameters and customise the settings for the

- "Data Handling" (transformations, interpolations, mean correction),
- "Regression Variables" (trading day and Easter effect, outliers),
-·"ARIMA Model Specification" or "Automatic Model Identification/Selection" and
- "Model Estimation"

- or "Decomposition" (ARIMA-model based method or MA-based procedure "X11") and
- "Forecasting".

Remark: The changes to the parameters will only be applied, if you quit the "Specification" dialog boxes using the "OK" button. No modifications will be applied if you quit with "Cancel". You will only

be able to perform parameter modifications after having created at least one "model". See the paragraph just above for more about how to create a new model.

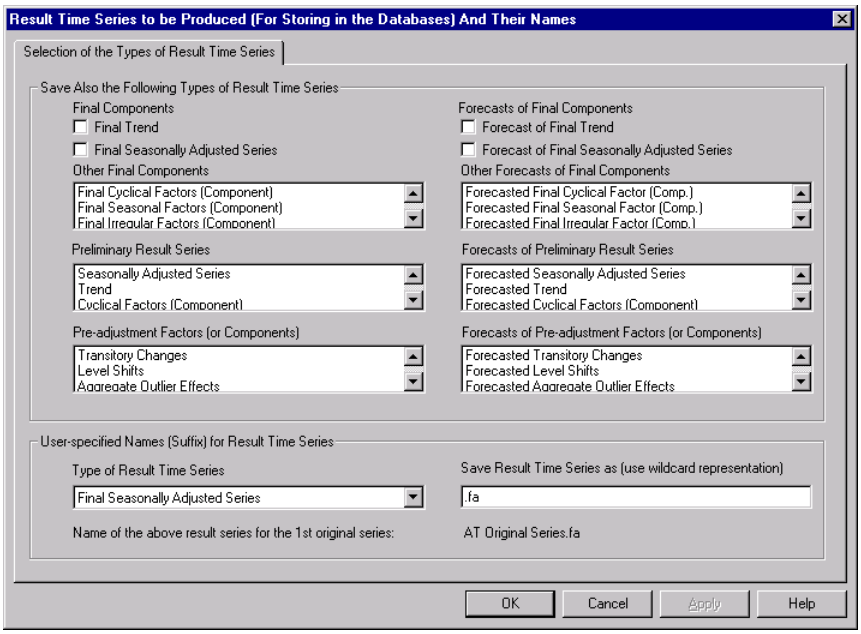
The parameters for modelling and statistical treatment can also be set or modified:

- while reading the model from the database: Demetra automatically finds models sets of previously treated time series
- while adding a model to the project: Demetra sets the parameters to the default, automatic or previously saved modalities for the new model.
- by Tramo/Seats and X-12-Arima: the SA methods can return new modalities of parameters and therefor change the executed model, e.g. the option for a pre-test of log-transformation will result in a decision: a model with or without log-transformation.

Modify application settings

Pulldown menus: Specifications – Result Series (for Databases)...
Specifications – Rules for Model Acceptance...

Demetra allows now the **a-priori selection of the result time series** that should be produced by the seasonal adjustment methods, and that are destined to be saved to the result databases when one modelling set is finally accepted. Make your choice at the beginning of your work before you run the seasonal adjustment methods because subsequent selections have no influence anymore!



This dialog box also provides input fields to customise the suffixes of the names of the result time series used for their saving.

Attention: The selection of a result time series does not mean that this series will necessarily be created: The SA-methods Tramo/Seats and X-12-Arima only produce the results that correspond to the regression and ARIMA model used (factors or components that represent the effects/terms included in the model). Only these results can be obtained. Missing results are therefore not an error of Demetra.

Remark: The changes to the parameters will only be applied, if you quit the "Result Time Series to be Produced..." dialog boxes using the "OK" button. No modifications will be applied if you quit with "Cancel".

Use the pull down menu item "**Rules for Model Acceptance...**" to select the diagnostic statistics that

DEMETRA should use to control the quality of adjustment like significance levels, the number of outliers which will be accepted, etc.

For more information, see page 20 for the Criteria for the automatic detection of difficult time series.

Process the adjustment for single models

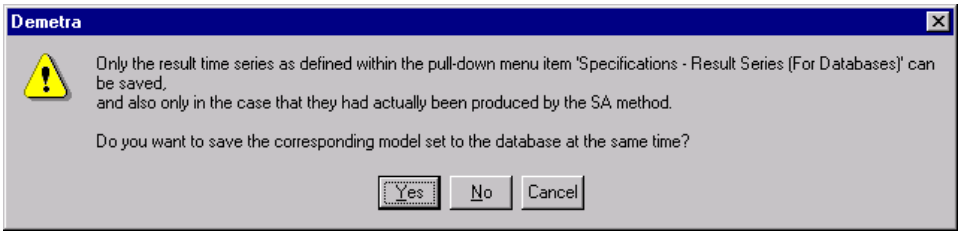
Pulldown menus: Processing – Execute SA...
Processing – Save Results to Database – Result Series
Processing – Save Results to Database – Parameter Set
Processing – Export Status Information

Run the SA-methods on the time series using one of the models in the project. You can run the methods several times on the same model even if you don't change any parameters. TRAMO/SEATS and X-12-ARIMA can return new modalities of parameters and therefore change the model (e.g. the option for a pre-test of log-transformation will result in the decision for a model with or without log-transformation).
After the seasonal adjustment, one can

- **save the results time series** (e.g. trend or seasonally adjusted series) for a given model to the database,
- **save the parameters of a model** to the original time series (The saved parameters can be used again in the automated module in statistical tool 1 or 2 using "Previous model settings"), and
- **export the information on the time series** like model specifications and diagnostic statistics to a text file (Use this function to create or update summary tables (for filing)- the format used is very convenient for an import in MS-Excel (tab-separated format). This function corresponds to the export of text information in the dialog box "Status of the Project" in the automated module.

Remark: In some cases, the treatment with the SA-methods can be very long, especially if you have a relatively difficult time series and options for new estimations. Please be patient and wait for the return of the programme. DEMETRA will normally tell you if any error occurred.

DEMETRA only saves the result time series that have been selected previously to the execution of the seasonal adjustment method, and that have actually been calculated by them. Make this choice at the beginning of your work before you run the seasonal adjustment methods because subsequent selections have no influence anymore!



Before saving the result time series, DEMETRA will request for the place of saving (name and location of result ASCII file, EXCEL file, SAS database or FAME database).

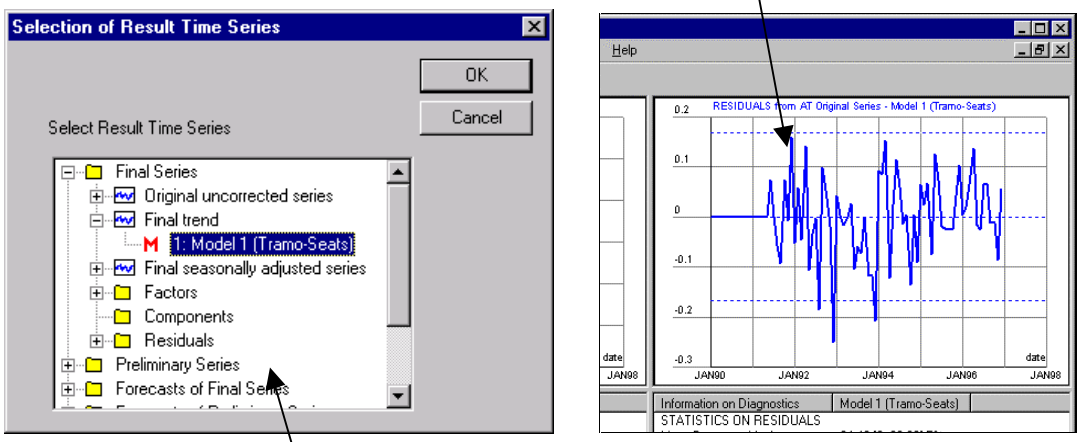
Compare the results (graphs and diagnostics) for different models

Pulldown menus: Result Analysis – Information on Models
Result Analysis – Information on Diagnostics
Result Analysis – Graph in Right Upper Area...
Result Analysis – Graphical Comparison Tool
Result Analysis – Show Log File...

Following modifications can be done to the detailed analysis project view:

- You can customise the degree of detail in the table of "**Information on Models**" and the table of "**Information on Diagnostics**": brief list, most important specifications and complete list.

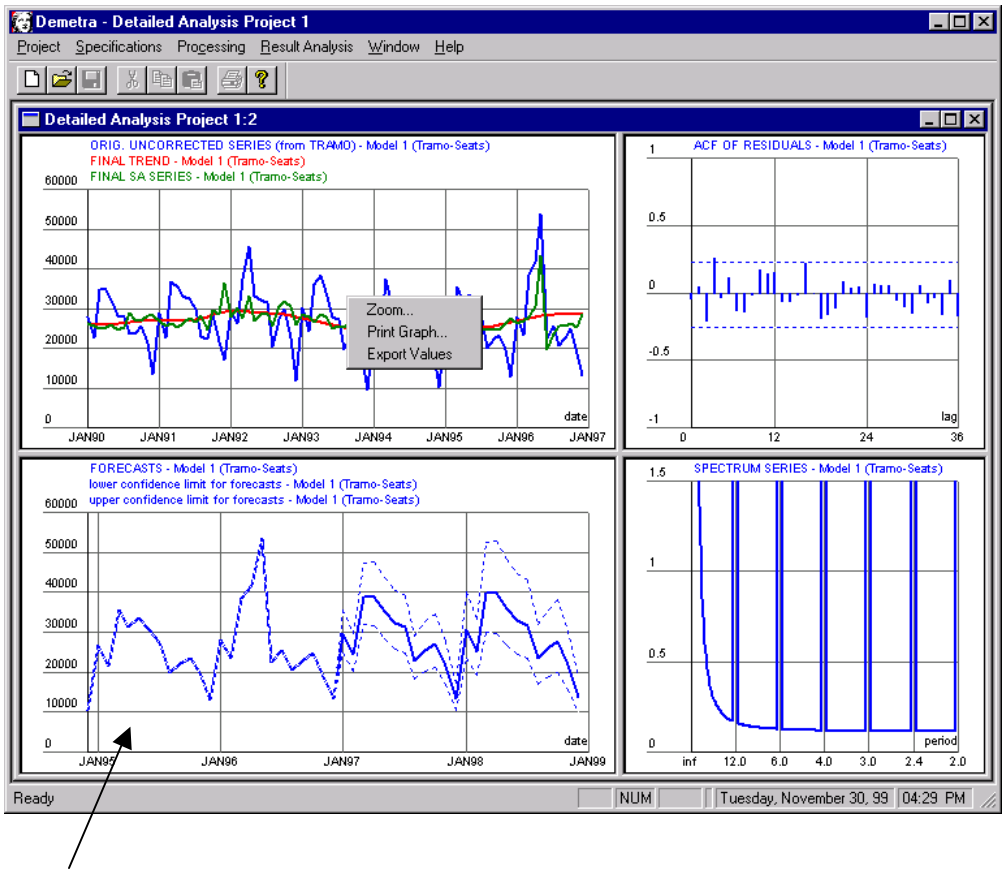
- You can customise the type of series shown in the upper right window that normally is the series of residuals. Only currently available result time series for any model can be selected with the pull-down menu item "**Graph in Right Upper Area...**".



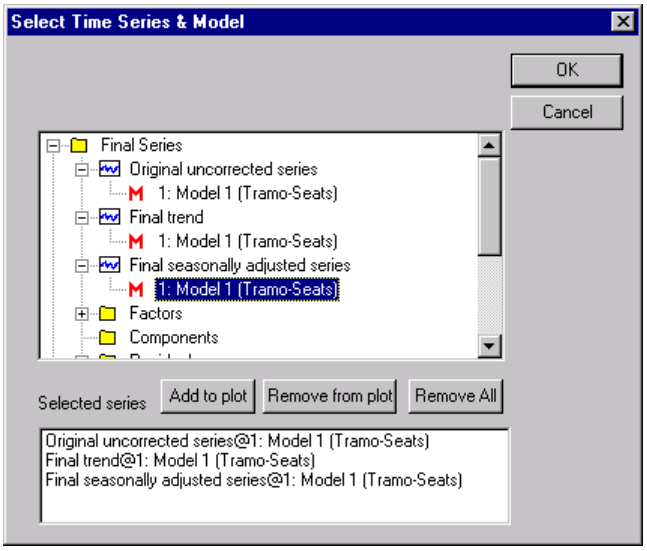
The tree shown in the first dialog box contains all the result time series available within the current Detailed Analysis project. It is structured in the following way:
1. level: general type of result time series
2. level: name of result time series
3. level: name of the modelling set to which the result time series belongs to

Note: To change the time series shown in the upper right area of the Detailed Analysis main project view, you must precise your selection up to the level 3! Otherwise an error message "You need to select a model." will be shown.

❖ An important tool in the detailed analysis module is the view for the graphical comparison of result time series. It is invoked by the menu item "**Graphical Comparison Tool...**" and opens a new window with 4 non-overlapping areas for different graphs.



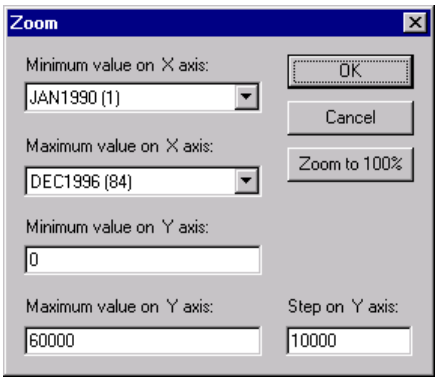
Double-click on the graph areas: to add or remove result time series to or from the charts.



The time series tree shown in this dialog box contains all the available result time series that have already been produced within the current Detailed Analysis project. It is structured in the following way:
1. level: general type of result time series
2. level: name of result time series
3. level: name of the modelling set to which the result time series belongs to

Remark: Demetra will take care about the compatibility of the time series chosen since only time series of the same type can be shown in one single plot. If you select series that can not be plotted in the same graph, an error message "Incompatible graph types for overlay" is shown.

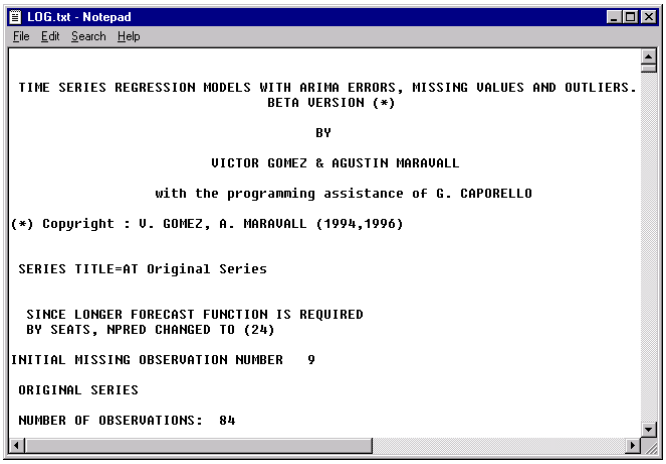
Right-click on the graph areas: to change the **graph scaling**, to get a tip for **printing graphs** and to **export the graphed data** to a text file that is immediately opened. Exported data can easily be copied into MS-EXCEL: use the CTRL + INSERT keys to copy the selected data to the clipboard, use the SHIFT + INSERT keys to paste the data into the already opened EXCEL sheet.



Zooming of graphs, customised scaling:
Use this dialog box to zoom the graph shown in the corresponding area of the Graphical Comparison Tool.

Use the button "**Zoom the 100%**" to automatically re-scale the graph to the original sizing. By default (except for some spectrum series), the scaling is calculated to show the complete series graph by optimally filling the plot area. The default scaling always depends on the size of the graph area and the screen resolution.

- It is possible to view the log files (also called output files) of the SA methods for a specific model using the notepad or wordpad viewer. For this use the menu item "**Show Log File...**". Only currently available log files can be viewed.



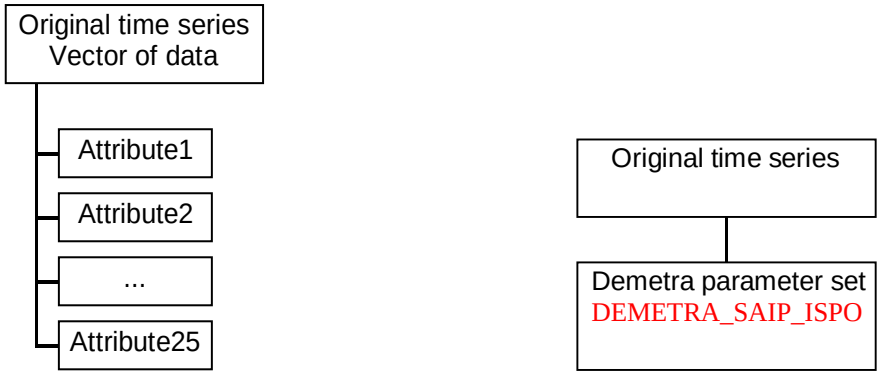
Use the different pulldown menus in "**Window**" and "**Help**" to manipulate the different windows and project views, to run the DEMETRA Help or to call the "About DEMETRA..." dialog box as usual just as in other standard MS Windows software.

Tips:

- *Clicking on the different model names in the column titles of the tables for "Information on Models" or "Information on Diagnostics" changes the model of the result series (e.g. residuals) shown in the upper right area.*
- *Clicking inside the different columns of the tables for "Information on Models" or "Information on Diagnostics" invokes a dialog box that let you customise the name of the corresponding modelling set.*
- *Moving the mouse cursor over the graph data invokes a small tip window that gives information on the currently hit series data (name of the series, name of the model, series value, date).*
- *Right-clicking on the graph areas allows you to change the graph scaling, to get a tip for printing graphs and to export the graphed data to a text file that is immediately opened. Exported data can easily be copied into MS-EXCEL: use the CTRL + INSERT keys to copy the selected data to the clipboard, use the SHIFT + INSERT keys to paste the data into the already opened EXCEL sheet.*

Chapter 5:
Input and output formats

Format for the storage of parameter sets in FAME databases



Example of a filled FAME attribute DEMETRA_SAIP_ISPO of a time series:

[TRAMO/SEATS
SAIP:SEATS=2,INIC=1,P=0,D=2,Q=1,BP=0,BD=1,BQ=1,
TH(1)=-0.502204260869,JQR(1)=1,BTH(1)=-0.605157773717,JQS(1)=1,INIT=2,
IMEAN=0,ITRAD=2,IEAST=1,INTERP=2,IATIP=1,VA=3.20,INT1=1997.01,
IREG=1,RG(1)=-0.112353516386768,RG(2)=-0.055734530489924,
RG(3)=-0.003498792919832,RG(4)=-0.045770062048928,NOADMISS=1,]
[REG:iuser=2,nser=1,pos(1)=1985.04,type(1)=AO,]
[ISPO:HOST=mypc,DIR=C:\Program Files\Demetra\data\,DB=myoutputdb.db,fa:##myfa,ft:##myft,]

FAME commands to manually display and modify the parameters managed by DEMETRA

* cd "*C:\Program Files\Demetra\data*"
  Changes the directory

* open *mydb.db*
  Opens a fame database

* catalog *mydb.db*
  Displays the names of all objects contained in the database

* display !string_attribute_names
  Displays all attributes of type string used in the database currently opened
  After having used DEMETRA, there should be an entry "DEMETRA_SAIP_ISPO"

* display DEMETRA_SAIP_ISPO(*name_of_time_series*)
  Displays the contents of the attribute defined by DEMETRA for the given time series
  If the given time series exists and you used DEMETRA once successful on this time series, you should get an output like this:

  DEMETRA_SAIP_ISPO(*name_of_time_series*)
  [TRAMO/SEATS SAIP:...,] [ISPO:...,]

Warning: Please, be careful with the following commands that modify the contents of the database. You can destroy very important information and data structures. Demetra may be unable to find the necessary information.

* set string_attribute_names={*OTHER_ATTRIBUTE(S)*, DEMETRA_SAIP_ISPO}
  Modifies the list of attributes of type string used in the database currently opened

* attribute DEMETRA_SAIP_ISPO(*name_of_time_series*)="[TRAMO/SEATS SAIP:...,] [ISPO:...,]"
  Updates the contents of the attribute defined by DEMETRA for the given time series

Format of ASCII files (input and output)

1. Each time series record contains 7 pieces of information:
- the name of the time series (1 item)
- the number of observations or -1 if Demetra should find it out (1 item)
- the starting year (1 item)
- the starting period (1 item)
- the periodicity (1 item)
- the time series data ([n° of observations] items)
- the seasonal adjustment parameters (1 item)

2. Each item must be separated from the next item. For doing this, an item must be followed by a tab character, a blank (space), a comma or a new line (carriage return/line feed).

3. The first item of each time series (name) must be enclosed by double quotes ("), if it contains several words.

4. The last item of each time series (parameters) must be enclosed by dollar signs ($), since it may also contain several words and figures. If no parameters are defined yet, this item can be empty, but must be indicated by a double dollar sign ($$). The dollar signs mark as well the termination of the time series record.

Name	Name string, e.g. "Product 1"; Must be enclosed by double quotes (**"**), if it contains several words.
N° of observations	Integer, e.g. 60 (or -1 if Demetra should find it out)
Starting year	Integer, e.g. 1988
Starting period	Integer, e.g. 2 for February or for the second quarter
Periods per year	Integer, e.g. 12 for monthly data, 4 for quarterly data
Time series values	Floating point or integer, e.g. 435.25 Missing values before or after the series have to marked with '**#N/A**' or a point '**.**', and inside the series with the value '**-99999.0**'
Parameters	String like '**$[TRAMO/SEATS SAIP: ...] [ISPO: ...]$**' or '**$[X-12-ARIMA SAIP: ...] [ISPO: ...]$**' or '**$$**' containing the adjustment parameters; Must be enclosed by dollar signs (**$**) even if it is empty!

Warning: Do not define the parameters yourself if you are not sure about the meaning or the format.

Example of an input/output file:

file: "user.txt"

```
"New Prod" -1     1987   1      12     117    153    241    218    202    200    192
    109    154    163    129    89     127    147    247    184    213    204    157
    123    135    166    139    113    153    178    233    215    197    182    155
    107    128    147    114    64     98     115    166    175    173    133    139
    99     123    136    109    88     120    143    193    222    187    183    162
    110    170    191    144    124    $$
Product_1  60     1987   1      12     117497 153276 241443 218709 202896 200064
    192762 109974 154109 163650 129863 89690  127367 147950 247927 184599 213691
    204560 157170 123872 135217 166298 139032 113558 153676 178397 233687 215396
    197457 182984 155172 107915 128639 147643 114334 64709  98618  115199 166369
    175057 173856 133181 139844 99098  123147 136589 109528 88284  120652 143008
    193415 222637 187172 183758 162622 110771 170540 191787 144563 124708
    $[TRAMO/SEATS SAIP:SEATS=2,INIC=1,P=0,D=1,Q=1,BP=0,BD=1,BQ=1,
TH(1)=-0.502204260869,JQR(1)=1,BTH(1)=-0.605157773717,JQS(1)=1,
INIT=2,IMEAN=0,ITRAD=2,INTERP=2,IATIP=1,VA=3.20,INT1=1995.12,IREG=5,
RG(1)=-0.112353516386768,RG(2)=-0.082420100950779,
RG(3)=-0.089793743762554,RG(4)=-0.057261937240423,
RG(5)=-0.055734530489924,RG(6)=-0.003498792919832,
RG(7)=-0.004577006204892,NOADMISS=1,]
[REG:iuser=2,nser=5,pos(1)=1985.04,type(1)=AO,pos(2)=1987.01,type(2)=TC,
pos(3)=1995.09,type(3)=TC,pos(4)=1983.12,type(4)=AO,pos(5)=1992.11,type(5)=LS,]
[ISPO:HOST=myPC,DIR=C:\Program
Files\Demetra\data\,DB=output.txt,fa:.myfa,ft:.myft,]$
```

Format of MS-EXCEL files (input and output)

Input

- input sheet to DEMETRA: the first sheet in the EXCEL workbook that does not contain the strings "Demetra_Results" or "Demetra_Parameters" in its name, and that has an entry "Vertical" or "Horizontal" in the cell "A1", or a date entry in either of the cells "A2" or "B1". A sheet is not used if its cell "A1" contains the text entry "Unused". Only one single sheet per EXCEL file is used for the input.
- vertical format: first column must contain the corresponding dates (the cells must be date formatted), optional: set cell "A1" = "Vertical"
- horizontal format: first row must contain the corresponding dates (the cells must be date formatted), optional : set cell "A1" = "Horizontal"
- one series in one column/row, the name of the series in the corresponding cell of the first row/column
- number of time series: only limited by the size (rows/columns) of the EXCEL sheets
- the time series values must correspond to the date column; leave the cells of the time series column empty for dates for which no data is available (before the time series start or after the time series end); fill not available data inside the time series span with "-99999.0", ".", "#N/A" or leave them empty – these values are automatically treated as missing values.
- the row/column that immediately follows the end of the last date in the date column/row can be used for the parameters (e.g. string like '[TRAMO/SEATS SAIP: ...] [ISPO: ...]' or '[X-12-ARIMA SAIP: ...] [ISPO: ...]') only if the first cell in this row/column has the text entry "Parameters". If this parameter item is not set, then the parameters will be read and written from and to a separate sheet in the same EXCEL file called "Demetra_Parameters" formatted in the same way than the sheet of the original series.

Example of an input file with vertical format:

Example.xls

	A	B	C	D
1	VERTICAL	Seriename1	Seriename2	
2	Jan-85	71.3		
3	Feb-85	77		
4	Mar-85	81.7		
5	Apr-85	72.7	97.9	
6	May-85	82.9	101.5	
7	Jun-85	86.9	101.5	
8	Jul-85	-99999	101.5	
9	Aug-85	-99999.	108.3	
10	Sep-85	#N/A	91.1	
11	Oct-85	.	83.9	
12	Nov-85		104.5	
13	Dec-85	88.9	104.6	
14	Jan-86	74.6	104.9	
15	Feb-86	80	113.7	
...				
128		109.4	86.3	
129	Aug-95	99.4	89.6	
130	Sep-95	115.3	91.5	
131	Oct-95	113.6		
132	Nov-95	119		
133	Dec-95	121.4		
134	PARAMETERS	[TRAMO/SEA	[TRAMO/SEATS SAIP:S	
135				

Note: In Excel, each date corresponds to an integer value that is than written in a special date format (e.g. "mmm-yyyy" or "dd/mm/yyyy"). Since dates must be specified by an exact day, month and year, for non-daily data it is the best to specify the first date of each month, quarter, year etc., for instance:

monthly dates:	quarterly dates	yearly dates
1 Jan 1980 ("Jan-1980")	1 Jan 1980 ("Jan-1980")	1 Jan 1980 ("Jan-1980")
1 Feb 1980 ("Feb-1980")	1 Apr 1980 ("Apr-1980")	1 Jan 1981 ("Jan-1981")
1 Mar 1980 ("Mar-1980")	1 Jul 1980 ("Jul-1980")	1 Jan 1982 ("Jan-1982")
1 Apr 1980 ("Apr-1980")	1 Oct 1980 ("Oct-1980")	1 Jan 1983 ("Jan-1983")
1 May 1980 ("May-1980")	1 Jan 1981 ("Jan-1981")	1 Jan 1984 ("Jan-1984")
1 Jun 1980 ("Jun-1980")	1 Apr 1981 ("Apr-1981")	1 Jan 1985 ("Jan-1985")
etc.	etc.	etc.

Demetra measures the distance between the first two date-entries, and finds itself the periodicity (e.g. quarterly data).

Example of an input file with horizontal format:

Example.xls

	A	B	C	D	E	F	G	H	I	J	...	DY	DZ	EA	EB	EC	ED	EE
1	HORIZONTAL	Jan-85	Feb-85	Mar-85	Apr-85	May-85	Jun-85	Jul-85	Aug-85	Sep-		Aug-95	Sep-95	Oct-95	Nov-95	Dec-95	PARAMETERS	
2	Seriename1	71.3	77	81.7	72.7	82.9	86.9	-99999	-99999.	#N/A		99.4	115.3	113.6	119	121.4	[TRAMO/SEATS	SAIP:S
3	Seriename2				97.9	101.5	101.5	101.5	108.3	91.1		89.6	91.5				[TRAMO/SEATS	SAIP:S
4																		

Output

- result time series saved to different sheets named "Demetra_Results (..)" in the same file, or, if the user specified a different EXCEL output file, to this one
- result sheets (vertically/horizontally) formatted like the sheet for the input
- one result sheet per type of result time series
- result time series are written at the position corresponding to the original time series
- only the specified and actually computed result time series, and only the ones for which the model was accepted are saved. Therefore, results of difficult time series or of time series marked with "to be treated with the detailed analysis module" are not saved.
- set cell "A1" of the result sheet to:
  - (EXCEL formatted) date: save only series data from this date onwards
  - positive number #: save only series data for the last # dates in the date column/row
  - negative number -#: save only series data for the last # years of the date column/row
  - "s" + positive number #: save only series data for the last # dates of the series
  - "s" + negative number -#: save only series data for the last # years of the series
  - "new": save only new series data for which no former values were saved
- last written result data are marked in red colour

- new parameters to be saved are written in the parameter item of the ***original*** time series if the text string "Parameters" is set just after the last date in the date row/column, or (in the opposite case) into a separate sheet in the input file called "Demetra_Parameters"

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